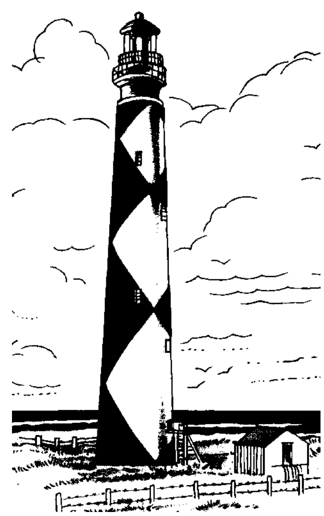
NAUTICAL CHART USER'S MANUAL



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration (NOAA)
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PREFACE AND ACKNOWLEDGMENTS

Many products are sold with user's manuals. Some, such as those for an aircraft, automobiles, or pieces of electronic equipment, are quite voluminous and complex. Others are more modest. A "patented insect destruction" novelty device sold several years ago consisted of only two small wooden blocks. Even this novelty device came with a user's manual; it consisted of a single sheet of paper with the following instruction, "place insect on face of one block and firmly place second block on top of first block."

Generally speaking, the more sophisticated and important the item, the more elaborate the user's manual. The modern nautical chart is reasonably complex and certainly an essential tool for the mariner. Yet, aside from passing mention in textbooks on navigation and the publication of Chart No. 1, no user's manual had been published for the nautical chart. Arguably, such a publication is long overdue.

This manual explains what is presented on the nautical chart, highlights the utility of this information, describes the charting conventions used to depict features and items of interest, and provides some practical pointers on how this information is used. It is written to serve many types of users, ranging from operators of recreational vessels to those who drive "heavy iron."

Abundant photographs and chart excerpts illustrate key points made in the text. All chart excerpts were current as of spring 1995. Since this manual was published, some charts may have been revised. Even if these specific charts have been revised, the general points remain valid. It almost goes without saying that these chart excerpts should not be used for navigational purposes.

This manual also identifies other publications, such as the *U.S. Coast Pilot, Tide Tables, Tidal Current Tables, Notices to Mariners, and the U.S. Coast Guard's Light List* which give additional relevant information to chart users. Excerpts from these publications are also provided in the manual. As with chart excerpts, these may also have been revised.

The writing style is less formal than that employed in many government publications—designed to make the manual more "user-friendly" in today's vernacular. The manual is authoritative, but not encyclopedic. To keep the manual to a manageable size, only the most important topics are included.

This is a chart user's manual, and not a textbook on seamanship or navigation. Nonetheless, nautical charts are used principally for navigational purposes and, therefore, some basic elements of the theory and practice of navigation are included in this manual. References that provide additional and more detailed discussions of relevant aspects of navigation are included at the end of each chapter. Inclusion of these references in this manual does not mean that the *National Oceanic and Atmospheric Administration* (NOAA) or any other agency of the U.S. government

agrees with any findings, conclusions, or opinions contained in these references. Likewise, inclusion of any trade names or photographs of specific equipment does not constitute a product endorsement.

The creation of this manual was a cooperative project between NOAA and the *United States Coast Guard Auxiliary* (USCGAUX), the volunteer civilian component of the U.S. Coast Guard. Dr. L. Daniel Maxim (DVC–ER, USCGAUX) wrote the manual. Mrs. Virginia L. Knudsen (DC–EX, USCGAUX) ably handled the layout and graphics. Many NOAA personnel made important contributions, notably CAPT Thomas Richards, NOAA, Messrs. Harold Schantz and Jeff Stuart who shared a common vision of excellence, always responded patiently to questions and provided constructive criticism and guidance throughout the project. A Committee consisting of CAPT David MacFarland, NOAA, Mark Friese, Robert Rodkey, Erich Frey, Nelson Garber, Jason Rolff, John Ondrejko, Ronald Stuckey, Thomas Dade, Stanley Weiss, Ken O'Dell, Eric Johnston, and LCDR Marlene Mozgala, NOAA, provided direction and expertise in developing and reviewing the Chart User's Manual. In addition, Ira Dolich and Andrew Ritzie (both USCGAUX) made helpful comments and suggestions which improved the quality of this manual. Credit, therefore, should be shared among many. The responsibility for errors and omissions rests solely with the author.

Special thanks to Dottie Brown for her attention to detail on the final edit of this manuscript.

Cranbury, NJ
December 1997

CHAPTER 1

"It would appear that on some [of the Marshall Islands]…these charts were considered so precious that they might not be taken to sea. This was partly because they might be damaged in the canoes and partly, perhaps, because the people might never come back, in which case the tribe's precious property would be lost for ever." [Emphasis added.]

Collinder

Introduction

Background

Marine transportation is crucial to the United States economy: according to data published by the U.S. Bureau of the Census, in 1991 approximately 99 percent of all U.S. trade by weight (48 percent by value) was waterborne. And safe operation is essential to marine transportation. Accidents result in injuries, cost lives, and increase insurance rates. Moreover, as the *Amoco Cadiz, Argo Merchant, Exxon Valdez,* and *Torrey Canyon* cases vividly demonstrated, accidents have the potential to cause significant environmental damage (Cahill, Keeble, Marriott, Nalder, Petrow, Winslow). Fortunately, the operational safety of ships, measured in terms of marine casualties (including ship losses, tonnage lost, and volume of oil spilled), has increased over the past several decades [*National Research Council* (NRC) 1994 b].

Accurate and up-to-date nautical charts are the most basic navigational aid—so basic, in fact, that carriage of corrected charts is a legal requirement for certain classes of vessels. The need for accurate charts was recognized early in the history of the United States. The situation in the early days was described by one observer (Stanley 1976):

> "Moreover, young America at the turn of the 19th century was experiencing a tremendous growth in maritime commerce. Heavily laden cargo vessels and passenger ships with their precious burdens were entering and departing American ports for all parts of the world… Charts then in existence consisted chiefly of those produced by the British Admiralty of Colonial America for use prior to and during the American Revolution. These charts were based upon vague and incomplete reports and sketches, and were totally inadequate for needs of the times."

In 1807, Congress passed the Organic Act authorizing President Thomas Jefferson "… to cause a survey to be taken of coasts of the United States, in which shall be designated the islands and shoals, with the roads or places of anchorage, within 20 leagues [approximately 60 miles] of any part of the shores of the United States; and also the respective courses and distances between the principal capes or head lands, together with such other matters as he may deem proper for completing an accurate chart of every part of the coasts within the extent aforesaid." In 1834, the Survey of the Coast, since renamed the Coast Survey (in 1936), the Coast and Geodetic Survey (in 1871), the National Ocean Survey (in 1970), and the National Ocean Service (in 1982), completed its first hydrographic survey of Great South Bay, Long Island, NY. The first U.S. Government produced nautical chart, a black-and-white print made from a stone engraving of Bridgeport Harbor, CT, was issued in 1835. Charts were not routinely produced until 1844, a year in which 169 copies were sold (Stanley 1974). Chart sales grew to 50,000 copies about the time of the Civil War, and 100,000 copies by the year 1900.

Schooners were employed as survey ships in those days, leadlines (a line, marked at graduated intervals, with a lead weight attached at one end) were cast at intervals to gather data on water depths, and *dead reckoning* (DR) and celestial navigation methods were used to fix the survey ship's position when out of sight of land. Primitive as these systems were, the results were useful and the charts based upon these surveys contributed substantially to safe navigation.

Hydrographic surveys were often dangerous in the early days, as often the survey ship ran into the very object their charts sought to warn of. Such was the case with the British Admiral Francis Beaufort, then a young man, who was aboard the *Vansittart* (a vessel of the East India Company) when it ran aground on a shoal being surveyed off the Sumatra coast causing all hands to abandon ship. The sinking provided dramatic evidence of the value of an accurate nautical chart (Wilford) and indirectly advanced the cause of nautical cartography because Beaufort later became one of the premier hydrographers.

Over the years, new technology advanced the state of the art for surveying, chart compilation, and publishing. To cite a few examples:

- Survey ships are now diesel powered, electronic depth sounding methods (e.g., side scan sonar) are used to survey the ocean bottom, and modern electronic navigation systems, such as Loran–C and the satellite-based *Global Positioning System* (GPS), are used to fix the survey ship's position.

- Most survey vessels now tow side scan sonars. This enables the hydrographer to survey a swath of the bottom, usually about 100 to 200 meters along the towfish track. Objects on the bottom, such as wrecks, rocks, and obstructions, cast a large shadow on the sonargram, which permits the approximate height of the object to be computed (*Nautical Charting Program*).

- Land areas depicted on nautical charts are surveyed with aircraft and other platforms, computers are used extensively in chart compilation and printing, and electronic charts based upon digital data are becoming commonplace.

- Printing techniques evolved as well, the stone engraving was soon replaced by the copperplate engraving, and this in turn by photo-lithography (Stanley 1974). In the near future, electronic charts will become commonplace, and the television monitor will replace the paper chart.

Although there is room for improvement as budget shortfalls have taken their toll in these days of government austerity (NRC 1994 a, NRC 1994 b, Queeney), U.S. Government nautical charts are recognized as being among the best in the world.

Technology has also reduced the cost of producing charts. As the opening quotation indicates, in some countries at least, charts were so valuable that they were not allowed to be taken to sea—a colossal irony. Now modern compilation and printing methods have so reduced the cost of charts that these have evolved from precious documents to working tools. Mariners of old would be astounded that courses are routinely *plotted* on charts, rather than calculated laboriously by mathematical methods.

The NOAA Ship *Surveyor* is One of a Fleet of Survey Ships Used to Gather Hydrographic Data

The Nautical Chart User's Manual

Even the best chart is of little value if the mariner is not thoroughly familiar with the various conventions and symbols used in its compilation. This manual was written to explain the symbols and conventions employed on U.S. nautical charts and to show how and why charted information is relevant. A listing of the various chart symbols with pictures of the specialized icons and other information is provided in *Chart No. 1, United States of America, Nautical Chart Symbols, Abbreviations, and Terms, Ninth Edition*, generally referred to simply as Chart No. 1.[1] Chart No. 1, described below and throughout this manual, provides a valuable compilation of chart symbols and conventions. However, Chart No. 1 is very compact—important definitions and explanatory material are omitted in the interests of brevity. Moreover, neither this chart nor the numerous excellent texts on navigation provide a comprehensive discussion of nautical chart conventions and their relevance to the mariner. Specialized publications, such as the *Nautical Chart Manual*, do address many of the topics covered here, but are written for a more technical audience and not widely available.

This Chart User's Manual supplements and expands upon the contents of Chart No. 1.

[1]Other nations publish a similar product (e.g., Carte No. 1, Chart 5011) to explain their charts.

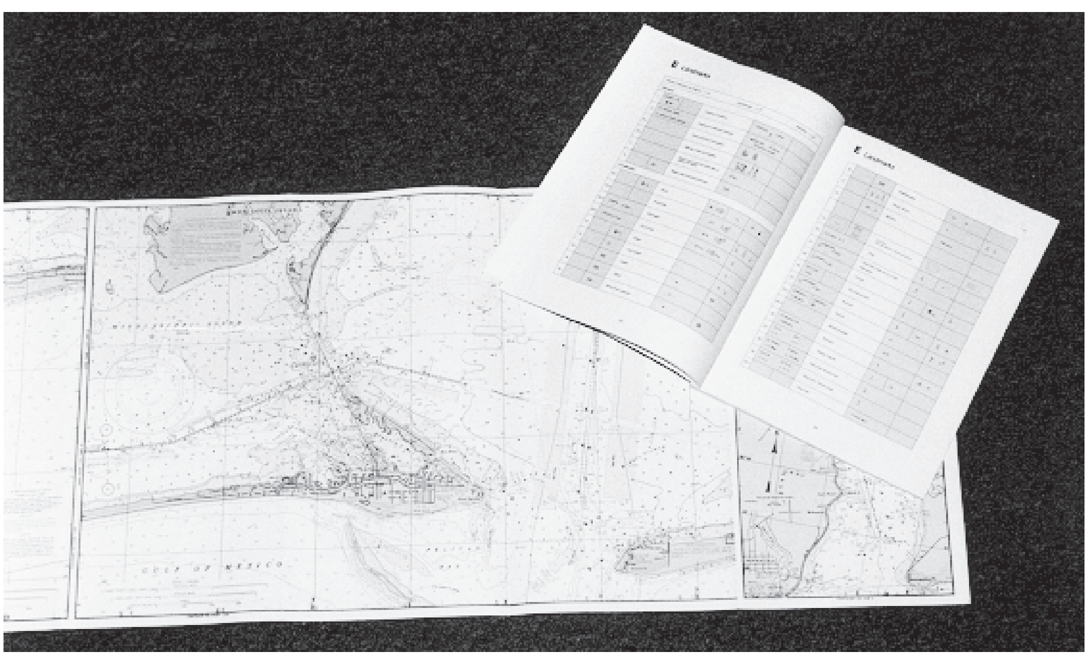
The manual not only identifies the chart symbols and conventions, but also explains the importance of the various charted features to safe and efficient navigation and the underlying cartographic philosophy embodied in the modern nautical chart. For example, Chart No. 1 identifies the chart symbol used to depict a restricted area, but does not inform the reader what this means nor where to find more about the regulations applicable to specific areas (see Chapter 7 for details). As a second example, Chart No. 1 shows the symbols used to depict landmarks, but does not state why only certain objects are charted as landmarks nor why some landmarks might be better than others for determining the vessel's position (topics explored in some detail in Chapter 6).

This manual is intended to be a "reader-friendly" synopsis of a great deal of technical information—organized in an easy-to-understand format suitable for self-study or inclusion as a supplemental text in courses on navigation or boating safety. This manual is not a textbook on navigation *per se*, but does provide essential background to help the reader understand why certain objects are charted and how the various features depicted on the nautical chart are potentially important to the navigator. References at the end of this chapter explore navigation more thoroughly.

Recreational boaters and professional mariners alike should find this manual interesting and relevant.

Organization of this Manual

Chapter 1 provides a general overview and introduction to the nautical chart and related publications. Chapter 2 provides additional general information about nautical charts together with specific material about the schematic layout of the chart, projections, type and scales of charts, chart overlap, vertical and horizontal datums, and other chart conventions. Chapters 3 through 7 provide a detailed exposition of various features found on the nautical chart. Chapter 3 shows how topography and many land-based features (e.g., buildings, roads, urban areas) are charted; Chapter 4 presents the same information for hydrographic features (depth curves, soundings, wrecks, shoals, obstructions and other hazards); Chapter 5 provides information on *Aids to Navigation* (ATONs), such as lights, ranges, and buoys; Chapter 6 discusses landmarks; and Chapter 7 covers areas, limits, and routes as depicted on the nautical chart. This manual is intended to be a companion to Chart No. 1, so the organization is deliberately similar. Space



This Manual Should Be Read with a Copy of Chart No. 1 and a Illustrative Nautical Chart Handy

constraints do not permit incorporation of Chart No. 1 in its entirety, but relevant excerpts are included where appropriate. Likewise numerous excerpts from actual nautical charts are furnished to illustrate key points in the text. It is recommended that the reader have Chart No. 1 and a typical nautical chart at hand when studying this manual. *Any excerpts included in this manual are for illustrative purposes only and are not to be used for navigation*. (For reasons discussed below and throughout this manual, charts and related material are revised periodically. The latest revisions may not be included in this manual. Even though specific charted features may change, the illustrations have generic value.)

Each chapter in this manual contains a list of references that contain additional relevant detail, or useful general information. Names or brief titles inserted in parentheses (e.g., Bowditch) refer to sources listed at the end of the chapter. Inclusion of a reference does not mean that any agency of the U.S. Government endorses the contents or any products mentioned therein. Indeed, some references are cited to present an alternative perspective.

Appendix A provides a glossary of specialized terms used in this manual and appendix B provides a list of abbreviations used in this manual, on nautical charts, or in related publications, such as the *Notice to Mariners* (NM) or the *Light List*.

Relevant Facts, Statistics, and Products

Table 1–1 provides salient facts and statistics regarding nautical charts of U.S. waters. The U.S. NOS, a part of NOAA, under the Department of Commerce, is the agency responsible for charting the national and territorial coastal waters of the United States, including the Great Lakes, Puerto Rico, U.S. Virgin Islands, U.S. Trust Territories, and other islands in the Atlantic and Pacific Oceans. (Hereinafter, these are referred to in this manual as “NOAA” charts. Specific chart numbers are referred to as “NOS Chart No. xxxxx.”) Another agency, the *National Imagery and Mapping Agency* (NIMA) *formerly the Defense Mapping Agency* , part of the *Department of Defense* (DOD), is responsible for publishing U.S. charts of other areas of the world. Charts of inland lakes and waters are also produced by the U.S. Army Corps of Engineers (USACE), working cooperatively with NOAA.

As can readily be imagined, the overall process of gathering relevant data (e.g., from aerial photographs, hydrographic surveys, reports of chart corrections sent in by mariners, other government sources such as the *United States Coast Guard* (USCG), and volunteer organizations such as the *United States Coast Guard Auxiliary* (USCGAUX) or the *United States Power Squadrons* (USPS)), compiling charts and checking, printing and distribution is a substantial undertaking. A

Table 1-1. Facts and Statistics Relevant to NOAA Products

Area of Charting Responsibility	The U.S. National Ocean Service (NOS) is responsible for charting the national and territorial coastal waters of the United States, including the Great Lakes, Puerto Rico, U.S. Virgin Islands, U.S. Trust Territories, and other islands in the Atlantic and Pacific Oceans.
Number of NOS Charts:	Approximately 1,000.
Area of NOS Chart Coverage:	Approximately 3.4 million square nautical miles.
Miles of Tidal Shoreline:	Approximately 100,000 nautical miles.
Products:	Canoe Charts, Catalogs of Charts and Publications, Conventional Charts, Dates of Latest Editions, Geophysical Maps, Marine Boundary Charts, Regional Tide and Current Tables, Small-Craft Charts, Special-Issue Charts, Tidal Current Charts, Tidal Current Tables, Tide Tables, and United States Coast Pilots.

few statistics are revealing. NOAA maintains approximately 1,000 charts in its inventory. These charts cover approximately 3.4 million square nautical miles of water and contiguous land area, including approximately 100,000 miles of tidal shoreline. In addition, NOAA maintains a small fleet of research vessels which conduct and revise hydrographic surveys to determine depths, and locate and identify natural (e.g., rocks, shoals, ledges, etc.) and artificial (e.g., wrecks, pipelines, cables, unexploded ordnance) hazards to navigation.

Charting is a dynamic, rather than static, activity. Over time, charts need to be revised. For example, the NOAA ship *Rainier* recently completed a thorough side-scan sonar survey in the vicinity of the offshore oil loading facility in Estero Bay, CA (Richards). This survey discovered 22 previously uncharted and potentially significant dangers to navigation. This is not an isolated example. Hurricanes and earthquakes literally raze the landscape; currents scour and fill areas, disturbing the pattern of depths; dredging activities straighten and deepen rivers; new ports and waterfront facilities and other construction activities alter landmarks, change bridge clearances; and myriad other natural and human activities gradually render present charts obsolete and ultimately potentially unsafe to use. The number of new or revised charts published annually by NOAA varies from year to year, but is measured in hundreds.

For reasons discussed at length in this and the following chapters, no one type of chart of an area serves all users. Therefore, NOAA produces an integrated series of charts and related products (see table 1–1 and below). This manual focuses upon chart products, but the content, role, and utility of related products (published by NOAA and other agencies of the U.S. Government) are too important to be ignored. These other publications are explained below and in appropriate sections of this text.

As shown in figure 1–1, the principal NOAA chart/map products (discussed in some detail in Chapter 2) include small-craft charts, marine facility charts, conventional charts (further subdivided, based upon chart scale and other attributes, into *Intracoastal Waterway Charts* (ICW), harbor charts, coast charts, general charts, sailing charts, and international charts), and training charts. Although many of NOAA's charts are used by all mariners, each of these products is designed to serve the interests of particular segments of the user population (see below) including both navigational and non-navigational consumers. For example, as the names imply, small-craft charts and marine facilities charts are intended principally for the recreational boater, and the content is customized to provide relevant information to this group. (In some areas, however, small-craft or marine facility charts are the only charts available and other users, such as operators of commercial vessels, have no alternative but to use these charts.) Conventional charts are used by all groups. Training charts are inexpensive products with a description of symbols and conventions printed on the back of the chart that are ideal

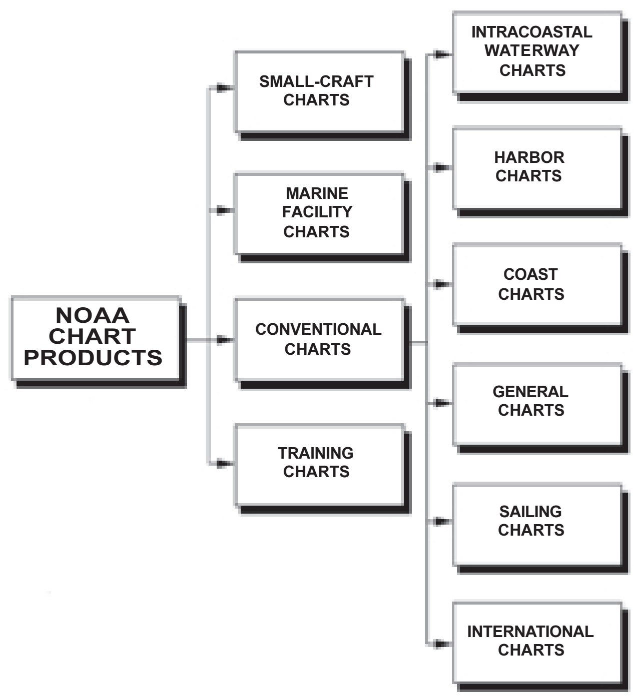


Fig. 1-1. Principal NOAA Chart/Map Products

for teaching navigation. Space and scope constraints preclude a detailed discussion of chart uses for purposes other than marine navigation.

Purpose of the Nautical Chart

In brief, the principal purpose of the nautical chart is to provide information necessary to promote safe and efficient marine navigation. The time-honored application of a chart is to provide data that can be used by the navigator to fix the vessel's position, for example, by taking visual bearings on charted natural and artificial features or ATONs. The fix might be used directly, or as a check on the vessel's position determined by other means, such as an electronic fix read from a Loran–C or GPS receiver.

As important as nautical charts are for position fixing, the real utility of a chart lies elsewhere—in *orienting* the mariner. A position fix merely answers the question, "Where am I?" But often a much more relevant question is, "What does it mean to be here?" From an decision theoretic perspective, "here" should not be described by the conventional coordinates of latitude and longitude, but rather in terms of the relevant features of the surroundings and their implications for underway decision making. Charts help answer numerous key questions. Is "here" in the vicinity of rocks, shoals, ledges, reefs, tide rips, sunken wrecks, or other potential hazards to navigation that should be avoided? Is "here" in the vicinity of a danger area, prohibited area, *traffic separation scheme* (TSS), or other regulated area? Is "here" near a planned turn point, waypoint, or destination? Is "here" a place that I can anchor safely, and if so, which anchor should I use to maximize holding power? Is "here" along my intended route, or should I make course adjustments to get back on track? And if "here" is on the desired track, am I on/ahead/behind schedule? If, as a result of some unforeseen contingency (e.g., medical emergency, mechanical problem, fuel shortage), I needed to select an alternate destination, how could I reach this alternate efficiently? In short, nautical charts furnish information critical to *enroute decision making.*

Nautical charts also provide information essential to *voyage planning;* figuring out how to get from "here" to "there" safely and expeditiously. Nautical charts are useful for voyage planning for many reasons; to cite just a few, these charts

- enable the identification of safe routes which are efficient in terms of total distance, but avoid known hazards,

- facilitate the determination of the true/magnetic courses and distances for each leg of the route (all key inputs to determining the estimated time enroute, estimated time of arrival, and fuel requirements),

- provide information on landmarks, ATONs, and other features that can be used to fix the vessel's position and track progress of the voyage,

- identify regulated areas and, in some cases, the specific regulations applicable to each area, and

- contain key information on facilities, such as repair services, fuel availability, piers, wharves, and marinas.

How Does a Nautical Chart Differ from a Map?

The words "chart" and "map" are often used interchangeably, but incorrectly, by the layman. Although certainly related, charts differ from maps. Reduced to its essence, the key difference between a nautical chart and a map is that the chart provides information relevant to marine navigation, whereas the map is oriented to the terrestrial user.[2] The focus of the nautical chart is on water areas, providing data on water depths, ATONs, hazards, etc. Contiguous land areas are also shown, but the features depicted are limited to those that are particularly relevant to marine navigation (e.g., shoreline, near shore topography, landmarks, piers, wharves). As noted in the *Nautical Chart Manual*,

> "The nautical chart differs considerably from the topographic map in its treatment of the coastline. The topographic map emphasizes the land forms and the representation of relief, with shoreline as an approximate delineation of the waterline at mean sea level. In contrast, the nautical chart has such a unique requirement for detailed and accurate representation of the coastline and water forms that it must be considered in a separate category from topographic maps in any discussion of coastal geography."

–An Illustrative Chart

Figure 1–2 contains an excerpt from NOS Chart No. 12314 (Delaware River, Philadelphia to Trenton) showing a portion of the Delaware River in the vicinity of Riverside, NJ. Depth contours, channel boundaries, soundings, lights, buoys (cans, nuns, and bifurcation buoys), ranges, wrecks, shoals, obstructions, piers, piles, ramps, cable and pipeline areas, bridges (with vertical and horizontal clearances), harbors, and other features important to navigation are found on this chart. Bottom characteristics (e.g., mud, grass) are also shown. To be sure, topographic features, such as roads, are also charted. But the emphasis is clearly on features relevant to marine navigation. The few structures depicted in figure 1–2, including buildings, tanks, and stacks, are landmarks (see Chapter 6) useful for taking visual bearings. Elsewhere on this chart (not shown in the excerpt in figure 1–2) information is presented on anchorage areas, tides and tidal currents, latitude and longitude scales, distance scales, and other related features. Were this chart of an open ocean or bay, Loran–C *time differences* (TDs) might be overprinted to provide the mariner with position information. Yet other features that would be shown include restricted areas, prohibited areas, danger areas, seaplane landing areas, TSS routes, etc. Distances measured on the chart are in exact proportion to actual distances between locations, and directions measured relative to parallels of latitude, meridians of longitude, or conveniently placed compass roses (see Chapter 2) equate to actual courses between points.

The land area depicted in the chart excerpt in figure 1–2 is relatively flat and so does not illustrate how topography is handled on a nautical chart. Some brief comments on the depiction of topography (discussed at length in Chapter 3) on the nautical chart are pertinent. As noted in the *Nautical Chart Manual*,

[2] Likewise *aeronautical charts* depict information relevant to the aviator.

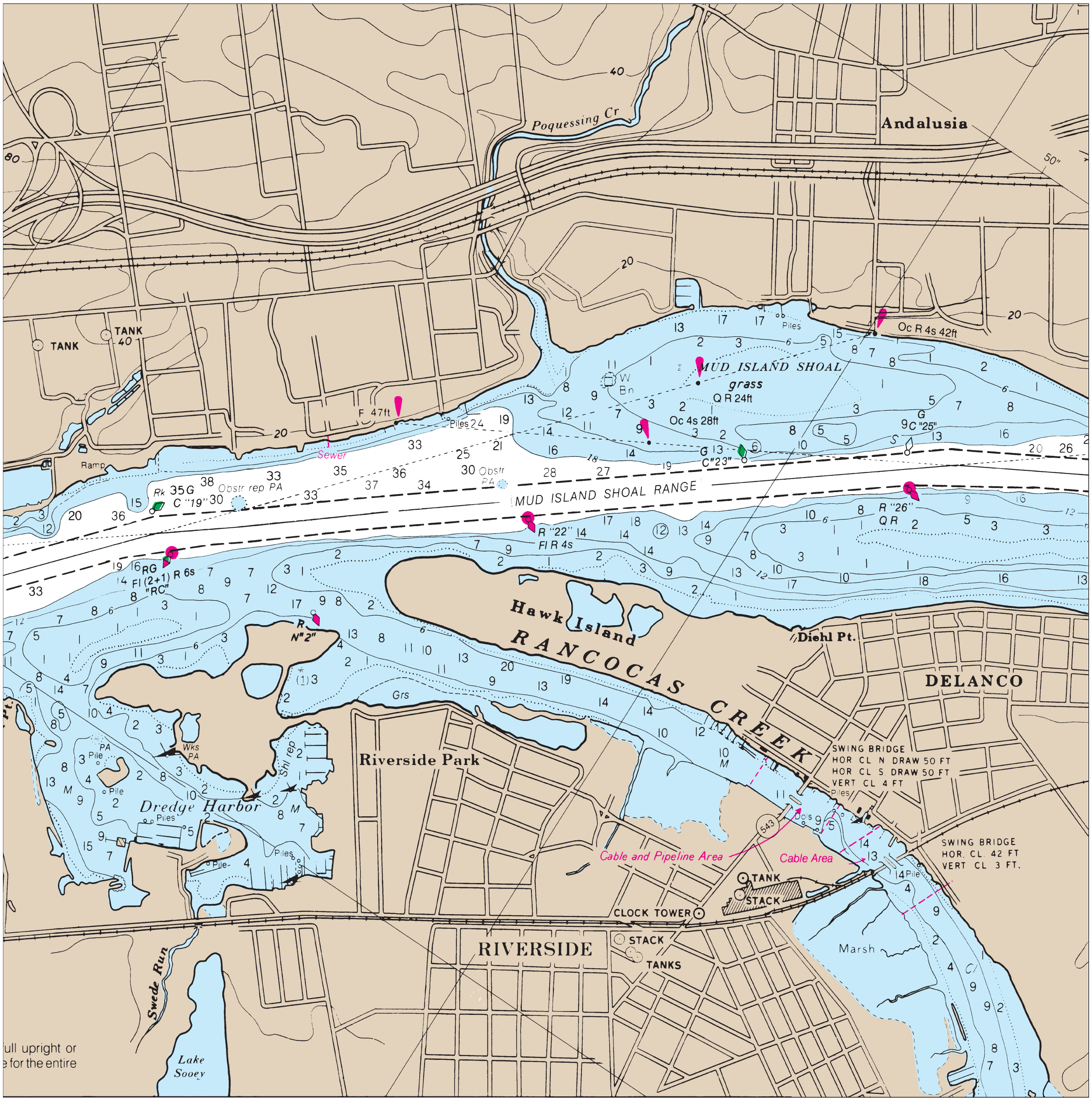


Fig. 1-2. Excerpt from NOS Chart 12314 (Delaware River, Philadelphia to Trenton) Showing Portion of Delaware River in the Vicinity of Riverside, NJ, at a Scale of 1:20,000

> "…although topographic contours are undeniably valuable to the mariner on charts of some areas for radar reflection, visual profiles, and identification for relative position locating, their inclusion on other charts causes an amount of work out of proportion to their value. The drafting of standard rules covering particular features often leads to a misguided attempt to give a chart uniform treatment throughout, whereas an essential element of successful chart compilation is that different considerations apply as a compiler works from inshore to offshore areas, or along an open coast toward a shoal-encumbered estuary, or inland from the coastline."

As an obvious, but revealing example, there is little value in charting topography that cannot be seen from the water. Likewise, charting cultural features, such as buildings, roads, etc., that cannot be seen (or otherwise detected)[3] from the water is unproductive—and continually so, because this detail must either be updated or consumers may lose confidence in the product.

–An Illustrative Map

Contrast figure 1–2 with figure 1–3, showing the same area, drawn to nearly the same scale, taken from a U.S. Geological Survey quadrangle map. Figure 1–3 shows much more nautical detail (e.g., depth curves, shoals) than would typically be found on a highway map, for example. Nonetheless, the focus of this map (figure 1–3) is clearly on the land, rather than the river. Town, county, and state boundaries, buildings, schools, churches, hospitals, street names, etc., are prominently displayed. A highway map of the same area, which is not shown to avoid copyright issues, would omit all nautical detail, and add such items as service stations. Maps are made for a variety of other purposes, such as showing land-use patterns, crop distributions, population characteristics, consumer demographics, etc. (Lewis, Makower, Monmonier, Wood). But all share a terrestrial focus unrelated to marine navigation.

Charts generally also differ from maps in terms of accuracy requirements. For most maps, if a feature were charted at a point several hundred feet from its actual location, the consequence would be small indeed. This same error in a nautical chart of a confined waterway strewn with rocks and shoals could be the difference between a safe and uneventful voyage and a shipwreck.

User Groups

As noted, the user population for NOAA charts is diverse. Figure 1–4 illustrates a typology of nautical chart users (NRC 1994 a). *Navigational users* include navies of the world, marine transportation, commercial fishing fleets, and recreational boaters and fishermen. *Non-navigational users* include those interested in coastal land development, research and exploration, conservation, and coastal zone planning. Non-navigational users and uses are described elsewhere (NRC 1994 a).

Even among navigational users, there is substantial diversity. To some degree the diverse needs and interests of navigational users can be accommodated by the different

[3]Airports are typically charted (see Chapter 3) even if they cannot be seen from the water, because the mariner can observe the rotating beacon, arriving and departing aircraft, or other clues to their existence.

Fig. 1-3. Excerpt from United States Geological Survey Map of Beverly Quadrangle (Beverly, NJ—PA) Showing Portion of Delaware River in the Vicinity of Riverside, NJ, at a Scale of 1:24,0000

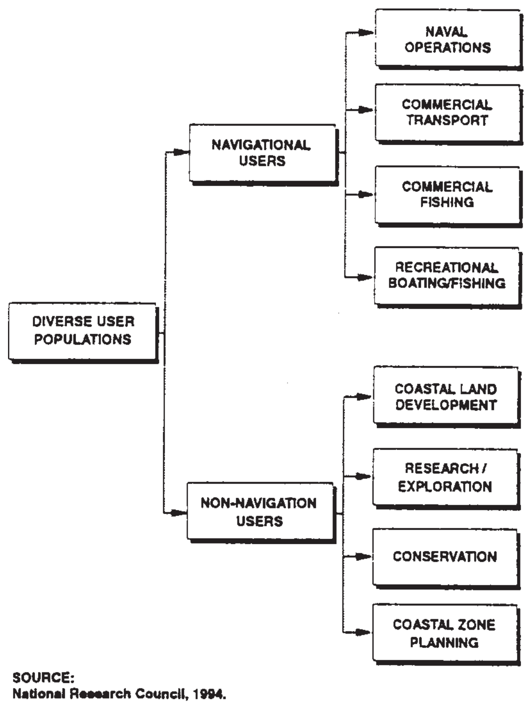


Fig. 1-4. A Typology of Nautical Chart Users

types of charts produced by NOAA. However, it would be wasteful to provide duplicate coverage for all areas. This means that the design of many nautical charts is, at least to some degree, a compromise. Consider depth information, for example. Most recreational boaters operate vessels with drafts less than about 6 feet (approximately 2 meters). To avoid recreational vessel groundings, it might be perfectly acceptable to produce a nautical chart with depth curves and soundings marked to say, 18 feet, and delete anything deeper. Although some utility would be denied the recreational boater by this action (e.g., the opportunity to use depth curves or soundings to establish position), the resulting chart would still be quite satisfactory. Operators of deep-draft vessels (and submarines for that matter) would find this simplified chart entirely unacceptable. These heavy-iron drivers would be more than happy to sacrifice charted depths and soundings less than their draft (all the shallow water detail) in the interests of chart simplification. And so it goes. Fishermen have unique interests, as do divers, offshore rig operators, tanker skippers, etc. Nautical charts are designed to strike a balance among the sometimes conflicting needs and interests of diverse user groups.

In a survey of user needs, NRC (NRC 1994 a) determined that, "the professional mariner uses the chart as a navigation tool and, therefore, generally wants uncluttered charts, believing that information which is available elsewhere (such as marina facilities) should not be included on nautical charts." Professional mariners wish to have all "extraneous information," by which is meant "anything that can be found anyplace else," deleted from the chart.

The recreational boater, according to this same survey, "generally has less storage and working space on board as well as fewer crew members and frequently prefers that as much planning information as possible be printed on the chart. While having the most current chart is generally important to the recreational boater, chart update information is generally not a critical requirement." In a phrase, recreational boaters want charts to offer "user-friendly, one-stop shopping."

The electronic chart of the near future (see below) will enable users to "customize" their charts to display only the information desired. However, paper charts do not offer this flexibility.

Efficiency of Chart Compared to Text

There is an old saying to the effect that a picture is worth a thousand words. As the example given below indicates, nautical charts are probably far more efficient than this comparison suggests. Imagine having to take all the information given on the nautical chart, convert it to text, and produce a detailed book describing the chart. Leaving aside the question of how the information can be effectively conveyed with the written word, even the information storage requirement would be massive. For example, NOAA's recently produced Delaware Bay electronic chart requires approximately 3.8 million bytes of storage. (NOAA uses a very efficient way of storing chart data—so efficient, in fact, that the compression method has been patented. Storage of the digital chart data in more conventional formats is estimated to require more than 100 million bytes.) For comparison, storage of written text using typical word processing software requires approximately 1,400 bytes per page of single-spaced text. Figured at this exchange rate, the Delaware Bay chart would be equivalent to approximately 2,700 pages of single-spaced text using the efficient storage method! Other quantitative assumptions might lead to somewhat different ratios of pages per chart, but all would support the conclusion that a nautical chart offers an extraordinarily compact presentation of the information presented.

It is interesting to note that, historically, the material now represented on nautical charts is believed to have been originally presented in the form of *sailing directions*; written accounts of harbors, courses, seasonal weather conditions, etc. (Dutton's, Williams). In other words, the nautical chart was a technological evolution of sailing directions (as might now appear in the *U.S. Coast Pilot*). This said, some information is more efficiently presented in written form than on the chart. NOAA products in written form are discussed below.

Chart Distribution—Where to Purchase Charts

NOAA charts are sold both through mail order and by a distribution network of authorized chart agents.

–Mail Order Sales

Customers wishing to purchase charts directly from NOAA should send a list of the charts requested, together with a check or money order (in U.S. funds) payable to NOS, Department of Commerce, to the following address.

Distribution Branch, (N/ACC33)
National Ocean Service
Riverdale, Maryland 20737–1199.

Charts can also be ordered from NOAA by telephone 1-800-638-8972. Credit cards (VISA or Mastercard) are accepted for telephone purchases. At the end of this manual are several blank order forms that can be used to request selected NOAA products.

–Authorized Chart Agents

Mariners who purchase NOAA charts from authorized chart agents do so for several reasons, including convenient locations, rapid service from available inventories, being able to view the charts before purchase, and to take advantage of the (often considerable) expertise of the agent. Some agents offer value-added features, such as providing a computer generated list of the NM, containing all the chart corrections as of the date of purchase—a particularly worthwhile service. As of this writing, there are approximately 2,200 nautical chart sales agents worldwide, varying in size from small marina operators to large map stores and ship chandlers (NRC 1994 a). The addresses and telephone numbers of all authorized chart agents are given in the *Nautical Chart Catalog*.

–The Nautical Chart Catalog

The *Nautical Chart Catalog* is a four-volume NOAA publication, ideal for identifying the charts required for a voyage. It may be obtained without charge from NOAA or from an authorized chart agent. Volume 1 covers the Atlantic and Gulf Coasts, including Puerto Rico and the Virgin Islands. Volume 2 covers the Pacific Coast, including Hawaii, Guam, and Samoa Islands. Volume 3 covers Alaska. Finally, Volume 4 covers the Great Lakes and adjacent waterways. Each volume of the chart catalog contains a map of the overall area on which are superimposed the outlines of each of the charts published for this area, color coded by type of chart. Tables within each catalog provide additional data on the chart number, chart title, scale, whether or not Loran–C or Omega *lines of position* (LOPs) are superimposed, and other information. As noted above, a complete list of authorized chart agents is printed in the chart catalog.

Chart Prices and Related Matters

Some mariners—particularly recreational boaters—complain about the purportedly high prices of government nautical charts. And, indeed, NOAA chart prices have increased significantly in recent years; from $5 per chart in 1983 to $14 per chart in 1996 (*The Boat Show Briefing Book*). However, over the long term,

The *Nautical Chart Catalog* Provides Ordering Information for NOAA Charts.

chart prices have increased only modestly in real (that is, constant dollar) terms. In 1939, for example, the average price of a NOAA nautical chart was $.75. But, in this same year (according to the November 1939 issue of the *National Geographic* magazine) the price of a single room at Boston's Copley–Plaza hotel was $4/night, one at New York's Barbizon was $2.50/night, and one at Washington's prestigious Hay Adams hotel was $3/night. In 1939 you could buy the best steak dinner in Buenos Aires for $.35, admission to most major league ball parks in the United States for $.50, an annual subscription to the *National Geographic* magazine for $3.50, and a Studebaker Commander automobile for $660!

In short, the prices of most things have increased since 1939. The relevant question is whether chart prices have increased more than consumer prices generally. Over the years from 1939 to 1995, NOAA chart prices have increased at a compound average rate of approximately 5.4 percent per year—only slightly more than the 4.4 percent per year increase in the consumer price index over this same period.

Another way of looking at price data is to calculate how many hours of labor it takes to earn the money to purchase a particular item, and track this statistic over time. For example, consider the case of a typical employee in the manufacturing sector of the economy; the average hourly wage in manufacturing was $.63 in 1939 (U.S. Department of Labor, Bureau of Labor Statistics, *Labstat Series Report*), so this employee had to work ($.75/$.63) = 1.19 hours in 1939 to earn the money necessary to purchase a nautical chart. By August 1994, manufacturing wages had risen to $12.03 per hour. The hours required to earn the money necessary to purchase a chart in 1994 were ($14/$12.03) = 1.16— actually slightly less than in 1939. Measured by these yardsticks, a NOAA nautical chart is still a good buy. Can you imagine the reaction of Columbus or Magellan if they could have purchased an accurate chart for the equivalent of 1.16 hours of labor!

Moreover, today's nautical chart is much more accurate and comprehensive than those produced in 1939. Although it is true (see Chapter 4) that some of the soundings data shown on today's charts are based upon hydrographic surveys conducted as far back as the 1930s—when the leadline was used extensively, much of the data used on the modern chart is based upon more recent and accurate hydrographic surveys, using modern technology. Shorelines are depicted based upon aerial photographs, computers are used extensively for chart compilation and production, and other technological innovations have been exploited. As well, the number of charted features has grown substantially, as waterfronts have been developed, new buildings constructed, additional ATONs placed, etc. Loran–C and Omega (radio navigation systems) didn't exist in 1939, now Loran–C TDs and Omega navigation data are shown on many charts. In short, the modern nautical chart is a significant improvement over those produced more than half a century ago. So today's mariner is able to buy a demonstrably better product for a comparable real price.

Most mariners are unaware that NOAA nautical chart prices are controlled by legislation (Public Law [PL] 99–272) and include only those costs attributable to data base management, compilation, printing, and distribution. Costs attributable to the acquisition or processing of data, such as hydrographic surveys, are not recovered in the chart price. In effect, nautical chart users are being subsidized by the government. Even at today's prices, the government recovers only about 60 percent of the cost of producing a nautical chart.

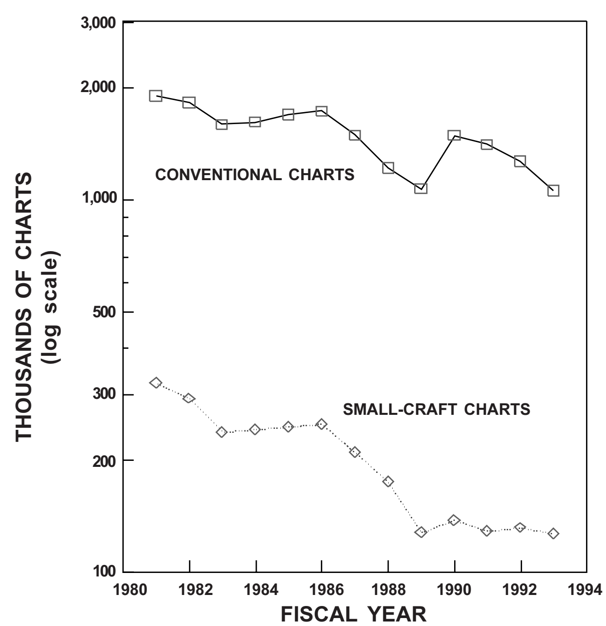
In recent years, about a dozen U.S. companies have begun to reproduce NOAA charts and sell these in a variety of formats, including waterproof paper, smaller paper size, and in chart books containing several charts for a region—often at prices lower than comparable NOAA charts. NOAA charts are not copyrighted as a matter of policy (17 *United States Code* [USC] 105), so this practice is perfectly legal. Chart reproduction can be profitable for commercial companies at lower prices than charged by NOAA because their only costs are for paper, copying, and distribution. No royalties or other costs are paid to cover the costs of chart compilation. The lower prices charged for nautical charts by commercial firms, therefore, are not necessarily a reflection of any greater economic efficiency of the private sector, but rather the fact that valuable chart data are provided to these firms without cost.

Commercial chart companies also attempt to escape liability costs by including such disclaimers as "not to be used for navigation" on their products—as though we should assume that mariners purchase these copies only for place mats, wall decorations, or boating safety classes! Court interpretations of the Federal Tort Claims Act have tended to hold the U.S. Government liable for damages due to incorrectly charted information. Reproducers of NOAA charts may be subject to similar liabilities.

The NRC, a part of the *National Academy of Sciences* (NAS), has offered several suggestions (NRC 1994 a) for cost recovery for NOAA data through royalties, licenses, and user fees, so the present situation may not continue.

Chart Demand

Customers for NOAA charts include government agencies, commercial navigators, and recreational boaters. Figure 1–5 (Source: NRC 1994a) shows a time series of sales of NOAA charts (conventional and smallcraft) from 1980 to 1993 (plotted on a logarithmic axis to emphasize percentage changes). As can be seen, total sales of NOAA charts have declined over these years. Sales of small-craft charts have decreased by approximately 61 percent (–7.5



SOURCE: NATIONAL RESEARCH COUNCIL

Figure 1-5. Recent Sales History of NOAA/NOS Nautical Charts: A Reflection of Evolving Technology or an Ominous Trend?

percent per year compound annual average) over this time period and sales of conventional charts have decreased by about 44 percent (–4.5 percent per year average annual). Factors accounting for this trend include increased prices for NOAA charts, the decrease in the number of U.S. flag ships, and the emergence of competitive commercial products (including variants of paper charts and electronic chart products).

Although exact sales data are unavailable, it is estimated (NRC 1994a) that sales of commercial charts are substantial and certainly exceed NOAA's sales volume.

Assuming, for argument's sake, that commercial sales were twice those for NOAA, sales of nautical charts would be only about 3 million charts per year—of which approximately 900,000 are used by government agencies—leaving approximately 2 million sold to commercial mariners and recreational boaters. However, according to estimates made by the USCG, there are more than 20 million recreational boats operating on U.S. waters (*Boating Statistics*). To be sure, many of these are very small craft operating in circumstances that may not require the use of a nautical chart—for example, 51 percent of the 11.3 million numbered recreational boats are under 16 feet in length. Nonetheless, there is a substantial gap between the estimated number of boats and the annual chart sales, suggesting that many recreational boaters purchase charts infrequently, if at all. Considering the wealth of essential information given on the typical nautical chart (see below and other chapters in this manual), this is evidence of false economy—could it be that some of today's mariners are subscribing to the ancient Marshall Islander's theory that charts are too valuable to be carried on board?

ECDIS, The End of the Paper Era?

Many mariners, including both recreational boaters and those from the commercial sector, now use some form of electronic chart system—more formally called *Electronic Chart Display and Information Systems* (ECDIS). These systems receive position information from onboard navigation systems, such as GPS, *Differential Global Positioning System* (DGPS), or Loran–C receivers, and display this information on an electronic reproduction of a chart. For highest accuracy, DGPS is the navigation system of choice.

Some electronic charting systems offer only a low-detail monochrome display, but the more advanced (which require personal computers) present faithful reproductions of nautical charts in color. The system allows a user to enter a course as a series of waypoints with intervening straight line legs that is superimposed on the electronic chart. Real time position information is provided with a vessel icon, showing its position with respect to the intended track. Often this system is integrated with an autopilot which, in navigation mode, automatically makes rudder corrections to maintain the vessel on the intended track. Details of this system, with legal, institutional, and charting implications, can be found in several sources (NRC 1994a, NRC 1994 b).

To support these systems, NOAA is engaged in a project to digitize existing charts and provide digital data to vendors designing and marketing ECDIS products. Digitizing chart products offers other advantages, not the least of which is a radical simplification of the chart correction process. For example, if a buoy is moved, this change can be noted in the digital data base and all charts which depict this buoy can be electronically updated.

However, full implementation of ECDIS requires additional survey work with modern hydrographic equipment to complement the data base development effort. It is literally true that the integration of DGPS and ECDIS provides the mariner with the ability to navigate with greater accuracy (3 to 5 meters) than was available to the surveyor who collected the data in the first place—at least for many areas. At present, the indicated position of a hazard on a nautical chart may be more uncertain than the vessel's position. Source diagrams, explained in Chapter 4 and in the *U. S. Coast Pilot*, provide the mariner with information on the survey date and scale supporting each nautical chart.

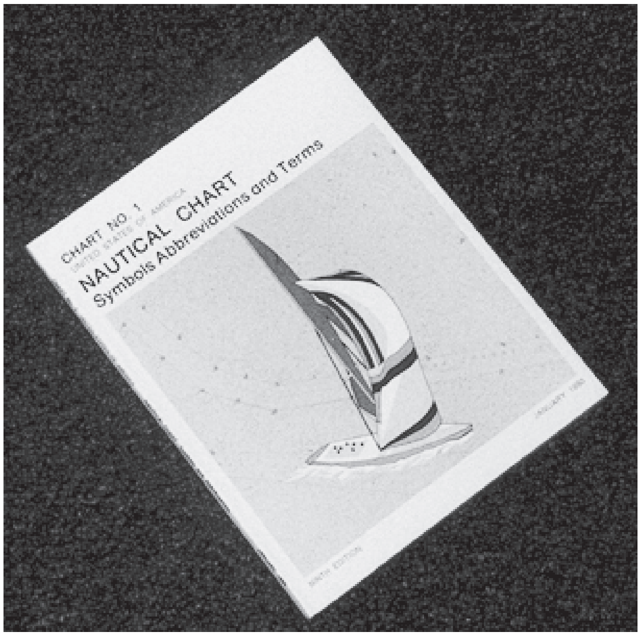


Chart No. 1 Provides Essential Information on symbols and Conventions Used on NOAA and NIMA Charts

Chart–Related Publications

Despite its comprehensiveness, the nautical chart is not a "stand-alone" publication. Rather it is part of an integrated series of publications by NOAA and other government agencies. Nautical chart users should be aware of the content of these companion publications. These are briefly described below.

–Chart No. 1

Chart No. 1 is published jointly by NOAA and NIMA. As noted, Chart No. 1 provides a compendium of chart symbols and other valuable data helpful in interpreting the nautical chart. Terms, symbols, and abbreviations are numbered in accordance with a standard format recommended by the *International Hydrographic Organization* (IHO). The layout of Chart No. 1 is described more fully in Chapter 2.

–Chart Catalogs

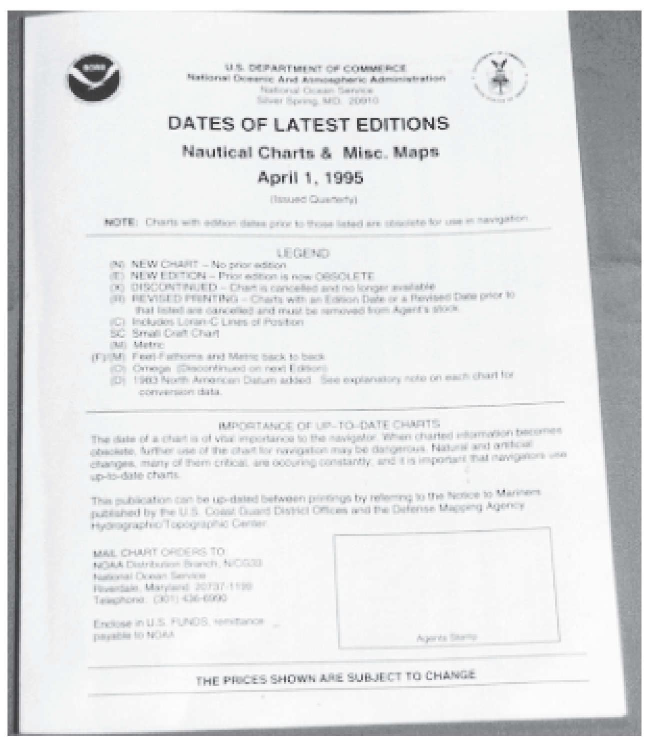
As noted, the *Nautical Chart Catalog* provides ordering information for NOAA charts and related products.

–Dates of Latest Editions

This pamphlet is published quarterly by NOAA and identifies the date of the latest edition of each nautical chart and other relevant information. Mariners can consult this publication to verify that they have the latest chart on board.

–Notice to Mariners

The NM, issued weekly, is prepared by NIMA with input from NOAA and USCG. The NM is of primary interest to navigators of deep-draft vessels; it presents information on changes to channels, ATONs, locations of wrecks, changes to depth curves and soundings, and other information necessary for updating the nautical charts and other publications produced by these agencies. In cases where the changes are too extensive to be listed in written form, NOAA prepares chartlets (page-sized, black-and-white portions of nautical charts) for inclusion in the NM. An illustrative chartlet is shown in Chapter 4. The NM is presently available in two forms, a weekly pamphlet containing corrections listed in order of chart number, together with


U.S. DEPARTMENT OF COMMERCE
National Oceanic And Atmospheric Administration
National Ocean Service
Silver Spring, MD. 20910

DATES OF LATEST EDITIONS
Nautical Charts & Misc. Maps
April 1, 1995
(Issued Quarterly)

NOTE: Charts with edition dates prior to those listed are obsolete for use in navigation.

LEGEND
(N) NEW CHART – No prior edition
(E) NEW EDITION – Prior edition is now OBSOLETE
(X) DISCONTINUED – Chart is cancelled and no longer available
(R) REVISED PRINTING – Charts with an Edition Date or a Revised Date prior to that listed are cancelled and must be removed from Agent's stock.
(C) Includes Loran-C Lines of Position
SC Small Craft Chart
(M) Metric
(F)/(M) Feet-Fathoms and Metric back to back
(O) Omega (Discontinued on next Edition)
(D) 1983 North American Datum added. See explanatory note on each chart for conversion data.

IMPORTANCE OF UP–TO–DATE CHARTS
The date of a chart is of vital importance to the navigator. When charted information becomes obsolete, further use of the chart for navigation may be dangerous. Natural and artificial changes, many of them critical, are occuring constantly, and it is important that navigators use up-to-date charts.

This publication can be up-dated between printings by referring to the Notice to Mariners published by the U.S. Coast Guard District Offices and the Defense Mapping Agency Hydrographic/Topographic Center.

MAIL CHART ORDERS TO:
NOAA Distribution Branch, N/CG33
National Ocean Service
Riverdale, Maryland 20737-1199
Telephone: (301) 436-6990

Enclose in U.S. FUNDS, remittance payable to NOAA

Agents Stamp

THE PRICES SHOWN ARE SUBJECT TO CHANGE

Dates of Latest Editions is an indispensable aid to the mariner.

```
                     AUTOMATED NOTICE TO MARINER                     3/11/95
                    CHART CORRECTION QUERY SYSTEM
               EXTRACT ALL CORRECTIONS TO SELECTED CHARTS
                         THRU CURRENT NTM 12/95

S  12314 28Ed.10/17/92  NEW EDITION          (NOS; CL1126/92)         4/93
        Add       Purple dashed lines joining
                     40deg 06min 15.5sec N   74deg 49min 56.5sec W
                     40deg 06min 13.0sec N   74deg 50min 14.0sec W
                     40deg 05min 56.0sec N   74deg 50min 26.0sec W
                     40deg 05min 50.2sec N   74deg 50min 24.0sec W

                        between
                     40deg 05min 51.0sec N   74deg 50min 14.0sec W
                     40deg 06min 05.3sec N   74deg 50min 03.0sec W

                  Legend "Cable Area''
                     40deg 06min 07.0sec N   74deg 50min 12.0sec W
                  (Previously published 46/92)

        Add       Tabulation of controlling depths
                  from back of Section I

   12314 28Ed.10/17/92  LAST NM 04/93                  (NOS)          14/93
        Change    Characteristic of range light,
                     front to Oc R 4s
                        40deg 07min 18sec N   74deg 46min 42sec W
                     rear to Oc R 4s
                        40deg 07min 18sec N   74deg 46min 41sec W

S  12314 28Ed.10/17/92  LAST NM 14/93              (30/93 CG5)        36/93
        Add       Buoys, each Y, Fl Y 6s (Priv maintd)
                     "N''
                      40deg 02min 01.2sec N   74deg 59min 40.0sec W
                     "S''
                      40deg 02min 00.0sec N   74deg 59min 41.6sec W

S  12314 28Ed.10/17/92  LAST NM 36/93              (CL978/93)         40/93
        Add       Tabulation of controlling depths
                  from back of Section I

S  12314 28Ed.10/17/92  LAST NM 40/93              (CL1268/93)        8/94
        Add       Tabulation of controlling depths
                  from Subsection I-2

S  12314 28Ed.10/17/92  LAST NM 08/94              (22/94 CG5)        28/94
        Change    Legend to
                     "Q 21ft (Day), QR 21ft (Night)''
```

Figure 1-6. ANMS Output for NOS Chart No. 12314

an identifier indicating the number of any prior NM affecting each chart, and a computer service, called the *Automated Notice to Mariners System* (ANMS) which provides several access and sort options. Figure 1–6 shows ANMS output for chart corrections for NOS Chart No. 12314 (the chart illustrated in figure 1–2). The ANMS updates are made continuously, so this system provides the most current information available. The ANMS can be accessed with an appropriate terminal (e.g., a personal computer with a modem) from anywhere in the world that data-grade telephone service is available, which means that vessels can obtain the latest corrections while enroute to a destination. Contact NIMA for details on this system and a user identification.

CHART/PUB. CORRECTION RECORD DMAHC-8660/9 (11-74)

CHART/PUB. NO.	PORTFOLIO NO.	EDITION NO./DATE	CLASS	PRICE	CORRECTED THRU N. TO M., NO./YR. OR PUB. CHANGES

TITLE

APPLICABLE NOTICE TO MARINERS

N/M YR	PUB. PAGE NO.	CORRECTION MADE		N/M YR.	PUB. PAGE NO.	CORRECTION MADE		N/M YR.	PUB. PAGE NO.	CORRECTION MADE		N/M YR.	PUB. PAGE NO.	CORRECTION MADE	
		DATE	INITIAL			DATE	INITIAL			DATE	INITIAL			DATE	INITIAL

CHART/PUB. NO.

Figure 1-7. Form for Recording NM Corrections

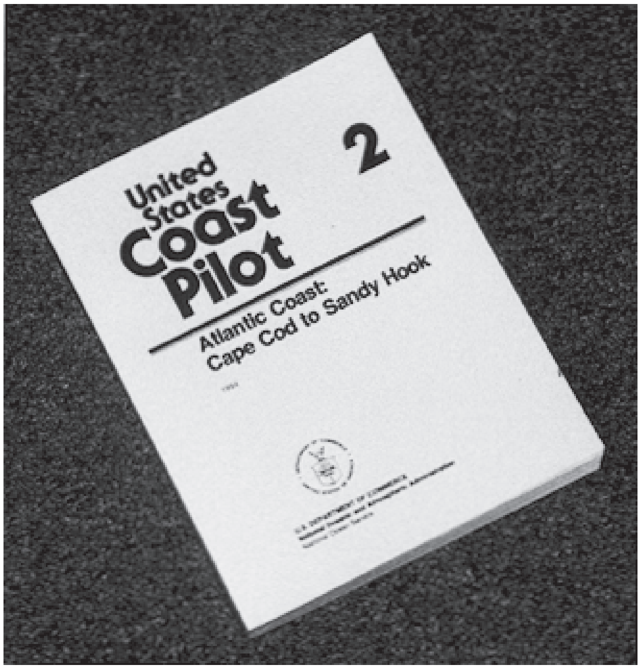
Besides listing chart corrections, the NM contains corrections for other publications, such as the *U.S. Coast Pilot* and *Light List* (see below). Figure 1–7 shows a convenient form for recording NM corrections.

Correcting charts is often a tedious and time-consuming job, particularly if the number of corrections is large, but essential nonetheless. In cases where carriage of charts is legally mandated (see Chapter 2), these charts are required to be corrected to the latest NM.

–Local Notice to Mariners

The NM presents worldwide information relevant to deep-draft vessels. Similar information on waters not navigable by deep-draft vessels, as well as temporary changes to published data, are not included in the NM. The *Local Notice to Mariners* (LNM), published by the USCG, provides this information. Small-craft owners using intracoastal and other waterways and small harbors that are not normally used by deep-draft vessels require the LNM to keep charts and related publications current. The LNM is available from each USCG District on a subscription basis. The number of subscribers to the LNM is very small compared to the number of registered boats, however, which means that the vast majority of recreational boaters do not subscribe to the LNM and are missing out on a valuable opportunity. Moreover, as noted by one observer (Dutton's),

> "Failure to have on board and use the *latest* charts and other publications, *and to keep them corrected*, may adversely affect a mariner's legal position should he have a grounding, collision, or other mishap in which chart or publication information in involved." [Emphasis in original.]



The *United States Coast Pilot* Provides A Wealth of Additional Information

–Coast Pilot

The *U.S. Coast Pilot* is a nine volume series (organized geographically) of nautical books published by NOAA that provide a wide variety of information important to mariners. This publication originated in 1796 with a commercial product, called the *American Coast Pilot*, published by Edmund March Blunt *(Coast Pilot Manual)*. The copyright was later sold to the United States in 1867.

Although there is some overlap with material presented on the nautical chart, most of the contents of the *U.S. Coast Pilot* cannot be shown graphically on the nautical charts and is not readily available elsewhere. For example, the general and specific federal regulations applicable to restricted and prohibited areas, along with other federal regulations are provided in Chapter 2 of each *U.S. Coast Pilot*.

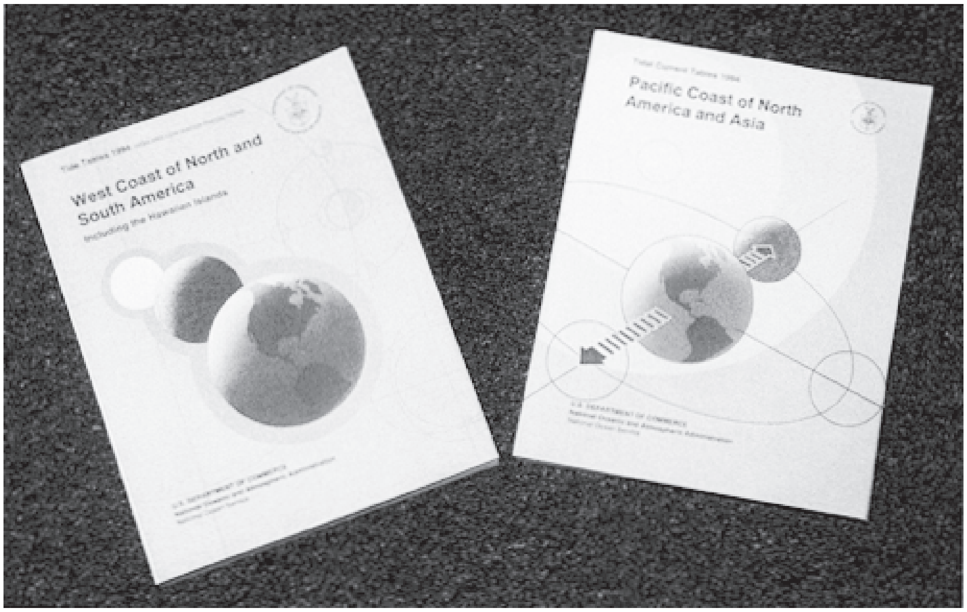
The subjects presented in the *U.S. Coast Pilot* include channel descriptions, anchorages, bridge and cable clearances, currents, tide and water levels, prominent features, pilotage, towage, weather, ice conditions, wharf descriptions, dangers, routes, TSSs, small-craft facilities, and federal regulations applicable to navigation. Revisions to the *U.S. Coast Pilot* are printed in the NM or LNM as appropriate. A related publication, the *Coast Pilot Manual*, provides valuable supplemental information relative to the *U.S. Coast Pilot*.

The Coast Pilot is a user-friendly publication. Reading it is rather like having a conversation with a master mariner with abundant local knowledge. The contents of the *U.S. Coast Pilot* are discussed in detail in other chapters of this manual.

–Light List

The *Light List* is a seven-volume series (organized geographically) published by the USCG and available from the U. S. Government Printing Office in Washington, DC, and authorized sales agents. This list, published annually, provides more complete information concerning ATONs than can be shown on charts. The term, light list, is actually somewhat of a misnomer, since the publication includes many unlighted ATONs. Specifically, the *Light List* contains detailed information on ATONs, including lights, fog signals, buoys, daybeacons, radiobeacons, *RAdar beaCONs* (RACONs), and Loran stations, in a tabular form. Entries in the tables include the *Light List Number* (LLNR), name and location of the ATON, position (latitude and longitude), characteristic, height, range, structure, and pertinent remarks (e.g., if replaced with a seasonal buoy, horn characteristics, RACON characteristic, light sector's arc of visibility, radar reflector, emergency lighting, etc.). Although some of this information is also shown on the nautical chart, the *Light List* provides additional details, such as the appearance of the structure, not found in any other source. The introduction to the *Light List* is particularly interesting, offering a wealth of general information on the ATON system.

The *Light List* contains a list of all federally maintained ATONs as well as so-called Class I and Class II privately maintained ATONs. Class III privately maintained ATONs (located in waters not ordinarily used by general navigation), USCG mooring buoys, and some buoys having no lateral significance, such as special purpose, anchorage, fish net, and dredging buoys are not listed. Corrections to the *Light List* are published in the NM.



Tide Tables and Tidal Current Tables, Issued Annually, Provide Daily Tide and Tidal Current Information

–Tide Tables and Tidal Current Tables

Tide Tables are published annually in four volumes by NOAA and give the predicted times and heights of high and low waters for each day in the year for approximately 200 of the most important harbors, designated as reference stations. These tables also provide additional data for interpolating tidal predictions at thousands of subordinate stations. Estimated tide heights can be used to adjust charted depths (and vertical clearances).

Tidal Current Tables, also published by NOAA, provide information in a similar format for estimation of the predicted times of slack, flood, and ebb, and the strength of the current at any time. Predicted tidal currents are used for estimating the vessel's speed over the bottom, requisite course corrections to maintain a specified track, and the most favorable times to transit certain areas. (Note, NOAA has announced that the Tide Tables and Tidal Current Tables will be printed by the private sector in the future.)

"What can be more difficult than to guyde a shyppe engoulfed, when only water and heaven may be seen?"

Martin Cortes, 1551
Quoted in Heinl

The Track Ahead

This concludes the general overview of U.S. nautical charts and related products. The following chapters are more specific and detailed. Gather a copy of Chart No. 1 and a familiar chart of local waters and see how to get the most out of the nautical chart.

"The position and extent of any shoal or danger discovered, especially of one upon which a vessel has struck or grounded, should be determined, if practicable, by five horizontal sextant angles between well selected objects."

Admiralty Manual of Navigation

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CHAPTER 2

"It is established for a custom of the sea that if a ship is lost by default of the lodesman, the mariners may, if they please, bring the lodesman to the windlass and cut off his head without the mariners being bound to answer before any judge, because the lodesman had committed high treason against the undertaking of the pilotage, and this is the judgement."

Twenty-Third Article of the Laws of Oleron 1190
Quoted in Schofield

General Information and Overview

Introduction

This chapter provides additional general information about nautical charts together with specific information about the schematic layout of a nautical chart, the chart title block, chart projections, types (and scale) of charts, chart overlap (and related matters), latitude and longitude axes, vertical and horizontal datums, isogonic lines and the compass rose, chart colors, chart lettering, and other miscellaneous charting conventions. Where appropriate, comments on the utility of this information are included, as are practical tips on how to use this information.

Many specialized terms used in this chapter are defined in the Glossary in appendix A. Abbreviations are included in appendix B. Names enclosed in parentheses (e.g., Bowditch) refer to sources listed at the end of this chapter that contain additional relevant detail or useful general discussions.

It is recommended that the reader have a nautical chart and Chart No. 1 at hand when studying the contents of this and subsequent chapters.

Chart No. 1

As noted in Chapter 1, *Chart No. 1, Nautical Chart Symbols, Abbreviations, and Terms (9th ed.),* provides an indispensable description of the symbols (both national and international) and many of the conventions used on the nautical chart. Chart No. 1 should be carried aboard all vessels. The contents of Chart No. 1 provide a useful framework for organizing this manual. Although space constraints do not permit inclusion of Chart No. 1 in its entirety in this manual, many illustrative excerpts are provided.

Chart No. 1 is organized into various sections, each providing information on one or more groups or classes of symbols and conventions used on the nautical chart. For example, general information is included in Section A (Chart Number, Title, Marginal Notes); information on positions, distances, directions, and the compass is presented in Section B; topographic features in Sections C through G; hydrographic information in Sections H through O; aids and services in Sections P through U; and alphabetical indices in Sections V through X. Within each Section of Chart No. 1 there are several subsections, and numerous individual symbols are presented within each subsection. For example, Section F contains port information, which is further subdivided into hydraulic structures, harbor installations, canals, transshipment facilities, and public buildings. Within the subsection on harbor installations F14 is the specific symbol used to depict a pier or jetty. Where appropriate, these sections and symbols are provided (e.g., F14) in the text or headings of this manual to refer the reader to the relevant section or symbol listed in Chart No. 1.

Charts published in the United States include those produced by NOAA, NOS—for U.S. waters—and NIMA, for other areas of the world. Symbols used by each agency are depicted in Chart No. 1.

Because of the importance of Chart No. 1, it is worthwhile to summarize briefly the schematic layout of this chart. Figure 2–1 illustrates this layout. Item 1 in this figure is the section ("Rocks, Wrecks, Obstructions"), and item 2 the section designation ("K" in this illustration). Item 3 denotes the subsection ("Wrecks"), and item 4 ("Supplementary National Symbols") provides a reference to any supplementary national symbols given at the end of each section. As the name implies, supplementary national symbols are unique to each country (e.g., those listed in Carte No. 1, Chart 5011) and do not conform to the standard symbols authorized by the IHO. Although not officially listed by the IHO, these supplementary national symbols have been retained for the convenience of chart users in each country. Standardized symbols facilitate chart use by mariners from different countries, while supplementary national symbols provide the flexibility to describe country-specific features and reflect historical charting practices.

Item 5 in figure 2–1 provides a cross-reference to terms contained in other relevant sections of Chart No. 1. In this illustration, the Plane of Reference for Depths, found in Section H, is relevant to information given in Section K. Item 6 (column 1) identifies the standard number which follows the "Standard List of Symbols, Abbreviations, and Terms" defined by IHO.

Item 7a in figure 2–1 is the symbol or representation as used on charts produced by NOAA. In many cases, the identical symbol is also used by NIMA. If not, as in this example, the NIMA symbol is provided in an additional column (item 7b). Item 8 ("Stumps of posts or piles, fully submerged") is a written description of the various terms or abbreviations associated with this symbol. Item 9 presents the chart symbol as prescribed/recommended by the IHO. Finally, item 10 presents the corresponding symbols that may appear on NIMA reproductions of foreign charts.

The reader interested principally in using NOAA charts should focus on items 1, 2, 3, 4, 5, 6, 7a, and 8 as shown in this excerpt from Chart No. 1.

Schematic Layout of a Nautical Chart

To begin, it is useful to examine the schematic layout of the nautical chart and to review the overall format, including the textual material given in the chart. According to the *Desk Reference Guide,*

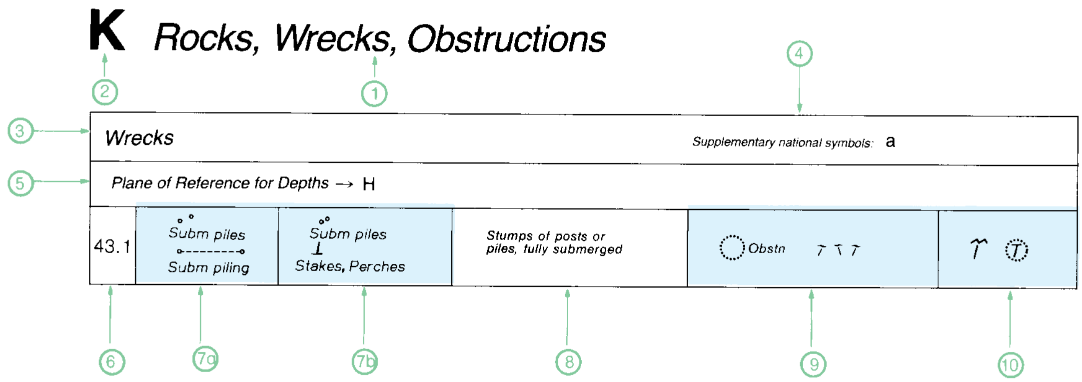
> "The chart format is the general plan of organization or arrangement of a nautical chart including the layout of the margin notes, border, title block, and insets."

Figure 2–2 presents the overall format of a nautical chart, and figure 2–3 provides additional explanatory information. The most important items shown in figures 2–2 and 2–3 are summarized in this chapter.

Number, Title, and Marginal Notes (A)

Item 1 in figure 2–2 is the chart number (412 in this illustration) in the (U.S.) National Chart Series, and item 3 is the corresponding chart number in the International Chart Series (if any). The system used for charts produced by both NOAA and NIMA assigns numbers to charts based upon the scale and the geographic area of coverage of the chart. One- to five-digit chart numbers are used. Details of the numbering convention can be found in several sources (e.g., Bowditch). For the most part, mariners using NOAA charts will be concerned with five-digit

Schematic Layout of Chart 1



1	*Section.*
2	*Section designation.*
3	*Subsection.*
4	*Reference to "Supplementary national symbols" at the end of each section.*
5	*Cross reference to terms in other sections.*
6	*Column 1: Numbering following the New "Standard List of Symbols, Abbreviations, and Terms" of the IHO.*
7a	*Column 2: Representation used on charts produced by the National Ocean Service (NOS). In certain instances, the representation is clarified by a label on the chart.*
7b	*Column 3: Representation used on charts produced by the Defense Mapping Agency (DMA). In certain instances, the representation is clarified by a label on the chart.* *Note: When the NOS and DMA symbols are identical, Column 2 and Column 3 are combined to show only one set of symbols.*
8	*Column 4: Description of symbol, term, or abbreviation.*
9	*Column 5: Representation following the "Chart Specifications of the IHO".*
10	*Column 6: Representation of symbols that may appear on DMA reproductions of foreign charts.*

Fig. 2-1. Schematic Layout of Chart No. 1

A Chart Number, Title, Marginal Notes

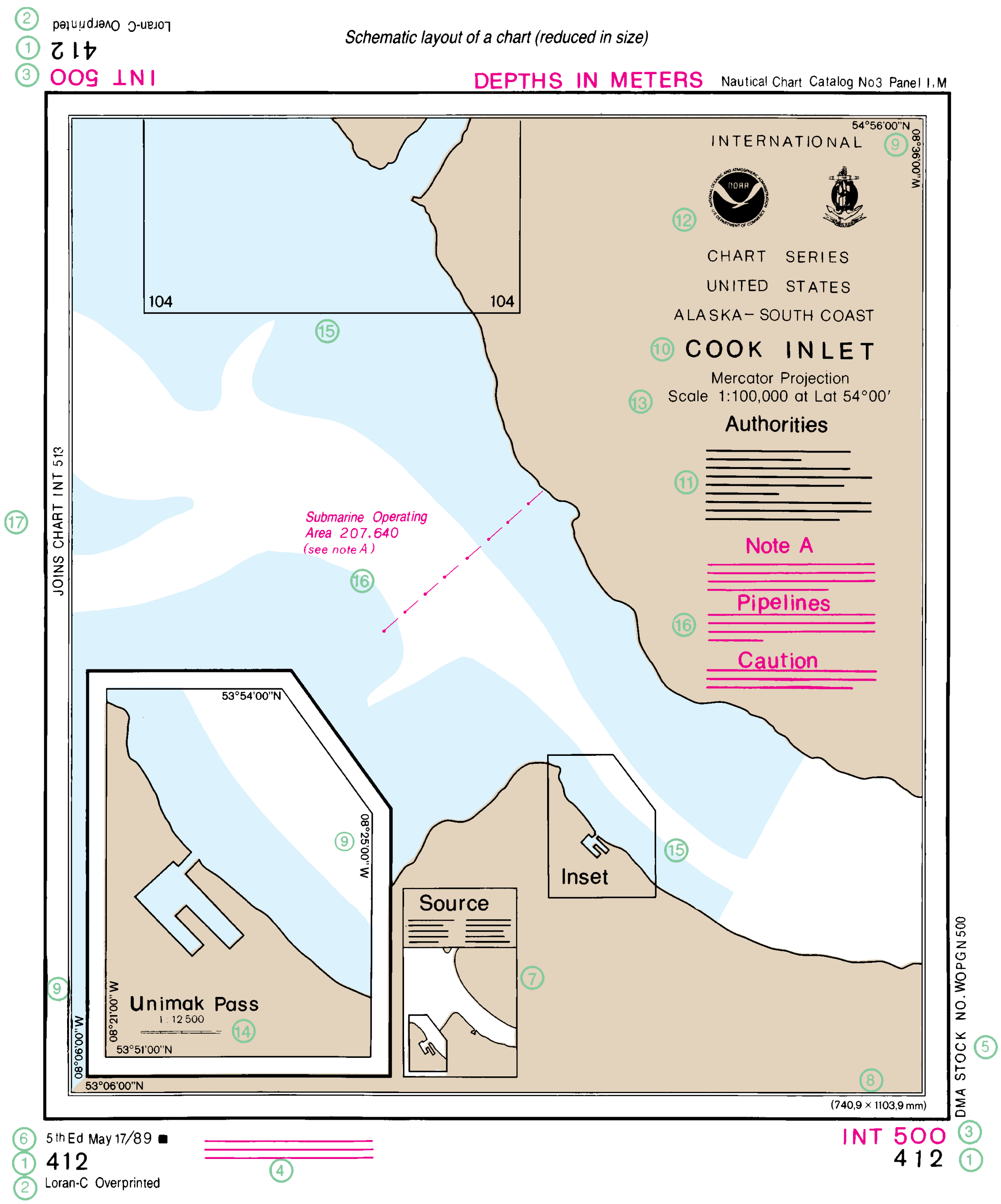


Fig. 2–2. Schematic Layout of a Nautical Chart

A *Chart Number, Title, Marginal Notes*

Magnetic Features → B	Tidal Data → H	Decca, Loran-C, Omega → S

	Chart number in national chart series
1	Identification of a latticed chart (if any): D for Decca LC for Loran-C Om for Omega
2	Chart number in international chart series (if any)
3	Publication note (imprint)
4	Stock number
5	Edition note. In the example: Fifth edition published in May, 1989
6	Source data diagram (if any). For attention to navigators: use caution where surveys are inadequate
7	Dimensions of inner borders
8	Corner co-ordinates
9	Chart title } May be quoted when ordering a chart, in addition to chart number
10	Explanatory notes on chart construction, etc. To be read before using chart
11	Seals: In the example, the national and International Hydrographic Organization seals show that this national chart is also an international one. Purely national charts have the national seal only. Reproductions of charts of other nations (facsimile) have the seals of the original producer (left), publisher (center) and the IHO (right)
12	Projection and scale of chart at stated latitude. The scale is precisely as stated only at the latitude quoted
13	Linear scale on large-scale charts
14	Reference to a larger-scale chart
15	Cautionary notes (if any). Information on particular features, to be read before using chart
16	Reference to an adjoining chart of similar scale
17	

Source: Chart No. 1

Fig. 2–3. Items of Interest in Figure 2–2

chart identification numbers, which are drawn to a scale (see below) of 1:2,000,000 and larger. Chart numbers and their respective areas of coverage are presented in the nautical chart catalog.

Latticed Charts (A)

Item 2 in figure 2–2 indicates whether or not a navigational lattice is overprinted on the chart and, if so, the type of lattice. For example, the legend "LORAN–C OVERPRINTED" informs the mariner that Loran–C TD data are superimposed on the chart, the legend "D" that Decca information is included, and the legend "OMEGA OVERPRINTED" indicates that Omega information is provided.

Although Decca and Omega navigation systems are used extensively in other parts of the world, Loran–C is of particular importance to mariners in U.S. waters. In view of the importance of this system, many NOAA charts are overprinted with Loran–C TD data. Most modern Loran–C receivers are able to convert from TDs to latitude and longitude, but use of TDs is still recommended for highest accuracy *(Loran–C User Handbook)* so a TD lattice is handy.

Nautical charts overprinted with a Loran–C lattice are identified in the nautical chart catalog with the letter "C" enclosed with a circle in front of the chart number. Loran–C TDs are usually provided on charts with 1:80,000 scale (see below) and smaller upon request of the USCG. Loran–C lattices are not shown on harbor or harbor entrance charts at scales of 1:50,000 or larger and over most inshore areas or inland waters because the navigational accuracy is adversely impacted by interference caused by land and/or building structures.

Edition (A)

The chart edition, shown as item 6 in figure 2–2, is one of the most important items of information given on the chart. The original date of issue (not shown in figure 2–2) of a new chart is printed at the top center margin. The edition number (e.g., 5th ed. May 17/89 in figure 2–2) is printed in the lower left-hand corner of the chart. New editions are published when, at the time of printing, the corrections from previous editions are too numerous or too extensive to be reported in the NM. Criteria for allocation of survey and chart compilation effort are given in table 2–1. A new chart edition supersedes all earlier editions. The date shown is the same as that of the latest NM to which the chart has been corrected. In this illustration, the 5th edition has been corrected through May 17, 1989. (Mariners sometimes overlook this important point, charts are corrected to the date shown, not to the *date of purchase.* Therefore, it is generally necessary to make corrections on a newly purchased chart.) A *revised print* published by NOAA may contain corrections which have been published in NM but does not supersede the current edition of the chart. The date of the revision is shown to the right of the edition date. Thus, for example, 5th ed. May 17/89; Revised June 20/94, indicates that this chart was revised in June 1994. A *reprint,* issued to replace depleted stocks, is an exact duplicate of the current issue with no changes in printing or publication dates.

A study by the NRC, indicated that nominal print cycles for NOAA charts range from 6 months to 12 years. In practice, new editions are initiated by the cumulative number of chart corrections, significant format or regulation changes, new basic data (e.g., survey data), low shelf stock, and available resources. Not all chart corrections are critical; critical chart corrections include changes in aid to navigation, obstructions, shoaling, and certain cultural and facility changes. According to NRC, 30 to 70 changes trigger a new edition.

Reconstructed, Provisional, and Preliminary Charts

Three other types of charts, reconstructed charts, provisional charts, and preliminary charts, are worthy of mention. According to the *Nautical Chart Manual:*

- A *reconstructed* chart, is one that is completely recompiled on a new projection. This is issued when the accumulation of new information is sufficiently extensive to affect most of an existing chart, or if there are changes to the chart limits, or the chart is produced using computer supported compilation and scribing techniques. A reconstructed chart is issued as a new edition.

Chart reconstruction is used to improve the quality of the chart and to incorporate any new symbols and conventions developed over the years. Changes in type style, particular symbols, and cartographic philosophy accumulate and evolve over the years with the result that older charts contain a mixture of type styles and may include outdated symbols (e.g., symbolized depth curves rather than labeled solid lines, excessive use of road symbols rather than urban tint, etc.) and conventions. Moreover, the chart reproduction process may cause a gradual deterioration of the image (e.g., line thickening, symbols becoming less distinct, etc.) to the point that certain symbols are difficult to recognize. When a chart is reconstructed, the symbology and chart conventions are updated along with the necessary revisions (e.g., relocated buoys, new wrecks, shoaling, etc.) typically noted in the NM or the LNM.

- A *provisional* chart is a special chart for which there is an urgent need. The chart is labeled "PROVISIONAL CHART" in the upper and lower margin or at a prominent location inside the upper and lower border.

- A *preliminary* chart is one for which there is an urgent requirement that cov-

Table 2-1. Criteria Used to Set Priorities for Survey and Chart Compilation Effort

1.	What is the cumulative number of NM or LNM corrections to the present edition?
2.	How safe (or hazardous) to navigation is the area?
3.	What type of craft frequent the area?
4.	What is the volume of traffic in the area?
5.	What resources are available for field surveys?
6.	Where are the field resources and when can they be made available?
7.	Which supporting data (e.g., tide, photogrammetry, geodesy) can be supplied?
8.	What are the weather conditions in the area?
9.	What comments have been received from the field regarding the adequacy of present charts?
10.	What production resources are available to translate field data to charts and for subsequent chart compilation?
Source: Adapted with minor modification from the Nautical Chart Manual.	

ers a region where some or all of the survey data fail to meet modern standards. Survey deficiencies might include small scale, outmoded or nonstandard survey techniques, obsolete, unprocessed, or unapproved data, or other factors which cause the survey data to be below customary standards for the scale of the chart. Not all preliminary charts are published in full color. Additionally, the source diagram (see Chapter 4) alerts the mariner to the provisional nature of the data, and a separate warning note is included. An illustrative warning note is shown below,

WARNING
PRELIMINARY CHART

"All of the data on this preliminary chart is considered to be of marginal quality for modern charts. Many of the depths were taken by leadline in the early 1900s, so uncharted shoals are likely in this area. Navigators should use this chart with extreme caution and report discrepancies or hazards to..."

From the above, it is clear that preliminary charts should be used with particular care. However, the fact that the chart may include some data of marginal quality does not mean that all data are suspect. If the preliminary chart has a source diagram (see Chapter 4), this diagram should be consulted to determine which areas of the chart may contain data of marginal or unverified quality. Mariners may be able to select routes which avoid these areas. Alternatively, the mariner might choose a greater "safety margin" (e.g., depth allowance) in selecting routes, navigate with especial vigilance, navigate at reduced vessel speeds, and employ other appropriate measures to reduce risk.

–Importance of Current and Corrected Charts

Coote recounts one opinion on the use of current charts:

> "In 1950 I joined Fandango for the Santender Race returning via a race to Belle Ile and cruising home... I looked over the charts [provided by the owner] and found that they had all been bought... in June 1934. The suggestion that sixteen years and a World War might have outdated some of the musty old charts was brushed aside... by the owner [with the statement] 'I believe that the rocks don't move, so what's the matter with you'."

This idiosyncratic view is colorful but foolhardy; most mariners agree that it is essential to use the current edition/revision of the chart, updated to include all corrections given in the NM or LNM. Use of obsolete editions for navigation could be dangerous; buoys are moved, other ATONs may have changed location or characteristics, new hazards (e.g., obstructions, wrecks) may have been identified, natural changes to hydrography may have occurred, and areas and limits (see Chapter 7) may have been changed. Indeed, as noted above, the accumulated number of chart corrections is one of the principal determinants of NOAA's decision to prepare a new edition.

If prudence alone is not sufficient motivation to ensure that a vessel is equipped with appropriate and corrected charts, mariners should be aware that carriage of such charts is a legal requirement for certain classes of vessels. According to 33 *Code of Federal Regulations* (CFR) Part 164, self-propelled vessels of 1,600 or more gross tons (when operating in the navigable waters of the United States except the St. Lawrence Seaway) are obligated (Section 164.33(a), *et seq.*) to carry (among other things) corrected marine charts of the area which are of a large enough scale and have enough detail to make safe navigation of the area possible.

The NOAA publication, *Dates of Latest Editions* (issued quarterly), provides a list of the current editions of each chart. Techniques for making chart corrections are discussed in several sources (e.g., Bowditch, Farrell, Maloney, Markel).

Source Diagram (A)

A source diagram (item 7 in figure 2–2) indicates the scale and date of hydrographic surveys upon which the nautical chart is based. Source diagrams and their utility are discussed in more detail in Chapter 4.

Neat Line Dimensions (A)

The size of a nautical chart is related to the chart scale (see below) which is dependent upon the amount of detail (geographic and cultural features, hydrography, etc.) that is charted to provide a concise, legible, graphic representation of the necessary data. The chart dimensions also reflect the sizes of printing presses found in nations around the world which reprint and reissue NOAA charts. The internationally accepted size "A0" paper has outside dimensions of 841 mm x 1189 mm and is one of the standard sizes used by NOAA.

The *neat line* is the inner border of the chart. The dimensions of the neat line (item 8 of figure 2–2 or 740.9 mm x 1103.9 mm for this particular chart) are printed at the base of the chart. Neat line dimensions, in concert with the chart scale, enable calculation of the geographic area covered by the chart.

Chart Title, Authorities Note, and Seal (A)

Item 10 of figure 2–2 is the chart title (Cook Inlet in this illustration). Although charts are generally ordered by chart number, the chart title serves as an additional identifier. The nautical chart catalog shows the area covered by each NOAA chart, and the corresponding chart number and title. Chart titles cannot be used alone (in lieu of chart numbers) because many place names (and chart names) are common throughout the world. According to one source (Coote), for example, there is a St. John in Newfoundland, New Brunswick, Antigua, the Red Sea, Florida, the Virgin Islands, Liberia, and near Hong Kong!

Item 11 of figure 2–2 contains the AUTHORITIES note. This note identifies the sources of data (e.g., NOAA, USACE, U.S. Navy, etc.) used in the compilation of the chart, explanatory notes on chart construction, and related material.

Item 12 is the chart seal. In the example shown in figure 2–2, the NOAA and IHO seals show this to be an international as well as national chart. Purely national charts have the national seal only. Reproductions of charts of other nations (facsimile) have the seals of the original producer (left), publisher (center), and IHO (right).

Projection and Scale (A)

Item 13 in figure 2–2 (located just below the chart title) identifies the type of chart projection (e.g., Mercator) and the chart scale. Projections and their relevance are discussed below.

–Projections

From earliest times, cartographers have been faced with the theoretically impossible task of accurately representing a spheroid (the earth) on a flat plane, a task referred to as projection. As the science of cartography evolved, numerous projections were developed, each with advantages and disadvantages. A complete discussion of these various projections is beyond the scope of this manual, but can be found in several of the references given at the end of this chapter (Air Navigation, Bowditch, Brown, Maloney, Naval Training Command, Snyder, and Voxland).

For nautical charts of other than high-latitude or polar regions, the Mercator projection is favored. This is because meridians of longitude are parallel straight lines, as are parallels of latitude. These straight lines intersect at right angles, making a convenient rectangular grid. Directions and geographic coordinates are easily read on this grid. A straight course line (rhumb line or loxodromic curve) drawn on the Mercator chart can actually be run; the rhumb line track will pass all features along that line exactly as they are charted. This is a great advantage in coastal navigation because the straight line represents a planned course and readily indicates the distance at which dangers will be passed abeam if this course is maintained.

The rhumb line is not the shortest distance between two points (a great circle), and either calculation or an auxiliary chart is required to determine great circle courses if a Mercator chart is used. However, the difference in distance between the rhumb line and the shorter great circle is very small for all but the longest voyages. Radio waves and light travel along great circles, which means that radio bearings taken some distance from the transmitter need to be corrected. Radio bearing corrections are tabulated on some nautical charts and can also be found in the *U.S. Coast Pilot* and other references (Bowditch).

In a more general context, the chief disadvantage of the Mercator projection is that it distorts the relative size of land areas—particularly for land masses located near the poles—other projections are superior in this regard. Indeed, one author (Monmonier) has argued (presumably tongue-in-cheek) that the Mercator projection has served the aims of political propagandists seeking to magnify the Communist threat, because this projection exaggerates the relative size of the former Soviet Union relative to countries situated at lower latitudes. (One can only marvel at the political prescience of Gerhard Mercator in anticipating this application when he developed the projection in the year 1569!) Whatever its other merits or faults, the utility and convenience of the Mercator projection for most marine navigation applications are unequalled.

For this reason, nearly all NOAA nautical charts are based upon the Mercator projection. The polyconic projection is used on some NOAA Great Lakes charts, but these charts are being converted to Mercator projections as resources permit.

Relevant attributes of Mercator and polyconic charts are summarized in table 2–2. As a practical matter, differences between these projections are only apparent on small-scale charts (see below). On large-scale charts, virtually identical plotting techniques are used.

The chief differences between small-scale Mercator and polyconic charts are:

- Distance is most accurately measured at or near the mid-latitude of the course on the Mercator chart. Distance scales (see below) are shown in nautical miles on Mercator charts, and in statute miles on polyconic Great Lakes charts.

- For all intents and purposes, great circles plot as straight lines on the polyconic chart. However, true directions from any point on the polyconic chart should be measured from the nearest meridian or nearest compass rose (see below). As noted, great circles do not plot as straight lines on Mercator charts. Instead, great circle courses must be calculated (or read from a polyconic or Gnomonic projection) as a series of points and transferred to the Mercator chart. Details of plotting great circle courses on Mercator charts are given in the references (Bowditch, Maloney).

- True directions (rhumb lines) can be measured with respect to any meridian or parallel (or any compass rose) on the Mercator chart, although in practice the nearest compass rose is used if magnetic courses are desired, because the magnetic variation varies with location on the chart.

- Plotting geographic positions is somewhat simpler on the Mercator chart, because meridians and parallels intersect at right angles. Great Lakes polyconic charts include a graphic plotting interpolator for the most accurate measurements of latitude and longitude.

Table 2-2. Key Characteristics of Projections Used in NOAA Nautical Charts

	Projection Type	
Attribute	**Mercator**	**Polyconic**
Invented by:	Gerard Mercator (the Latinized form of DeCremer or Kremer) in 1569.	Ferdinand Hassler, first director of the Coast Survey (later U.S. Coast and Geodetic survey) about 1820.
Poles:	Cannot be shown.	Points.
Projection:	Cylindrical.	Series of cones.
Conformality:	Conformal.	No, but approximately so.
Distance Scale:	Variable (measure at mid-latitude).	True along the central meridian and along each parallel.
Distortion of Shapes and Areas:	Increases away from equator.	Free of distortion only along central meridian. Extensive distortion for small-scale charts.
Angle Between Parallels and Meridians:	90°	Variable.
Appearance of Parallels:	Parallel straight lines unequally spaced.	Arcs of nonconcentric circles nearly equally spaced.
Appearance of Meridians:	Parallel straight lines equally spaced.	Curved lines (nearly straight) converging towards the pole and concave to the central meridian.
Straight Line Crosses Meridians:	Constant angle (rhumb line).	Variable angle (approximately great circle).
Great Circle:	Curved line (except at equator and Meridians).	Straight line (approximately)
Rhumb Line:	Straight line	Curved line
Used for:	Nearly all marine navigation charts produced by NOAA.	Some Great Lakes charts; being replaced by Mercator as resources permit.
True Direction Measured at:	Any place on chart; nearest compass rose most convenient.	Nearest meridian or compass rose.

–Chart Scale

The *scale* of the chart is the ratio of a given distance on the chart to the actual distance that it represents on the earth. Scale is expressed in various ways. The most common expression is a simple ratio or fraction known as the *representative fraction.* For example, a scale of 1:40,000 or 1/40,000 means that one unit (e.g., one inch) on the chart represents 40,000 of the same unit(s) on the surface of the earth. This scale is also termed the "natural" or "fractional" scale. A chart covering a relatively large area is called a "small-scale chart," and one covering a relatively small area is termed a "large-scale chart." To remember the difference between small scale and large scale, it is helpful to think of a small-scale chart as presenting only a small amount of detail and a large-scale chart as presenting a large amount of detail.

On a chart based upon the Mercator projection (the type shown in figure 2–2), the scale varies with the latitude. This variation is only noticeable on a chart covering a relatively large distance in a north–south direction. *On such a chart, the scale at the latitude in question should be used for measuring distances.*

Table 2–3 provides relevant scale information for various scales used in the preparation of nautical charts. For each chart scale, table 2–3 shows the number of nautical miles represented by 1 inch in length and its reciprocal, the length of 1 nautical mile in inches. This table

Table 2–3. Relevant Scale Information

Chart Scale 1	1 Inch in Nautical Miles	1 Nautical Mile in Inches	Coverage Square NM[1]	Nautical Chart Type[2]	
				Conventional	Small Craft
5,000	0.069	14.58	6	Harbor	
10,000	0.137	7.29	24	1:50,000 and	
20,000	0.274	3.65	96	larger	1:10,000 to
30,000	0.411	2.43	217		1:80,000
40,000	0.549	1.82	385		
50,000	0.686	1.46	601		
60,000	0.823	1.22	866	Coastal	
70,000	0.960	1.04	1,179	1:50,000 to	
80,000	1.097	0.91	1,540	1:150,000	
90,000	1.234	0.81	1,949		
100,000	1.371	0.73	2,406		
150,000	2.057	0.49	5,413		
200,000	2.743	0.36	9,623		
300,000	4.114	0.24	21,651	General	
400,000	5.486	0.18	38,491	1:150,000 to	
500,000	6.857	0.15	60,142	1:600,000	
600,000	8.229	0.12	86,605		
700,000	9.600	0.10	117,879		
800,000	10.972	0.09	153,964	Sailing	
900,000	12.343	0.08	194,861	1:600,000 and	
1,000,000	13.715	0.07	240,569	smaller	
2,000,000	27.430	0.04	962,274		
3,500,000	48.002	0.02	2,946,965	International	
10,000,000	137.149	0.01	24,056,854		

Notes:

[1] Assumes standard neat line size of 750 mm x 1,100 mm for AO paper.

[2] ICW charts are at a scale of 1:40,000.

also shows the area covered (in square nautical miles) by the chart, assuming neat line dimensions of 750 mm x 1,100 mm (one of the standard chart sizes). Thus, for example, on a chart with a scale of 1:10,000 (a large-scale chart), the area covered by the chart is approximately 24 square nautical miles, 1 inch on the chart is approximately equal to 0.14 nautical miles, and 1 nautical mile is approximately 7.3 inches in length.

–Chart Types

No one chart scale is adequate to serve all purposes. Nautical charts vary in scale with the importance of the geographic area, the purpose for which the chart is designed, and the necessity for clearly showing all dangers within that area. NOAA charts include small-craft charts, conventional charts, ICW, and marine facilities charts.

Small-craft charts, identified by the letters "SC" in the nautical chart catalog, are described below:

- *Small-craft charts,* published at scales ranging from 1:10,000 to 1:80,000, are designed for easy reference and plotting in limited spaces. Although normally used by operators of small craft, these charts provide the only chart coverage for all other marine users in some areas. These charts include the items normally depicted on other nautical charts together with details of special interest to small-craft operators, such as enlargements of harbors; tide, current, and weather data; rules-of-the-road information; locations of marine facilities and anchorages; courses and distances. Types of small-craft charts include: *folio charts* (consisting of two to four sheets printed front and back, folded, and bound in a protective cardboard jacket); *area charts* (versions of conventional charts overprinted with additional small-craft information); *route charts* (published in a single long, narrow sheet printed front and back and folded); *modified route charts; recreational charts;* and *canoe charts* (a chart series of the Minnesota–Ontario border lakes providing information relevant to those who use canoes, kayaks, and similar craft).

Conventional charts are flat (rather than folded) and depict the nature and shape of the coast (see Chapter 3), depth of the water (see Chapter 4), general configuration and character of the bottom (see Chapter 4), prominent landmarks (see Chapter 6), port facilities (see Chapter 3), cultural details, dredged channels, ATONs (see Chapter 5), marine hazards, magnetics (described below), areas and limits (see Chapter 7), and seaward boundaries (see Chapter 7). The five classifications of conventional nautical charts include:

- *International charts* (such as that illustrated in figure 2–2) include a series of five small-scale charts covering the Northeastern Pacific Ocean and the Bering Sea at scales of 1:3,500,000 or 1:10,000,000 compiled to internationally standardized cartographic specifications. The navigational information presented on these charts includes depth curves, soundings, nautical symbols, and related data.

- *Sailing charts,* published at scales smaller than 1:600,000, are intended for planning voyages and for fixing the mariner's position as the coast is approached from the open ocean or for sailing along the coast between distant ports. The shoreline and topography are generalized, and only offshore soundings, principal navigational lights and buoys, and landmarks visible at considerable distances are shown. Figure 2–4 contains an excerpt from NOS Chart No. 13003 (Cape Sable to Cape Hatteras). This sailing chart is drawn to a scale of 1:1,200,000. In the right-hand corner, some depth and ATON information is depicted at the entrance to the Delaware Bay. No soundings, depth contours (see Chapter 4), or ATONs (see Chapter 5) are given for the Chesapeake Bay, and the city of Annapolis is depicted with only a city symbol (see Chapter 7).

- *General charts,* published at scales ranging from 1:150,000 to 1:600,000, are intended for coastal navigation when a course is well offshore but can be fixed by landmarks, lights, buoys, and characteristic soundings. Figure 2–5 contains an excerpt from NOS Chart No. 12260 (Chesapeake Bay, Northern Part) showing a portion of the area covered in figure 2–4. This general chart is drawn to a scale of 1:197,250. Soundings and ATONs in the Chesapeake Bay are shown, but Annapolis is still depicted with only a city symbol, and very little detail is presented in the vicinity of the Severn River.

- *Coast charts,* published at scales ranging from 1:50,000 to 1:150,000, are intended for nearshore navigation, entering or leaving bays and harbors, and in navigating the larger inland waterways. Some coast charts omit detail in areas that are covered by larger scale charts. For example (Chapman), Narragansett Bay appears on NOS Chart 13218, but no hydrography, ATONs, etc., are depicted. A small note refers the user to a larger scale chart. Figure 2–6 contains an excerpt from NOS Chart No. 12270 (Eastern Bay and South River) depicting a portion of the area covered in the preceding two figures. This chart is drawn to a scale of 1:40,000, slightly larger than a coast chart scale. Much more detail is presented on this chart. City streets, landmarks for position fixing, ATONs, soundings, and some harbor detail (e.g., piers, etc.) are clearly shown.

- *Harbor charts,* published at scales of 1:50,000 and larger, are intended for navigating in harbors and smaller waterways and for anchorage. Harbor charts present more numerous soundings than are shown on smaller scale charts and *all* ATONs to maximize the accuracy of positions determined from plotted bearings. Figure 2–7 contains an excerpt from NOS Chart No. 12283 (Annapolis Harbor). This harbor chart is drawn to a scale of 1:10,000. Individual buildings at the U.S. Naval Academy are shown as are details important to the mariner intending to anchor in this area.

NOAA publishes ICW (inside route) charts at a scale of 1:40,000, which depict the inside route from Miami, FL, to Key West, FL, and from Tampa, FL, to Anclote Anchorage, FL.

Finally, NOAA publishes *marine facilities charts.* According to the *Nautical Chart Manual,*

> [Marine facilities charts] "are conventional charts with small-craft marine facility information overprinted on the chart and presented in tabular form on the back. These are produced for major port areas where facility information for a wide area, such as Narragansett Bay or Galveston harbor, is useful for the mariner."

Marine facility charts are identified with the letters "MF" in the nautical chart catalog.

–A Mix of Charts Necessary

The prudent navigator carries a mix of sailing or general charts for overall voyage planning (if a long distance voyage is contemplated), coast charts for actual use (e.g., intended tracks and DR plots) for the longer runs, and harbor charts for entering ports and trips up smaller rivers and creeks. For example, on a hypothetical voyage from Bermuda to Annapolis, sailing and general charts would be used for offshore navigation, coast charts for the trip up the Delaware Bay, through the C & D Canal (although a large-scale chart of this canal is published), and down the Chesapeake Bay, and the Annapolis Harbor chart for final approach and anchoring or docking. Continuing the example (Chapman), the best overall route up or down the Chesapeake Bay is more easily plotted on two

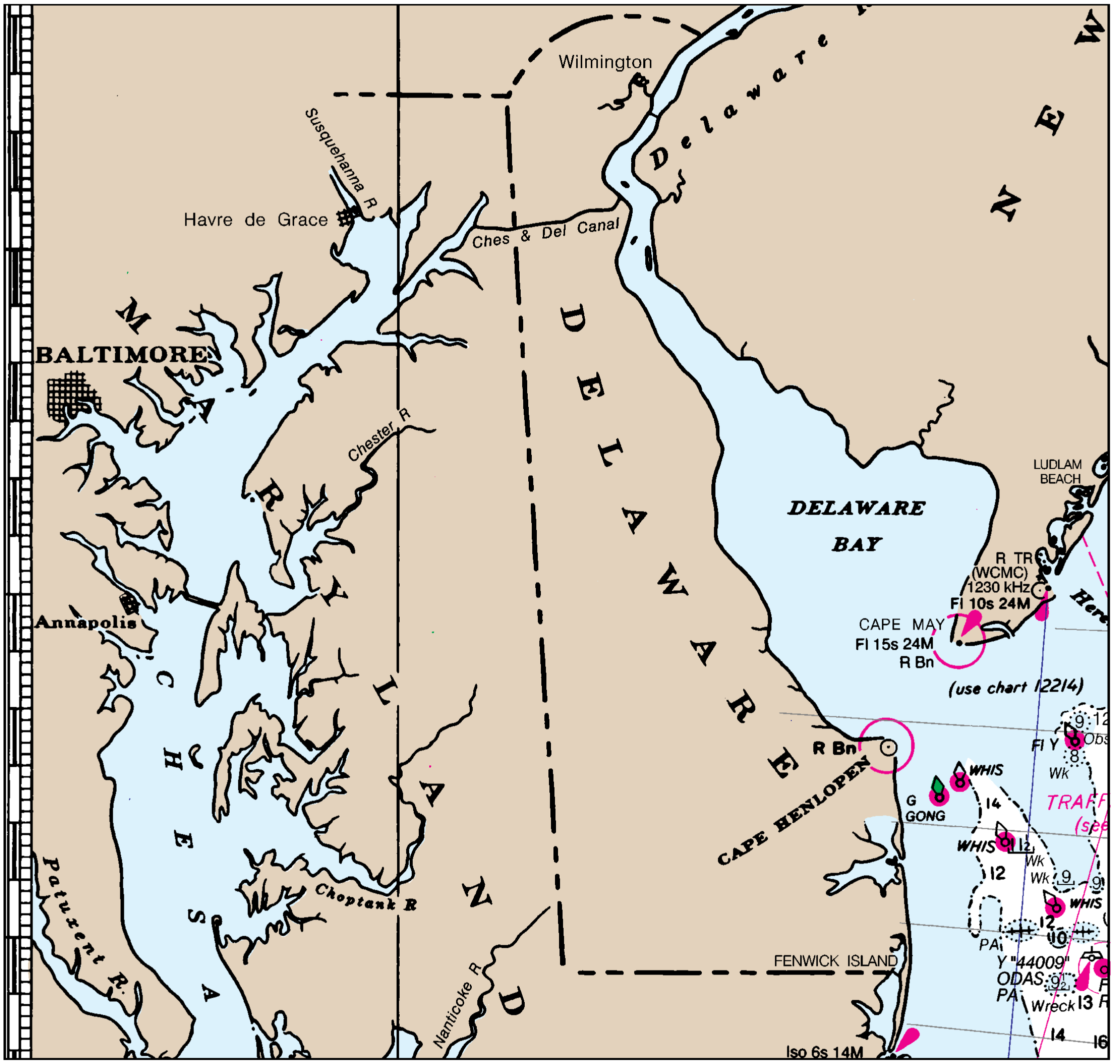


Fig. 2–4. Excerpt from NOS Chart No. 13003
(Cape Sable to Cape Hatteras)
Drawn to a Scale of 1:1,200,000

general charts (NOS Charts 12220 and 12260), rather than on a series of five coast charts (NOS Charts 12221 to 12273) covering the same area. The coast and harbor charts are appropriate for the actual trip.

As a general matter, the mariner is well advised to use the largest scale chart of the area, as this chart presents the greatest amount of detail. Many mariners carry harbor charts for other harbors along the intended route as insurance against the possibility that mechanical malfunctions, weather, fuel shortages, medical emergencies, or other unforeseen events make a diversion to an alternate harbor advisable (Blewitt).

Failure to carry sufficient charts to accommodate possible diversions can have serious consequences from both safety and legal standpoints, as numerous case studies of commercial vessel strandings (Cahill) illustrate. In retrospect, it is virtually impossible to justify the loss of a multimillion dollar tanker (or even a $50,000 cabin cruiser) for the lack of a $14 chart! Although today's civil penalties for a lack of prudence are less draconian than that listed in the opening quotation of this chapter, these are harsh enough to command attention.

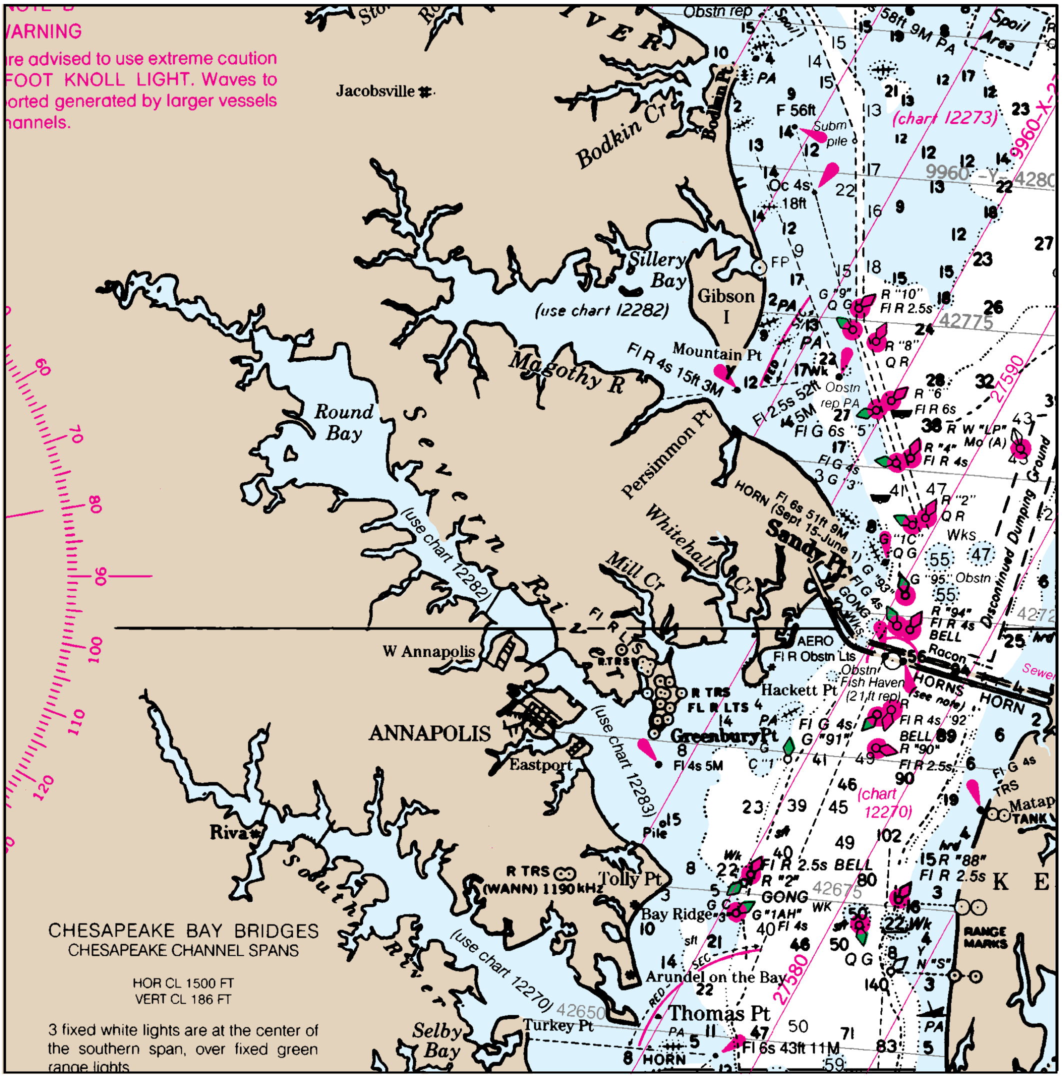


Fig. 2–5. Excerpt from NOS Chart No. 12260
(Chesapeake Bay, Northern Part)
Drawn to a Scale of 1:197,250

A Brief Aside, Chart Storage and Care—Rollers versus Folders

As noted, conventional charts are sold as flat sheets, and typically shipped rolled in cardboard tubes, whereas small-craft charts are prefolded to simplify stowage problems on small craft. Most mariners would agree that, ideally, conventional charts should be stored flat—in a draftsman's cabinet—provided adequate space exists. However, many vessels (and, indeed, most recreational vessels) do not have sufficient space to accommodate flat storage of conventional charts.

There is no general consensus on how best to store conventional charts in cramped quarters. Rather, the world of navigators (or, at least, the world of navigation textbook writers) appears to be fundamentally divided on whether to roll or fold these charts. "Rollers" (see Chapman, Graves) argue that conventional charts should be rolled if possible, claiming that the disadvantage of the ends curling is more than outweighed by the longer life of a chart if it is not creased. "Folders" (Campbell) argue that it is difficult to plot on a rolled chart and offer numerous suggestions on how best to fold charts

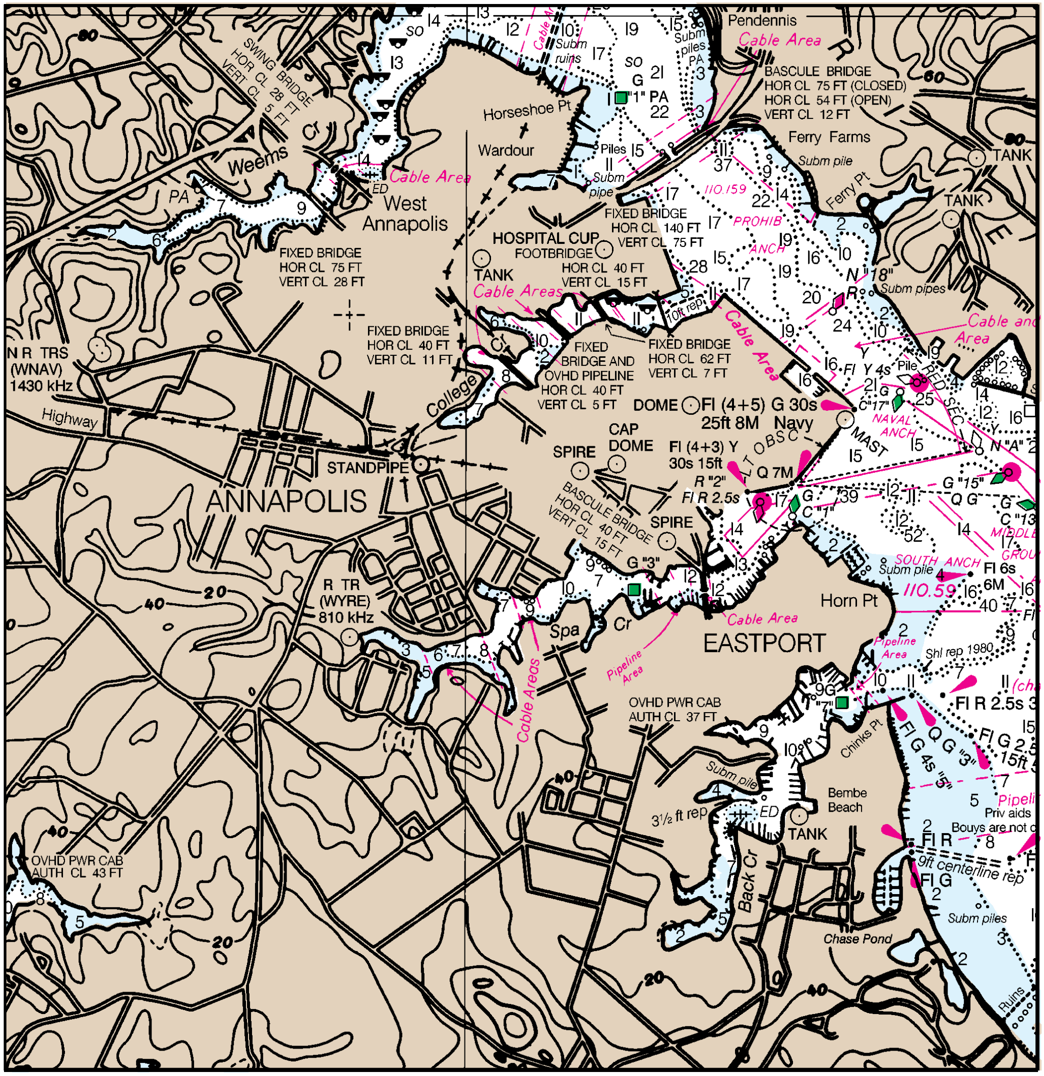


Fig. 2–6. Excerpt from NOS Chart No. 12270 (Eastern Bay and South River) Drawn to a Scale of 1:40,000

(e.g., in four sections, each about the size of an average navigation desk on a yacht, with the printed side facing out). In the end, this reduces to a matter of personal preference.

If there is controversy between "rollers" and "folders," there is unanimity that charts should be stored in a convenient but dry area in the vessel. Damp storage areas often result in mildew damage, and water spray creates bubbles, folds, and resulting distortions when the chart finally dries out. Durable as it is, the paper on which nautical charts are printed cannot stand repeated cycles of water spray, let alone water immersion.

Linear and Logarithmic Speed Scales (A)

Item 14 on figure 2–2 is a linear scale, often provided on chart insets (see below) and larger scale charts. The *linear scale* (also termed a *bar scale*) is found on Mercator charts (or insets) with chart scale of 1:80,000 and larger (1:120,000 and larger for polyconic projections). Bar scales enable the user to measure distances (in nautical miles, statute miles (on Great Lakes charts), yards, and meters) quickly with a pair of dividers. The linear scale is used in lieu of the latitude scale at the side of the chart. Figure 2–8 (top) shows an example of a bar scale.

Logarithmic speed scales, shown in figure

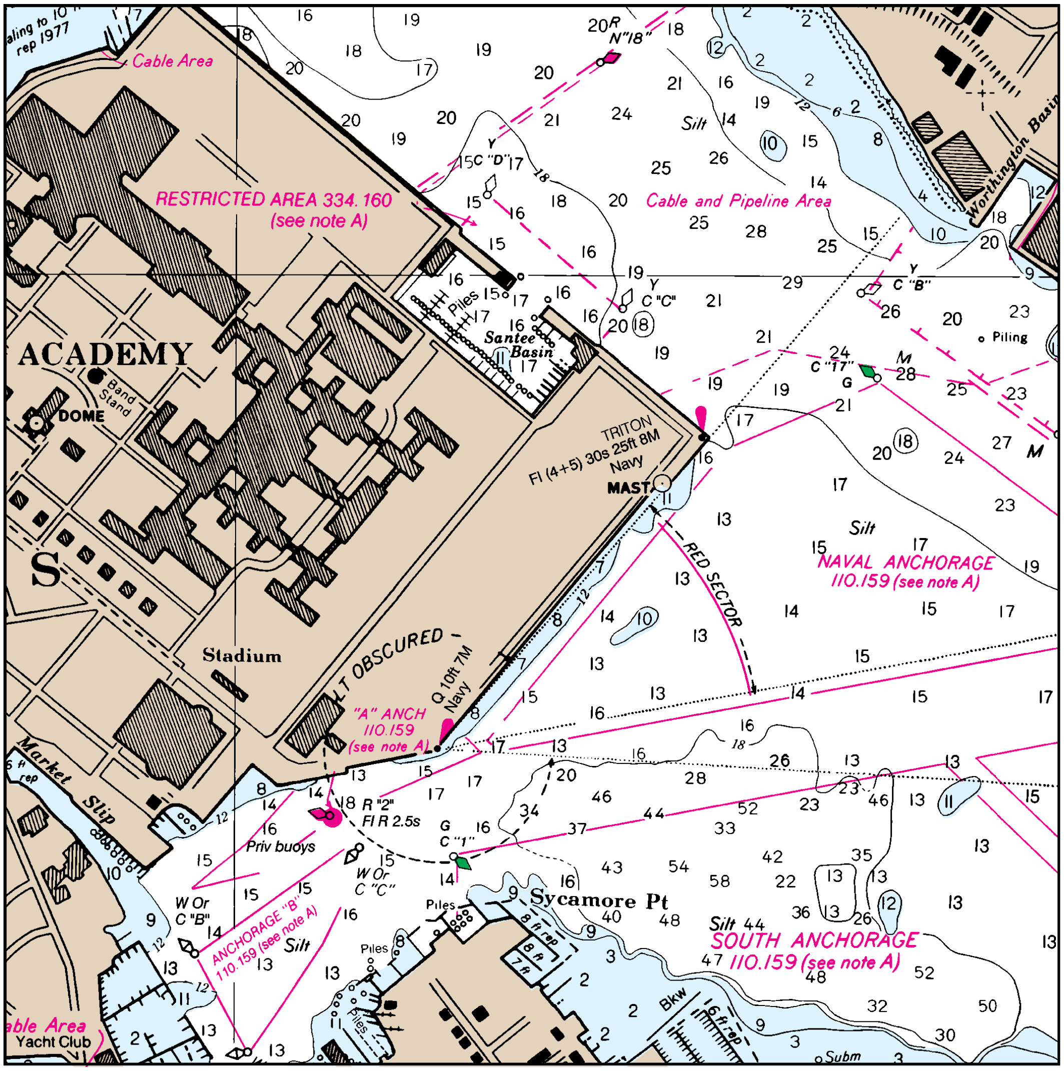


Fig. 2–7. Excerpt from NOS Chart No. 12283
(Annapolis Harbor)
Drawn to a Scale of 1:10,000

2–8 (bottom), are also printed on these charts. The *logarithmic speed scale* is an ingenious nomograph to solve *time-speed-distance* (TSD) computations. It is used to calculate speed, based upon the distance and time run. To find the speed, one point of a pair of dividers is placed on the distance run (in any unit) and the other on minutes run. Without changing the divider spread, the right point of the divider is placed on the number 60; the left point of the dividers will then indicate the speed in units per hour. Thus, for example, if a vessel travels 4 nautical miles in 15 minutes, the calculated speed is 16 knots.

Notes and Cautions

Item 16 on figures 2–2 and 2–3 refers to cautionary notes (if any) depicted on the nautical chart. These notes, *which should be read before using the chart,* present a variety of general and particular information. Specific notes and their meaning are discussed throughout this manual. Table 2–4 provides a sample of notes taken from various nautical charts which illustrates the type of information provided. Notes may be located at or near the title block as shown in figure 2–2, but may also be located anywhere on the chart where they do not obscure navigationally relevant data or information.

Chart Overlap, Insets, and Related Matters

There is an old military adage (Heinl) to the effect that battle is a process which always takes place at the junction of two maps. Many navigators believe that this maxim applies equally to nautical charts. Before a vessel crosses from waters described by one chart to those covered by another, it is necessary to extend the course to the adjoining chart. Moreover, the course has to be selected so as to maintain a safe distance from charted hazards and take advantage of ATONs and landmarks depicted on the adjoining chart. As the vessel crosses into waters depicted on the adjoining chart, the navigator must be able to plot fixes rapidly on the next chart in sequence. If electronic fixes are available (e.g., from a GPS or Loran–C receiver), the fixes are easily plotted on the appropriate chart. However, if visual bearings are used, plotting fixes may be more difficult if the vessel's position is near a chart border.

–Measures to Minimize Confusion: The Chartmaker's Perspective

NOAA uses four methods to minimize problems associated with the transition from one chart to another.

- First, nautical charts are sized and aligned (insofar as possible) to ensure that dangerous passages are not located near the chart borders. This lowers the likelihood of a vessel entering a hazardous area when it is necessary to shift from one chart to the next.

- Second, nautical charts are deliberately drawn so as to overlap slightly. Adjoining charts of the same scale, particularly coastal charts, generally have an inch or two of overlapping coverage. The amount of overlap varies from chart to chart and is sufficient to include enough common prominent features, important aids to navigation, etc., to facilitate the quick transfer of a plotted course and position from one chart to the next in sequence. The detail presented on overlapping charts of the same scale is identical or nearly so.

- Third, if (despite efficient location and overlap) there are still important features located just outside the chart border, a border break (sometimes

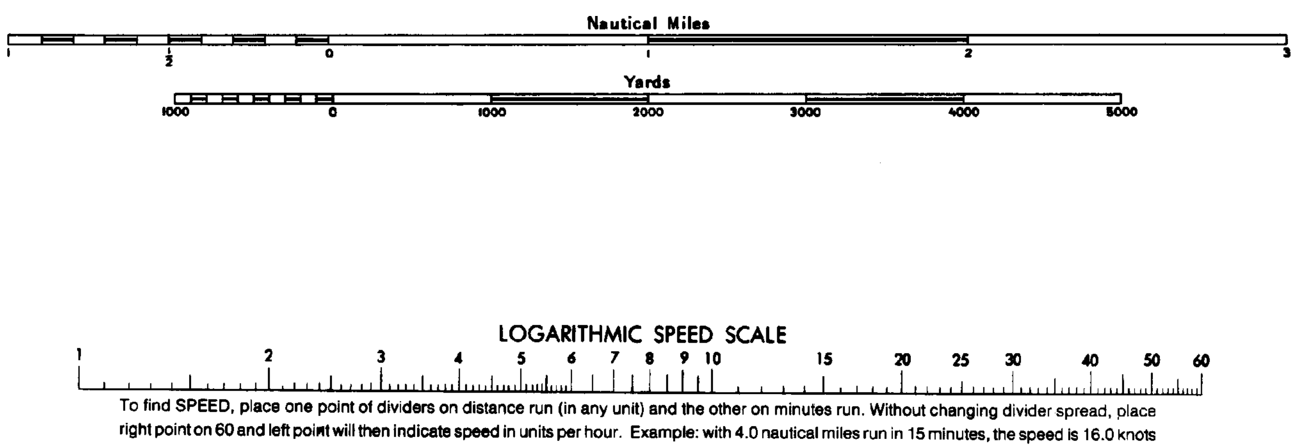


Fig. 2–8. Bar Scales and Logarithmic Speed Scales Shown on Selected Nautical Charts

Table 2–4. Illustrations of Various Notes and Cautions Found on NOAA Charts

NOTE C
Strong currents exist between buoys creating hazardous navigating conditions. Use extreme caution

CAUTION
Extremely heavy tide rips and strong currents may be encountered in the vicinity of the islands shown on this chart.

CAUTION
Improved channels shown by broken lines are subject to shoaling, particularly at the edges.

NOTE A
Navigation regulations are published in Chapter 2, U.S. Coast Pilot ___. Additions or revisions to Chapter 2 are published in the *Notices to Mariners.* Information concerning the regulations may be obtained at the Office of the Commander, ___ Coast Guard District ___ , __, or at the Office of the Division Engineer, Corps of Engineers in ___ , __. Refer to charted regulation section numbers.

RACING BUOYS
Racing buoys within the limits of this chart are not shown hereon. Information may be obtained from the U.S. Coast Guard District Offices as racing and other privately maintained buoys are not all listed in the U.S. Coast Guard *Light List.*

NOTE B DANGER AREA
Area is open to unrestricted surface navigation but all vessels are cautioned neither to anchor, dredge, trawl, lay cables, bottom, nor conduct any other similar type of operation because of residual danger from mines on the bottom.

WARNING
The prudent mariner will not rely solely on any single aid to navigation, particularly on floating aids. **See:** U.S. Coast Guard *Light List* and U.S. *Coast Pilot* for details.

RADAR REFLECTORS
Radar reflectors have been placed on many floating aids to navigation. Individual radar reflector identification on these aids has been omitted from this chart.

CAUTION
Only marine radiobeacons have been calibrated for surface use. Limitations on the use of certain other radio signals as aids to marine navigation can be found in the U.S. Coast Guard *Light Lists* and *Defense Mapping Agency Publication 117.*

NOAA VHF - FM WEATHER BROADCASTS
The National Weather Service stations listed below provide continuous marine weather broadcasts. The range of reception is variable, but for most stations is usually 20 to 40 miles from the antenna site.

CAUTION
FISH TRAP AREAS AND STRUCTURES
Mariners are warned that numerous uncharted duck blinds and fishing structures, some submerged, may exist in the fish trap area. Such structures are not charted unless known to be permanent.

CAUTION
BASCULE BRIDGE CLEARANCES
For bascule bridges, whose spans do not open to a full upright or vertical position, unlimited vertical clearance is not available for the entire charted horizontal clearance.

CAUTION
Temporary changes or defects in aids to navigation are not indicated on this chart. **See:** *Notice to Mariners.*

During some months or when endangered by ice, certain aids to navigation are replaced by other types or removed. For details see U.S. Coast Guard *Light List.*

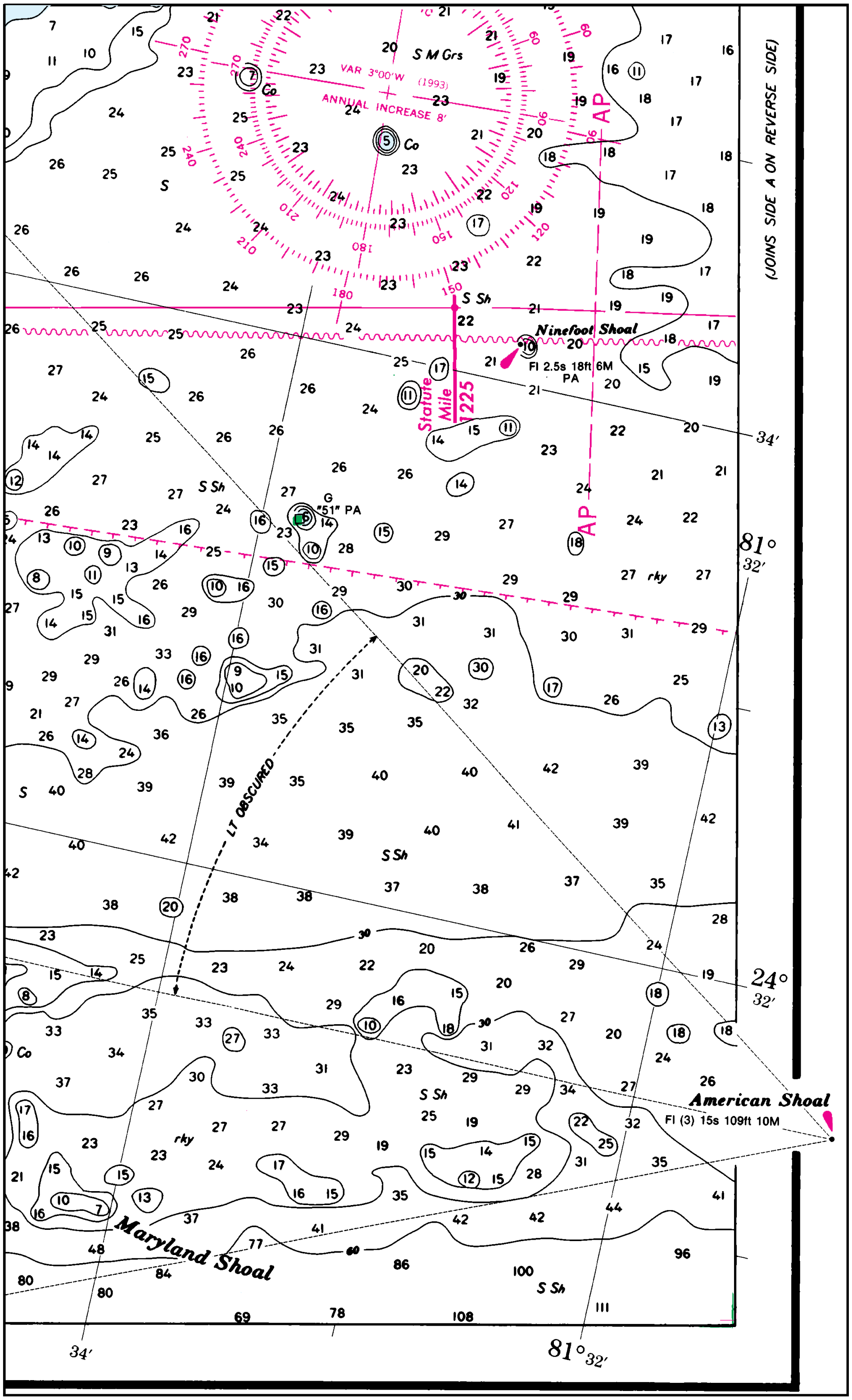
also called an extrusion, extension, or blister) is used. The *border break,* as the name implies, is an extension of the charted area outside of the chart neat lines to depict particularly important feature(s). Figure 2–9 presents an excerpt from NOS Chart No. 11445 (Sugarloaf Key to Key West), an ICW chart, which includes a border break. Note in the lower right-hand corner of this illustration that the *American Shoal* light is actually located outside the chart border. Because this light is deemed important to navigation, a border break is used to show it on this chart. Border breaks are also used to eliminate the need for printing an additional chart. For example, figure 2–10 contains an excerpt from NIMA Chart No. 28160 (Tela to Pelican Keys). The border break in this metric chart avoids the necessity of printing another chart just to depict the small portion of the *Bahia De Amatique* (Honduras Bay) near the *Temash River.*

- Fourth, notes (and sometimes diagrams) are provided on the nautical chart to identify the adjoining chart(s) so that the user can quickly identify the appropriate chart. This is done in various ways. For example, notes (e.g., *JOINS CHART 12214,* if the adjoining chart is to the same scale, or *CONTINUED ON CHART 12311* if the adjoining chart is of a different scale) printed in black italic capital letters outside the neat line of the nautical chart identify the adjoining chart. Refer to item 17 in figure 2–2. (Cross-reference to join points on small craft and ICW charts is facilitated by a dashed magenta section line, e.g., line AP - - - AP in figure 2–9, which is also displayed on the adjoining chart.) In cases where a larger scale chart of the same area is available a note (e.g., *chart 12284)* is printed in lower case italic magenta type at or near the boundary of the larger scale chart on the smaller scale chart. (Hydrographic detail may be suppressed on the smaller scale chart in this case.) In some cases the larger scale information may be presented in an inset (see, for example, item 15 in figure 2–2), in which case the inset will be printed somewhere on the chart so as not to obscure navigationally relevant information. Finally, chart outlines and diagrams are also used to display larger scale overlapping or adjoining chart coverage on smaller scale charts. The intent is to provide the user with a complete reference to larger scale chart coverage. This is done either by providing an outline of boundaries of the larger scale chart on the smaller scale chart (as shown by item 15 in figure 2–2) or by providing a convenient chart index diagram which shows the available larger scale charts. Figure 2–11 contains a chart diagram found on NOS Chart No. 12260 which shows the boundaries of the larger scale charts available for this area.

–Measures to Minimize Confusion: The Navigator's Role

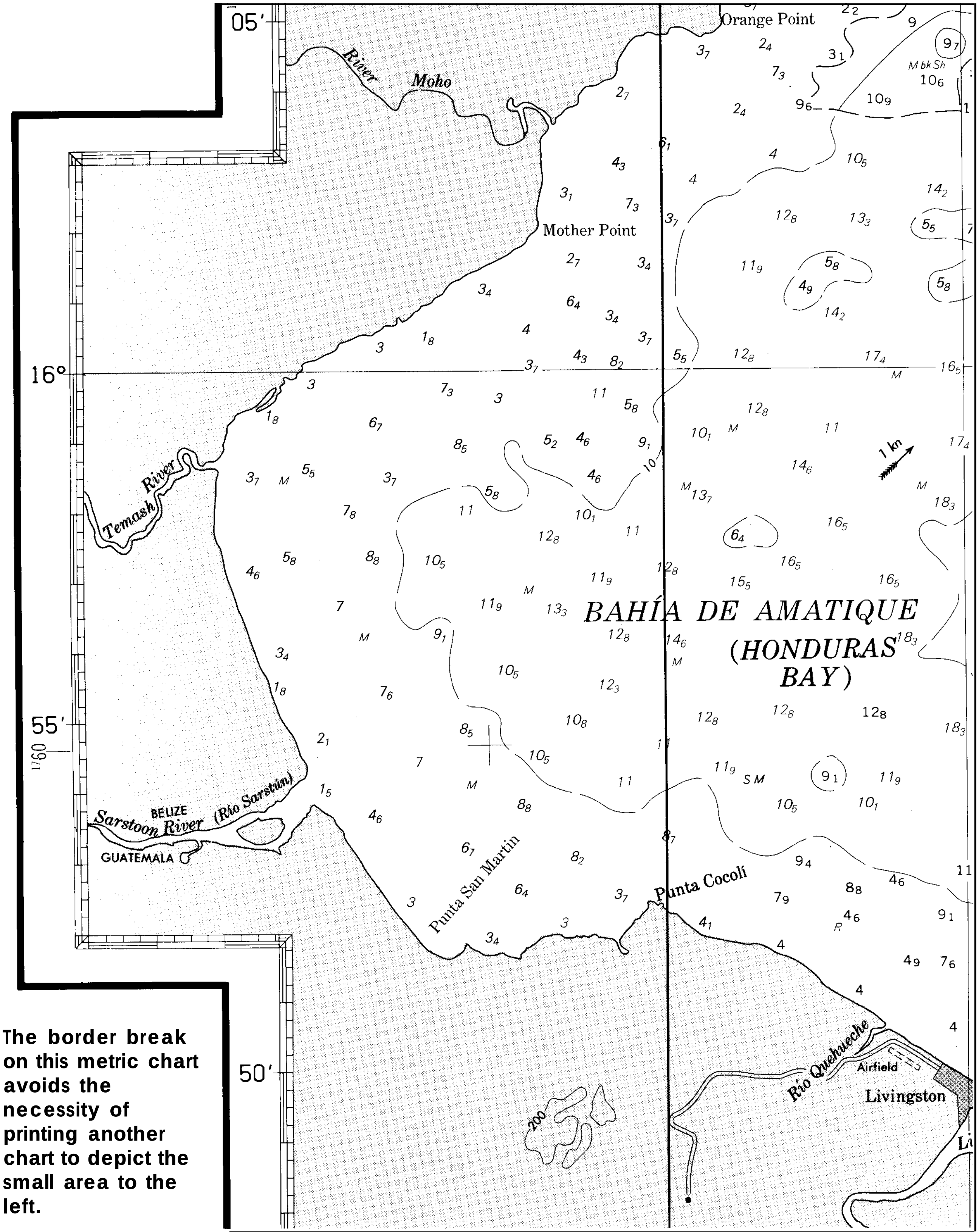
The navigator should also take steps to minimize any confusion that might occur when shifting from one chart to another.

- First, the proper adjoining (or larger scale) chart should be selected from the storage area so that it is readily at hand well before the chart is actually required. This is particularly important if the mariner is “single-handing” (traveling alone) or if the chart storage compartment is located some distance from the helm or plotting area. Indeed, it is a good idea to lay out all the required charts for a voyage prior to getting underway, labelling each with a removable gummed label with an attached sequence number. This procedure not only facilitates selection of the right chart, but also ensures that any missing charts are identified at the dock, rather than while underway. Few things are more frustrating than having to divert to an alternate harbor



This figure illustrates a border break to include an important light and the dashed magenta symbol (AP – – – AP) to cross-reference a position on the next chart. Note also the skewed projection.

Fig. 2–9. Excerpt from NOS Chart No. 11445 (Sugarloaf Key to Key West)



The border break on this metric chart avoids the necessity of printing another chart to depict the small area to the left.

Fig. 2–10. Excerpt from NIMA Chart No. 28162 (Tela to Pelican Cays)

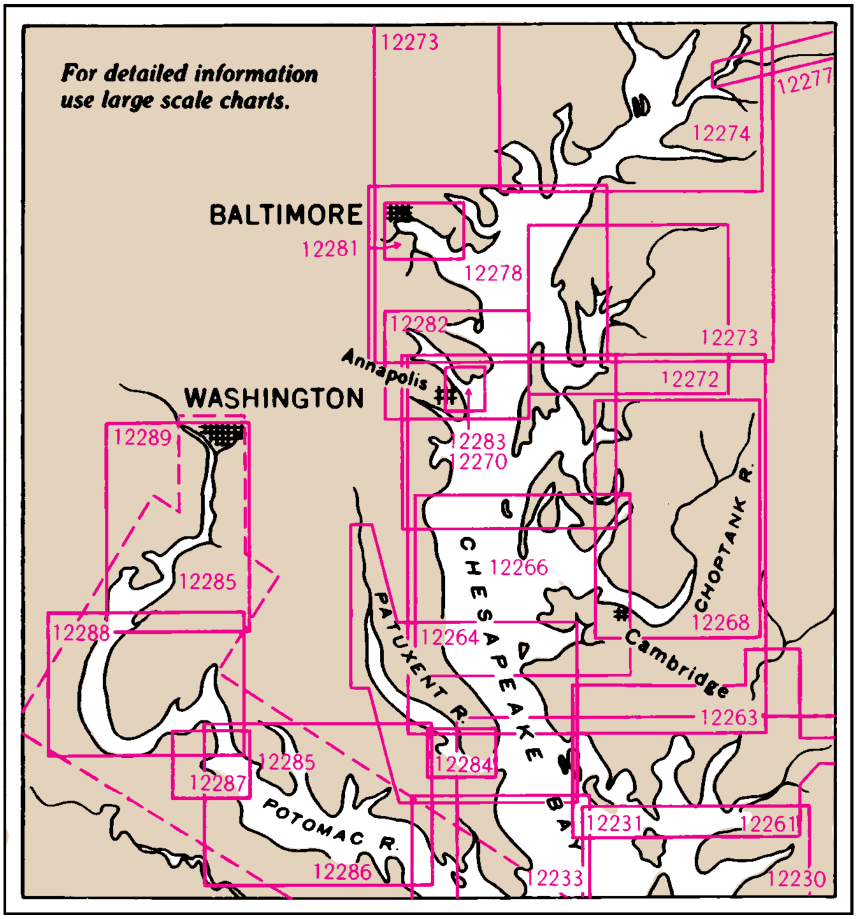


Fig. 2–11. Chart Diagram Found on NOS Chart No. 12260 Identifies Larger Scale Charts to be Used for Navigation

because the required chart is not aboard! (The alternative of pressing on without the missing chart in hopes that the channel is well-marked is so hazardous as to be unthinkable.)

- Second, the vessel's intended track should be plotted on the adjoining (or larger scale) chart before this chart is required. The DR plot should be drawn in while underway, but the intended track can be plotted beforehand. Where possible, the intended track should be laid out so as to minimize the necessity for accurate navigation in the immediate vicinity of a chart junction.

- Third, if using landmarks or ATONs for position fixing, the navigator should plan ahead to avoid selecting objects that are not shown on the same chart. For example, visual bearings on two objects not shown on the same chart cannot readily be plotted to obtain a fix. Alternatively, the navigator can designate a checkpoint or waypoint that is located in the overlap area common to both charts. Arrival at the waypoint signals the need to change charts. This is particularly convenient if a navigational receiver (e.g., GPS or Loran–C) with a waypoint alarm is used.

- Fourth, the navigator should fix the position of the vessel more frequently when in the vicinity of the chart junction.

- Fifth, the navigator should be particularly alert to any change in scale whenever shifting to another chart as, for example, when shifting from a coast chart to a harbor chart. Although adjoining charts are often drawn to the same scale, this is not always the case. Moreover, larger scale charts and chart insets always involve a change in scale. Attention to scale changes is particularly important if an external distance scale (e.g., a paraline plotter) is used. These instruments often have several distance scales scribed along the straight edge. It is a common error to use the wrong distance scale, particularly when transitioning to a chart with a different scale from that used previously. Use of the wrong distance scale translates into an incorrect DR plot with attendant hazards. To avoid this error, many navigators disregard the scribed distance scales on plotters and always measure distances with dividers using the latitude scales or the linear scale printed on the chart. (Separate latitude scales or linear scales are always printed on insets of a different scale.)

Navigators using commercial reproductions of portions of NOAA charts, especially those printed in relatively small booklets, soon learn that chart changes are more frequent and that it is often difficult to find the adjoining chart in the booklet.

Latitude, Longitude, Regular, and Skewed Projections

Each nautical chart will have lines marking parallels of latitude and meridians of longitude. (In the Mercator projection, as shown in table 2–2, latitudes are parallel straight lines, and meridians of longitude are likewise parallel straight lines.) These are used to measure the geographic location of any point on the chart in terms of latitude and longitude. The latitude scale is also used to measure distance; 1 nautical mile is equal to 1 minute of latitude. The interval between adjacent parallels and meridians depends upon the scale of the chart.

Latitude and longitude scales are marked with degrees and minutes. NOAA charts with a scale larger than 1:50,000 subdivide minutes into seconds or multiples of seconds. Small-scale charts subdivide minutes into tenths, fifths, or halves. Read these scales carefully. It is also important for the mariner to note the units of latitude/longitude readout of an electronic navigation receiver (e.g., GPS or LORAN-C) as these may differ from those used on the chart. For example, most electronic receivers measure latitude or longitude to degrees, minutes, and tenths (or hundreths) of minutes, rather than degrees, minutes, seconds.

Most conventional charts are oriented “north up” with latitude scales at the sides of the chart and longitude scales at the top and bottom. Some conventional charts and many small-craft charts are printed as a skewed projection so as to make the most efficient use of space. In these skewed (non-north up) projections, lines of latitude and longitude are not parallel to the borders of the chart. A *skewed projection* is illustrated in figure 2–9.

Depth Units and Vertical Datum

The units of depth (e.g., feet, fathoms, fathoms and feet, meters) employed on the chart are shown in the title block and in capital magenta letters at the top and bottom of the chart. As discussed in Chapter 4, NOAA charts are now published in both “traditional” (feet, fathoms, fathoms and feet) and metric units. In the future, charts with traditional units are being replaced by those charted in metric units. Kals offers an interesting anecdote on misreading depth units:

> “In Montreal I once conned the craft of a friend who had urgent business below. Avoiding the ship channel, I headed straight for our destination over soundings of 2, 3, and 4 fathoms. [Note 1 fathom is 6 feet.] No problem; his schooner drew only 5 feet. The river must have been well above datum level or I would have run her hard aground. The soundings were in feet!”

Not all such stories have such a happy ending. It is essential to check the depth units on the chart. This is especially important during the present transition period from conventional units to metric units.

The chart note regarding depth units also defines the vertical datum (typically mean lower low water for soundings and mean high water for heights) used on the chart, as discussed in more detail in Chapter 4.

To provide a ready source of unit conversion information, NOAA charts also include a depth conversion scale. This scale shows the correspondence between fathoms, feet, and meters. Figure 2–12 illustrates the depth conversion scale designed for horizontal placement. A similar scale has been designed for vertical placement. These scales are typically placed near the chart borders.

Horizontal Datum

The horizontal datum is shown just below the title block of the chart. The horizontal datum is a set of constants specifying the coordinate system used for geodetic control, that is, for calculating coordinates of points on the earth. Different horizontal datums use different ellipsoids to represent the earth's shape. Prior to widespread use of satellite systems for surveying and navigation, most countries developed an ellipsoid that fitted the curvature of the earth for the particular areas charted. In consequence, numerous datums were employed because the datum providing the best fit for one area might not provide the best fit for another.

Most NOAA charts are based upon the *North American Datum of 1983* (NAD 83), the current standard for U.S. nautical charts. This datum is quite close to the *World Geodetic System of 1984* (WGS 84). Other datums presently used on NOAA charts include the:

- *North American Datum of 1927*
- *North American Datum of 1902* (found only on some Great Lakes charts),
- *Old Hawaiian Datum,*
- *Puerto Rico Datum,*
- *Local Astronomic Datums,* and the
- *Guam 1963 Datum.*

With the exception of the charts of the Hawaiian Islands and other western Pacific islands (which will be compiled on WGS 84) all new charts and reconstructed NOAA charts are based on NAD 83.

–Relevance of Horizontal Datum

For navigators using radar or visual means for position fixing, the particular datum used is merely an academic curiosity. However, for those using electronic navigation systems, such as GPS or LORAN-C, the chart datum is potentially more relevant. This is because the mathematical conversion routines employed in these receivers to convert the received signals (e.g., LORAN-C TDs) to latitude and longitude depend upon the assumed datum. A shift from one datum to another could shift the position of the apparent fix by an amount ranging from meters to miles. One source (Brogden) notes that, outside the United States, it is commonplace to find differences of half a mile to a mile between GPS fixes and a local chart.

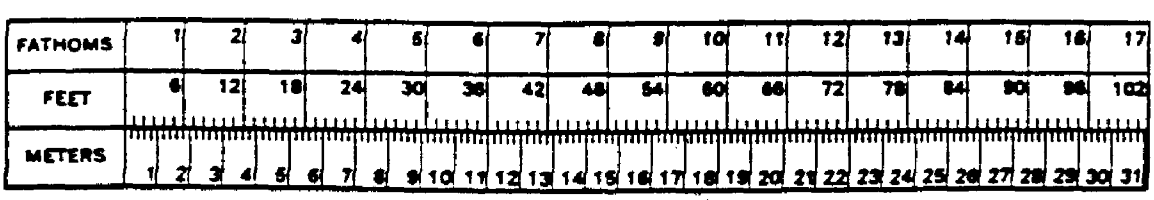


Fig. 2–12. Depth Conversion Scale for Horizontal Placement

Most modern makes and models of GPS and LORAN-C receivers have the capability of shifting from one datum to another (Dahl, Brogden), often offering a wide selection (as many as 50 to 100) of alternate datums. *If the vessel's navigation receiver is so equipped, it should be set to match the datum used on the nautical chart of the area.*

Direction and Magnetics (B)

True and magnetic information is provided on nautical charts to enable mariners to measure direction and determine magnetic courses. This information is provided in various ways. Latitude and longitude lines provide north–south and east–west orientation. The mariner can determine true direction from either parallels of latitude or meridians of longitude with the aid of various commercially available course plotters. True and magnetic directions are provided with one or more compass roses (B70) located on the chart. Magnetic information is also displayed by the use of isogonic (lines of equal magnetic variation) lines (B71) shown on the chart.

–Compass Roses (B70)

A compass rose, as illustrated in figure 2–13 (top), is placed on nautical charts to help mariners plot bearings and lay out courses. As a point of interest, the use of the compass rose to indicate true and magnetic directions is a tradition dating back several centuries. As noted by Brown, "The earliest known rose to indicate compass variation appeared on a map in the *Cosmographiae Introductio* of Apianus printed at Ingolstadt in 1529."

On the modern nautical chart, the compass rose consists of two concentric graduated circles:

- The outer circle (true rose), graduated in increments from 0° through 360°, is aligned with true north. (Depending upon the scale of the chart, the increments may be 1°, 2°, or 5°.) The star symbol atop the 0° mark presumably denotes Polaris, the north star.

- The inner circle (magnetic rose), also graduated in increments of 1°, 2°, or 5° and labeled MAGNETIC, is aligned with magnetic north. The arrow atop the magnetic scale points to magnetic north. A second set of graduations within the inner (magnetic rose) circle is graduated in the older 32-point system (1 point = 11.25°). Half points and quarter points are also given.

- Another label (e.g., VAR 4° 15'W (1985) ANNUAL DECREASE 8', in figure 2–13), shows the magnetic variation (4°15'W) for the charted area as of a specified date (January 1, 1985), and the annual increase or decrease to permit adjustment to the current date. This is necessary because magnetic variation is not constant, but rather changes due to the fluctuations of the earth's magnetic fields.

Use of the compass rose for measuring courses or bearings is explained in numerous texts (e.g., Bowditch, Dutton) and is not discussed here. Compass roses are positioned on a chart so as to be convenient to the most important navigational areas, and at sufficiently frequent intervals so that all water areas are within the reach of the parallel ruler. If the compass rose is positioned on a land area, some topographic detail may be removed to reduce chart clutter. Compass roses are not placed in water areas at the entrance to a harbor, at or near hazards to navigation in the water, nor do the graduations obscure relevant soundings.

Compass roses are printed in magenta on all new charts and new editions. Some existing charts, especially those with magenta Loran–C lines, have compass roses printed in black. These will be converted to magenta when new editions are published.

–Local Magnetic Disturbance Notes

Local magnetic disturbances, which may cause substantial deflections of the compass, occur quite commonly in shallow water near

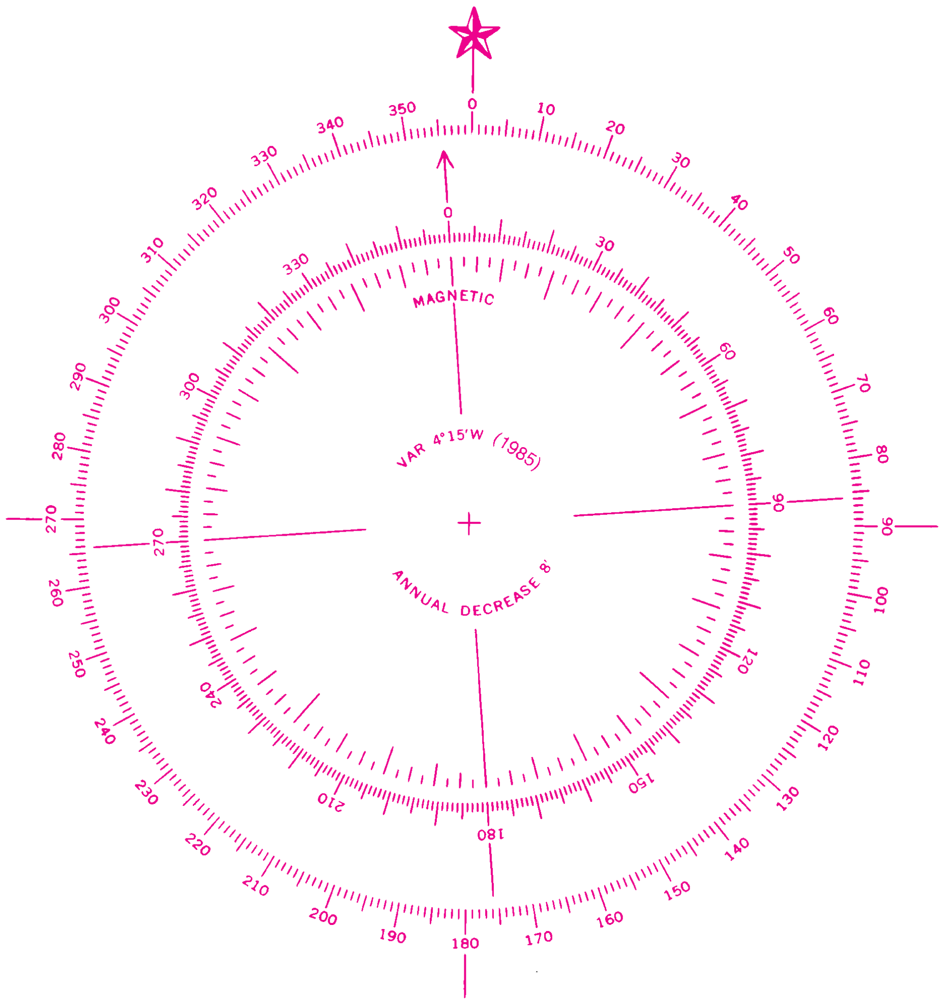
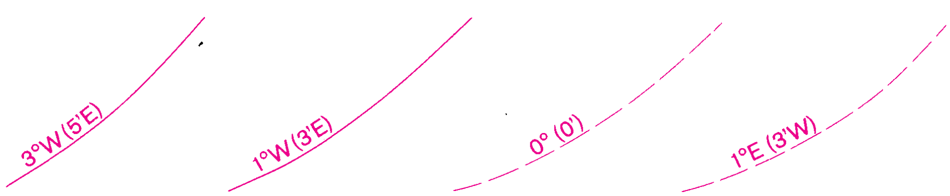
70	*Compass rose, normal pattern (smaller patterns of compass rose may be used)*
	Magnetic Variation (example): 4° 15′ W 1985 (8′ E) *on magnetic north arrow means Magnetic Variation* 4° 15′ W *in* 1985, *annual change* 8′ E *(i.e. magnetic variation decreasing* 8′ *annually).* 
71	*Isogonic lines*
	Magnetic Variation Curves are for 1985 *The Magnetic Variation is shown in degrees, followed by the letter W or E, as appropriate, at certain positions on the curves. The annual change is expressed in minutes with the letter W or E and is given in brackets, immediately following the variation.* 

Fig. 2–13. Compass Rose (B70) and Isogonic Lines (B71) Shown on Nautical Charts

mountain masses. Notes, printed in magenta, alert the mariner to these areas wherever deviations of 2° or more (3° in Alaska) exist. Here are two 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.

If space constraints prevent inclusion of the entire note, the full note is placed elsewhere on the chart and the following reference note (in magenta) is placed in the area of the disturbance:

LOCAL MAGNETIC DISTURBANCE
(SEE NOTE)

–Isogonic Lines (B 71)

Magnetic variation is shown by isogonic lines on smaller scale charts. Isogonic lines are lines connecting points of equal magnetic variation. The line passing through points having zero variation is termed the *agonic line.*

Isogonic lines are shown on those charts drawn to scale at which a variation of 1° will result in a distance between adjacent lines of less than 12 inches. Each isogonic line is labeled with the amount and direction of variation, and the date of the variation. As shown in the example given below, charts with isogonic lines carry a magenta note stating the name of the mathematical model used for computation, the year the model was computed, and the year the charted isogonic lines represent.

MAGNETIC VARIATION

Magnetic variation curves are for 1992 derived from 1990 World Magnetic Model and accompanying secular change. If additional change is in the same direction as variation it is additive and the variation is increasing. If annual change is opposite in direction to the variation it is subtractive and the variation is decreasing.

Additional Information

Certain charts (e.g., small-craft and marine facilities charts) provide a variety of additional relevant information in the form of notes, tables, and pictures of harbors, landmarks, or ATONs. Examples of additional information found on small-craft charts include:

- A tide note (H 30) which provides information on tide heights, and daily tide tables are often printed on the jacket of small-craft charts.
- Marine facility tabulations (U 32), such as that illustrated in figure 2–14, provide information on tides, depth, services, and supplies found at various locations shown on the chart.
- Several charts include additional technical tables, such as a radio bearing conversion table, to correct measured bearings to Mercator bearings, a table of distances to the horizon as a function of the height of eye of the observer, a conversion table from degrees to compass points and vice versa, or a table for determination of wind speed from observed sea conditions.
- Several charts provide tables of port-to-port distances which are useful for voyage planning.

NO	LOCATION	TIDES		DEPTH: APPROACH-FEET (REPORTED)	DEPTH: ALONGSIDE-FEET (REPORTED)	SERVICES: ELECTRICITY-MOORINGS-BERTHS (TRANSIENTS)	RAMP SURFACED-NATURAL	REPAIRS HULL-MOTOR-RADIO	MARINE RAILWAY-FEET	LIFT CAPACITY-TONS	BOAT RENTAL: CANOE-ROW-MOTOR	BOAT RENTAL: CHARTER-HOUSE-SAIL	FOOD-LODGING-CAMPING	TOILETS-SHOWERS-LAUNDRY / PUMP-OUT STATION	WINTER STORAGE WET-DRY	SUPPLIES: NAUTICAL CHART SALES	WATER-ICE	GROCERIES-HARDWARE	BAIT-TACKLE	DIESEL OIL-GASOLINE
1	MIAMI BEACH MAR					B E					M	C S	FL	TSL P	W	C	WI	GH	BT	DG
2	LANGER'S MARINA			14	6			MR	30	5								H		
2B	*66 MARINA*			*14*	*14*								*F*	*T*		*C*	*WI*	*GH*	*BT*	*DG*
8	MERRILL STEVENS			10	6	B E		HM	30					TS	WD		WI	H		DG
10	DINNER KEY MARINA	1.7	+1¾	7	4	B E	S					C S		TSL P	W		WI			
11	DINNER KEY MARINA			7	4	B E	S					C S		TSL P	W		WI			
12	DINNER KEY MARINA			7	4	B E	S					C S		TSL P	W		WI			
13	SEMINOLE RAMP						S													
16A	HOMESTEAD BAY			5	5	E	S			6			F	T P	W		WI	G	BT	DG
18	ELLIOT KEY HBR			3	6	B					C		C	TSL			I			
23	ANCHORAGE RESORT			6	6	B E					C		FL	TSL			I			
24	*GIBERT'S MOTEL MAR*			10	10	B E	S	M					FL	TSL			WI		BT	DG
25B	RESCUE SERVICE			5	12	BM	S	HMR		5				TS	WD		W	H		
26	GARDEN COVE MAR	2.2	+¾	3	10	B				4			F				WI		BT	DG
28A	ROWELL 'S MARINA			6	30		S	HM						T		C	I	H	BT	G
29	TWIN HARBORS			3	8	BME	S		60		M	S	LC	TSL	WD		WI	H		G
33	CORAL REEF PARK	1.1	+3¼	5	20	BM	S				C M	CHS	F C	TS		C	WI			DG
34A	AMERICA OUTDOORS			5	5	B E	S				CR	S	F C	TSL	W	C	WI	GH	BT	DG
35	UPPER KEYS S C			6		B	SN					S	F	TS			WI			
35C	OCEAN DIVERS, INC			5	20	B E	S				M	C S	F	S		C	WI	G		DG
35D	MARINA DEL MAR			4	30	BME					M	S	F	TSL			WI			DG
37A	ROCK HARBOR MAR	2.2	+½	4	6	B E	S	R					LC	TS	WD		WI	H	BT	G
38	MANDALAY FISH C	2.2	+½	4	3	B E	S	M			CRM	C S	FLC	T	WD		WI	GH	BT	G
38B	CURTIS MARINE,INC.			4	2	B E								TSL				H		
39	CAMPBELL'S MAR	2.2	+½	4	4	B E		HM		16				TSL P	WD		W	H		DG
44	PLANTATION KEY			5	5			HMR		3	M			T		C	WI	H	BT	G
45	PLANTATION YCHT			5	5	B E	S				C	C S	FL	TSL			WI			DG
49	CALOOSA COVE MARINA			6	6	B E		M		27	M	C	FL	TSL	WD	C	WI	GH	BT	DG
51	HOLIDAY ISLE M	2.1	+¾	5	8	B E	S				M	C	FL	TSL		C	WI	GH	BT	DG
54	ISLAMORADA Y C			4	5	B E	S					C	F	TSL	W		WI			
56A	CORAL BAY MARINA			5	6	B E	S	HMR		60		H	FLC	TSL	WD	C	WI	GH		
56	CARIBEE BOAT SALES			4	4			M		5					D	C	WI	H		G
57	BAYSIDE MARINA			3.	5 5	B E		HM		3½	C M		F	TS	WD	C	WI	H	BT	G
57A	MAX 'S MARINA			5	6	B		HMR		30				T	WD	C	W			DG
58	BUD N MARYS MAR	2.0	+¾	4½	6	B E		HM		12	M	C	FLC	T	D	C	WI		BT	DG
58B	RENT-A-BOAT INC			6	7	BME	S	M		10	M	C	F	T	WD	C	WI		BT	DG
64	OUTDOOR RESORTS			4			S							TSL		C	WI	GH	BT	G
65	EDGEWATER MOTEL	0.9	+1¾	7	3½							C	L				I		B	
69	DUCK KEY MARINA			16	55	B E	S				M	C S	F	TSL P		C	WI	GH	BT	DG
71	*KEY COLONY BCH*			*8*	*8*	*B E*					*M*	*C*	*F*	*T L*	*W*	*C*	*WI*	*GH*	*BT*	*DG*
71A	THE BOAT HOUSE	1.0	+8¼	5	5	B		HM		26				TS	WD	C	WI	H		DG
71B	HOLIDAY INN MAR			4	5	BME	S				RM	C S	FL	TS P			WI	G	BT	DG
74	LAGOON MOTEL M			2			S					C	F	T L			WI		B	G
77	BAYLES BOATYARD	0.8	+6¾	7	7			HMR		50				TS	WD			H		G
78	MARATHON BOATYD	1.5	+1½	8	15	B E		HMR		60				TS		C		G		DG
79	FARO BLANCO MAR	0.8	+6¾	7	12	B E	S	HMR					FL	TSL	W	C	WI	H	BT	DG
80	HALLS MOTEL			3	5	B	S	M			M	C	FL	L	W	C	WI	G	BT	G
86	KNIGHT KEY CGR			3	5		S						LC	TSL P	D		I		BT	G
86B	*CLYDES 7 MILE MAR*			5	4						*M*	C					*WI*	*H*		*G*
87	PINELLAS MARINE			8	7									T			WI	GH	BT	DG
88	OCEANSIDE MAR	1.5	+1½					HMR		7				T				H		
89	FARO BLANCO MARINA			8	8	B E	S						FL	TSL P		C	WI	G	BT	
89A	SUNSHINE KEY M			5	5	B E	S				M	C	F C	TSL	WD	C	WI	GH	BT	DG
90	FLAMINGO LODGE&MAR			5	6	B E	S				CRM	H	F C	TS P		C	WI	G	BT	DG
91	MARATHON SEAFOOD			8	12	BM		HMR		30			F	TS	WD				B	DG

(+)DENOTES HOURS LATER (-)DENOTES HOURS EARLIER
THE LOCATIONS OF THE ABOVE PUBLIC MARINE FACILITIES ARE SHOWN ON THE CHART BY LARGE MAGENTA NUMBERS.
THE TABULATED "APPROACH-FEET(REPORTED)" IS THE DEPTH AVAILABLE FROM THE NEAREST NATURAL OR DREDGED CHANNEL TO THE FACILITY.
THE TABULATED "PUMPING STATION" IS DEFINED AS FACILITIES AVAILABLE FOR PUMPING OUT BOAT HOLDING TANKS.

THIS TABULATION WAS PRODUCED USING COMPUTER ASSISTED METHODS.

Fig. 2–14. Marine Facilities Tabulation Found on NOS Chart 11451 (Miami, to Marathon and Florida Bay)

Although this same information is available in a variety of companion publications, such as the *U.S. Coast Pilot* or the *Tide Tables,* recreational boaters typically appreciate its inclusion on the nautical chart (NRC). Interestingly, many professional mariners, who normally have these other reference publications, would prefer "less cluttered" charts (NRC), an illustration of the trade-offs made by NOAA in deciding what to include.

Lettering Styles (Vertical versus Slant Type)

Chart features depicted in vertical type include the names of topographic features and fixed objects which extend above high water. Slant (italic) type is used for names of hydrographic features, including names of water areas, underwater features, and floating aids.

Use of Color on Charts

Color is used on nautical charts to call the mariner's attention to key features and to facilitate chart interpretation. NOAA uses five colors (some with different shades) to depict chart features and other information: black, blue, gold, green, and magenta. The general color conventions on NOAA charts are as follows:

- *black* is used for most symbols, printed information (e.g., notes, titles, certain Loran–C TDs, etc.), to outline shores, topographic features, and depth contours;

- *blue* (in one or more tints) is used to depict shallow water areas, the boundaries of certain regulated areas (see Chapter 7), and Loran–C TDs;

- *gold* (buff) is used to show land areas, and a darker screened tint is used to show built-up areas, such as cities (on charts published by NIMA, land areas are shown in a screened black that appears to be gray);

- *green* is used to depict areas that cover and uncover depending upon the stage of the tide (e.g., marches, mud flats, sand bars, etc.), another shade of green is used to depict green buoys and daybeacons;
- *magenta* is used to depict red buoys and daybeacons, lighted buoys, and important caution and danger symbols, compass roses, and recommended course (if given), Loran–C TDs; and finally

- *white* (the natural color of the chart paper) is used to depict deep-water areas, dredged channels, etc.

Symbols and Abbreviations

As noted, a standardized set of symbols is used to represent the various features depicted on nautical charts. These symbols are shown in Chart No. 1 and discussed throughout this manual. Numerous standardized abbreviations are used on nautical charts to conserve space. These abbreviations, together with others used in this manual, are shown in appendix B.

Use of Charts

Throughout this manual the proper use of nautical charts is explored at length. Two concluding comments are relevant here.

First, the mariner should keep in mind that, aesthetics aside, the modern-day nautical chart is a working tool. In earlier times, charts were highly valuable documents printed on animal skins, parchment, and other valuable materials. The navigator's determinations of course and distance measurements, plots of dead reckoning positions, fixes, etc., were typically made on separate pieces of paper. Distances and courses (the sailings) were determined by calculation, not actual plotting. Technical progress and economies of scale have changed the chart from an object of veneration to a working tool. Intended tracks, DR plots, bearings, fixes, distance measurement, ranges of visibility of lights, etc., are now plotted on the chart, rather than laborious calculation. So don't be afraid to use the chart, and annotate it appropriately for the voyages you plan to take.

Second, the chart should be studied carefully before it is actually put to use. The legends should be read, scale determined (particularly if the scale changes from chart to chart), and all notes and symbols read and understood. On an actual voyage, particularly in congested and potentially dangerous waters, there may be little time to consult additional documents to determine the significance of a particular chart symbol, note, or legends. The horizontal datum should be noted and the GPS or LORAN-C receiver checked to ensure that this datum is being used. Latitude and longitude scales should be reviewed as these differ from chart to chart. Depth units should be checked and a realistic danger sounding selected (see Chapter 4) and marked on the chart. The navigator might wish to annotate the chart with additional relevant information, such as arcs of visibility of lights, prominent ranges, landmarks, facilities, danger bearings, and other relevant information from the chart or other sources such as the tide or tidal current tables, *Light List,* or *U.S. Coast Pilot.* As noted earlier, the charts should be laid out and sequenced to ensure that all necessary charts are aboard and that they can be retrieved expeditiously and in the correct order.

"Part of the responsibility for the continuing accuracy of charts lies with the user. If charts are to remain reliable, they must be corrected as indicated by the Notice to Mariners. *In addition, the user's reports of errors and changes and his suggestions often are useful to the publishing agencies in correcting and improving their charts. Navigators and maritime activities have contributed much to the reliability and usefulness of the modern nautical chart. If a chart becomes wet, the expansion and subsequent shrinkage when the chart dries are likely to cause distortion."*

Bowditch

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CHAPTER 3

Topography and Related Information

Introduction and Overview

The preceding chapters of this manual provide *general* information on nautical charts, projections, orientation, measurement of position/distance/direction, etc. This is the first of several chapters that explain the symbols and chart conventions used to depict *specific* features of interest. As noted in earlier chapters, the use of a standardized and compact set of symbols and other chart conventions (e.g., stylized labels and notes, standardized colors, and typeface choices) to depict specific features contributes greatly to the efficiency with which a chart can communicate a mass of detailed information to the mariner. Moreover, except for a few supplementary national symbols, these same chart conventions are employed in numerous countries throughout the world. As noted in the introductory chapters of this manual, the publications that correspond to Chart No. 1 issued by other nations (e.g., Chart 5011, *Carte* No. 1) appear nearly identical.

Chart No. 1 organizes the symbols used to depict charted features into three broad categories: *topography* (Sections C through G), *hydrography* (Sections H through O), and *aids and services* (Sections P through U). In slightly modified form, this same classification system is used to organize the contents of this manual. Thus, Chapter 3 addresses topography and related information, Chapter 4 examines hydrography and related information, Chapter 5 presents information on ATONs, and Chapter 6 covers landmarks.

On nautical charts, the coastal configuration, prominent land features, landmarks, and cultural features are included to help the mariner determine the vessel's position, alert the mariner to potential land-based hazards to navigation (e.g., breakwaters, overhead cables), and inform the mariner of the availability and location of facilities and services (e.g., dry docks, piers, pilot stations, wharfs).

This chapter addresses topography and related information, including natural features (such as coastlines, terrain relief, and vegetation), cultural (manmade) features (such as settlements and buildings, roads, railways, airfields, bridges, and overhead cable crossings), landmarks (mentioned briefly in this chapter and explored in detail in chapter 6), and ports (such as hydraulic structures in general, harbor installations, canals, and transshipment facilities). In general terms, topographic and related information refers to charted features located on land, or at least those which are normally above water. (For logical consistency, land-based ATONs are covered in Chapter 5.)

As shown in figure 3–1, the chart features included in topography and related information are covered in Sections C through G (with

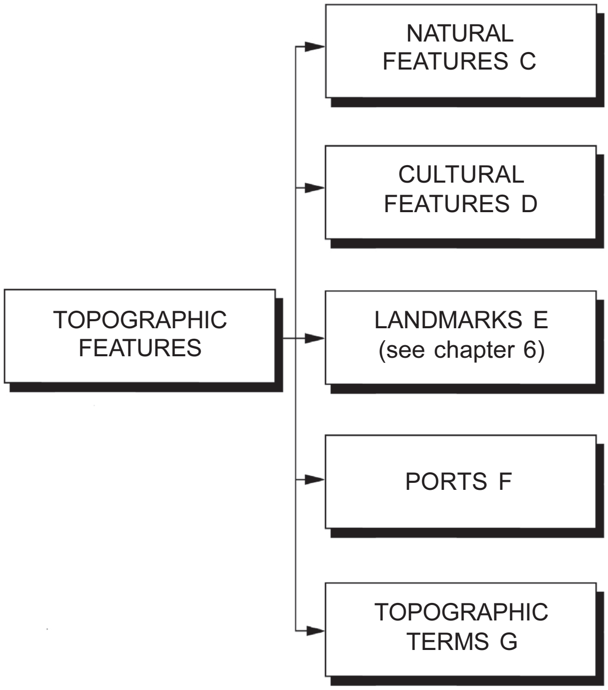

Fig. 3-1. Topographic and Related Information Depicted on the Nautical Chart

selected additions from Sections T and U and miscellaneous others) of Chart No. 1.

This chapter provides essential background, summarizes the utility of this information, describes the charting conventions (e.g., symbols, labels, and notes) used to depict this information, identifies other relevant sources (e.g., the *U.S. Coast Pilot),* and presents practical pointers on how this information can be used by the prudent mariner. By actual count there are more than 200 features or groups of features that fall into the category of topography and related information—well more than can be discussed in detail in this manual. For this reason, the focus of this chapter is limited to those features likely to be of greatest relevance to the recreational and commercial vessel operator.

Many specialized terms used in this chapter are defined in the Glossary in appendix A. Names enclosed in parentheses (e.g., Bowditch) refer to sources listed at the end of this chapter that contain additional relevant detail or useful general discussions. Letters and numbers (e.g., F 1) refer to specific sections and symbols presented in Chart No. 1. Although selected excerpts from Chart No. 1 are provided as illustrations in this chapter, space constraints prevent including this chart in its entirety. Therefore, it is recommended that Chart No. 1 be kept at hand when reading this chapter.

Utility of this Information and Implications for Chart Design

On first reflection it may seem odd to include *any* topographic and related information on a nautical chart. As noted in Chapter 1, nautical charts are distinguished from maps because the chart contains information of particular relevance to the mariner, whereas maps generally serve the terrestrial user. Nonetheless, depiction of topography and related information on the nautical chart is very important to mariners. Although many commercial vessels routinely voyage across the oceans, coastal navigation techniques (which exploit charted topographic features) are employed in the departure and arrival phases of every ocean voyage. Indeed, because of traffic density and the proximity of hazards to navigation, the arrival and departure segments of an ocean voyage are typically more challenging then the enroute segment (e.g., Graves)—requiring the most precise navigation. A 3-mile fix error typical of a celestial fix, for example, would be perfectly acceptable in the middle of the ocean, but entirely too large in a harbor or harbor entrance where appropriate tolerances on fix accuracy might be measured in yards or tens of yards.

Moreover, recreational vessels seldom venture out of sight of land. The majority of the USCG *search and rescue* (SAR) cases occur either on inland waters or within 3-nautical miles of the coastline. Vessels using coastal waters navigate by a variety of methods, including dead reckoning, electronic navigation, etc., but the use of visual observation of natural or artificial land features (pilotage) is essential for taking departure, position fixing, plotting danger bearings, determining turning bearings, compass spot checks and calibration, anchoring, and other assorted navigational chores (see Chapter 6). An abundance of accurately charted terrestrial features is essential for coastal piloting.

Although some coastal features clearly belong on a nautical chart, others would merely add clutter and require needless updating. The nautical cartographer must be selective in deciding which features should be charted. Generally features located along the shoreline are charted, but the density of charted features falls off rapidly with distance from the coast. The distance inland to which topographic features are depicted on the nautical chart varies with the chart scale, type of terrain, availability of source data, and the adequacy of ATONs. The significance of topographic features to the mariner is determined by the requirements of both visual and radar navigation. Because marine navigators see the coast in profile, their interest in land detail is greatest at the shoreline and diminishes rapidly inland. Nonetheless, some inland features, such as airports, are charted because navigators can infer the existence of the feature from other clues. For example, an airport may not be visible from seaward, but its existence could be inferred from aircraft seen to be departing and/or on approach to landing (see Markell). High mountains with defined peaks might also be charted even if located well inland, if these could be used for position fixing. On coasts poorly marked by ATONs, detailed coastal topography is particularly important to the navigator. Nonetheless, topographic detail depicted on the nautical chart is kept to a minimum consistent with the need to show the significant identifiable features and the general relief of the skyline. The amount of charted detail also varies with the distance inland. Inconspicuous features, such as marshes and minor lakes and streams are usually shown only when located within a short distance (e.g., 1 mile) of the shoreline. Conspicuous features, such as steep coasts with deep-water close inshore, are normally charted. Even inconspicuous or minor features (sand dunes, mangroves, low bluffs, etc.) might be charted in areas devoid of more prominent features.

This chapter includes many features other than coastline and topography. Features such as berthing structures (piers), erosion-control structures (breakwaters), ports and harbors, as well as bridges and roads, buildings and other structures (e.g., tanks and towers) are potentially relevant to the mariner for operational or safety reasons.

Coastline/Shoreline (C 1 – C 8)

For charting purposes the terms "coastline" and "shoreline" are considered to be synonymous. Standardized symbols (C 1 – C 8) are used to depict various coastline features. Figure 3–2 contains a diagram identifying several

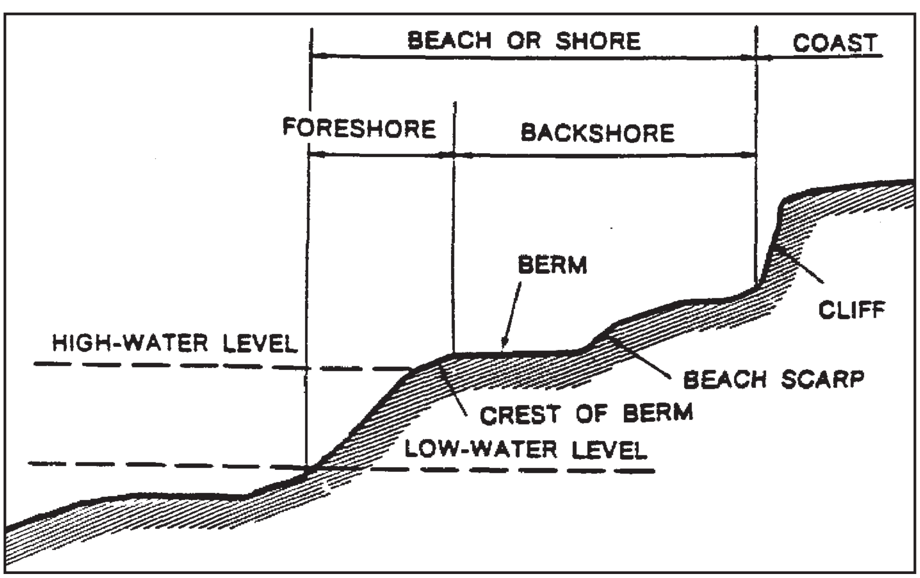

Fig. 3-2. Shoreline and Foreshore Features
Source: *Nautical Chart Manual*

of the more important shoreline and foreshore (defined below) features discussed in this section.

–Shoreline Plane of Reference

The shoreline is the line of contact between the land and a selected water elevation and is delineated whenever possible from survey data. This dividing line between land and water features is also termed the *shoreline plane of reference* (SPOR).

In areas affected by tidal fluctuation, the SPOR is usually the *mean high water* (MHW). In confined coastal waters of diminished tidal influence, a *mean water level line* (MWLL) may be used. The shoreline of interior waters (rivers, lakes) is usually a line representing a specific elevation above a selected datum which is noted on the chart.

Natural shoreline is generally depicted on nautical charts by a heavy solid black line. The exceptions to this lineweight convention are for apparent shoreline, minimum-size islets, and the various forms of manmade shoreline (wharfs, piers, jetties, breakwaters, etc.); these are delineated by a thinner solid black line. The land area delineated by the shoreline is tinted in a buff or gold color; the foreshore (if any) is green; and the water seaward of this line is shown in a blue tint or in white, depending upon the depth of the adjacent water (see Chapter 4 for details).

–Apparent Shoreline (C 32, C 33)

The apparent shoreline is defined in appendix A as the seaward limit of marine vegetation, such as mangrove, marsh grass, or trees in water that would reasonably appear (visually, not necessarily by radar) to the mariner from a distance to be the fast shoreline. Shorelines observed using radar (DMAHTC 1994 provides an excellent discussion of landmass recognition) may be quite different from those observed visually. Mangrove, for example, might give a strong radar return if sufficiently dense, but other vegetation may be relatively transparent to radar. The seaward limits of kelp, low grass in water, and other low-lying vegetation normally do not constitute an apparent shoreline. Apparent shoreline is depicted with a light solid black line. Labels (see below) may be added to describe the shoreline vegetation.

–Approximate or Unsurveyed Shoreline (C 2)

An approximate shoreline is one that has been inadequately surveyed. It is shown on larger scale charts by a dashed black line (C 2) delimiting the gold tint. Mariners voyaging near such shorelines should exercise caution—the hydrography may likewise be incomplete or approximate.

–Flat Coast (C 5)

A flat coast is characterized by a shallow slope without any distinguishing features. The position of a flat coast may be difficult to determine by either visual means or with the use of radar. It is depicted with a unique symbol (C 5), and may also include a descriptive label, e.g., "Sandy," "Stony," "Marsh," or "Dunes," which is written in black vertical type, initial capitals only. (Label conventions are discussed in more detail in other chapters. Briefly, vertical type is used for names of topographic features and fixed objects which extend above high water. *Italic* type is used for names of hydrographic features, including names of water areas, underwater features, and floating ATONs. Soundings may be shown in either type according to whether conventional (vertical type) or metric (italic type) units are given.)

–Steep Coast–Bluff; Cliff (C 3)

A coast backed by a conspicuous cliff or very sharp rise is considered to be a bluff (if it is not rocky) or a cliff (if it is rocky). Such a coast is potentially useful for both visual and radar identification.[1] (See Mellor or Graves for a contrary opinion.) Cliffs/bluffs are a particularly useful shoreline reference if these alternate with low-lying coast along the shore-

[1]Visually, rocky cliffs can sometimes be distinguished from soil-covered bluffs by the relative absence of observed vegetation.

line. Prominent cliffs/bluffs are shown on all scales of charts provided there is charted hydrography within their range of visibility. The maximum elevation of a cliff may be used by mariners for determining a vessel's distance offshore (see Bowditch or Dutton) and is often shown as an elevation if it is prominent and conspicuous (C 11). The series of marks depicting the face of the cliff/bluff symbol (C 3) are referred to as *hachures* (derived from the French noun *"hache"*—meaning axe—because these resemble axe marks). Hachures are used to depict relief in cases where contour lines are omitted.

–Surveyed Coastline (C 1)

Surveyed coastline is shown by a solid black line delimiting the gold land tint. On small-scale charts the details of the shoreline must be generalized. Such generalization, although necessary, makes visual identification of charted features more difficult. This is just one of many reasons why the largest scale chart of the area should be used for near-shore navigation

–Other Shoreline Types

Symbols (C 4, C 6, C 7, and C 8) are used to depict coastal hillocks (undetermined elevation), sandy, stony, or shingly shore, and sandhills/dunes respectively.

–Foreshore

The part of the shore lying between the crest of the seaward berm (or upper-limit of wave wash at high tide, see figure 3–2) and the ordinary low-water mark is called the *foreshore*, which is ordinarily covered and uncovered by the waves as the tide rises and falls. Foreshore areas are tinted green (C c) on nautical charts, and the character of the area labeled (e.g., *"Mud," "Gravel,"* etc.) in italic type as appropriate.[2] These labels may assist the mariner in deciding where a safe landing may be made in an emergency (the hydrography must be examined as well) and in determining the vessel's location.

–Chart Sounding Datum Line (C a)

The chart sounding datum line in tidal areas is represented by a single row of dots called the low-water curve. The area between the SPOR and the sounding datum is tinted green, and (if known) the character of this area is labeled appropriately.

–Approximate Sounding Datum Line (C b)

A special symbol (C b) is used in cases where the sounding datum line is only approximately known.

–Breakers (C d)

Breakers along a coast are charted if these appear consistently in a location where no shoals or reefs (see Chapter 4) are charted. If charted, a unique symbol (C d) is used and a label *"Breakers"* in black italic type is added. Limits of large areas of breakers may be shown using another special symbol (K 17). *Vessel operations in surf zones are potentially hazardous and should be avoided.*

–Grass

Grassy areas seaward of the high-water line are charted using a dashed line to show the limit of the grassy area, and labeled *"Grass"* in black italic type. Grass can foul propellers and clog water intakes.

–Mud/Sand/Stone or Gravel/Sand and Mud/Sand and Gravel/Rock/Coral/Rubble

Appropriate labels (e.g., *"Mud," "Sand,"* etc., in black italic type) describing the foreshore may be added along the inshore side of the low-water limit line, and the enclosed area depicted with a green tint. The offshore limit of the uncovering area is symbolized by a dotted line (C c, J 20.1).

Rock or coral that uncovers at sounding datum is charted using the appropriate label and symbols (J 21, J 22). Rubbled (i.e., a foreshore characterized by loose angular rock fragments) foreshore is depicted by a unique symbol (C e) and labeled *"Rock"* in black italic type.

[2]The green tint is produced by overprinting the gold land tint and the blue water tint.

–Illustration

Figure 3–3 contains an excerpt from NOS Chart No. 12284 (Patuxent River, Solomon Island, and Vicinity),[3] which illustrates many of the above features. Note the hachures (C 3) along the coast south of ***Cuckold Creek*** indicative of an elevated coastline. The coastline (C 1) in this vicinity is surveyed. Further to the southeast is a marsh (C 33). Just north of **Half Pone Pt.** the foreshore (C c) is shown.

Elevation and Relief Data

Elevation and relief are important features depicted on the nautical chart. These features can be used by the mariner for both general orientation and more precise position fixing (see Eyges). Another use of terrain data is to identify areas where protection from the elements would be expected. For example, a lagoon with elevated terrain to the northeast would probably be reasonably well-protected from "Nor'easters." An ideal anchorage (see Chapman) is a harbor protected on all sides with water of suitable depth and good holding ground. Water depths and bottom characteristics are discussed in Chapter 4. But shelter from the winds can be determined approximately from the characteristics of the terrain surrounding the harbor, inlet, cove, or lagoon. Finally, it should be mentioned that the "underwater topography" or hydrography of an area is likely to be generally similar to that observed and charted on the nearby land. Thus, an area characterized by numerous rocky peaks would probably have a similar underwater profile. The charted hydrography should bear this out. If not, it is a possible indication of the unreliability of the charted hydrography (see Chapter 4).

This section provides information on the charting conventions used for elevation and relief data.

Hachures, *spot elevations,* and *contour lines* present elevation and relief data on nautical charts. Hachures provide a *qualitative* indication of relief; contour lines and spot elevations provide *quantitative* data able to be used for "distance-off" computations using a sextant or stadimeter (Bowditch, Dutton, Maxim).

–Land Contours (C 10)

Contour lines depict a vertical distance (in feet on conventional charts, in meters on metric charts) above a datum plane, usually *mean sea level* (MSL).[4] (Note that the vertical datum plane for contours generally differs from that used to depict bridge heights and other charted height information.) When contours and spot elevations (C 11) are charted, a note labeled "HEIGHTS" is included specifying the plane of reference used. The text of the heights note is:

> "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 [meters] and refer to Mean Sea Level."

(The contour height datum is potentially relevant because it is necessary to correct for the

[3]Note also the two tanks on the land south of ***Cuckold Creek.*** Both are landmarks (see chapter 6). The southernmost of these tanks is shown with the *approximate* position symbol explained in chapter 6—a small black circle 0.5 mm in radius without any center dot. This tank is plotted within 100 feet of its correct geographic position. Slightly northwest of this tank is another denoted with an *inexact* position symbol: the small circle with the letters PA. This is plotted with a position accuracy of 101 feet to 300 feet of its correct position. Neither landmark would be shown if more accurately located and conspicuous landmarks were available in this area. The absence of charted land detail tells the mariner that this area has few distinguishing features.

[4]Heights given are for *land* elevations—not from MSL to the tops of any trees. In low-lying areas where tree heights are relatively large, this difference can be substantial. See text on tree-top elevations.

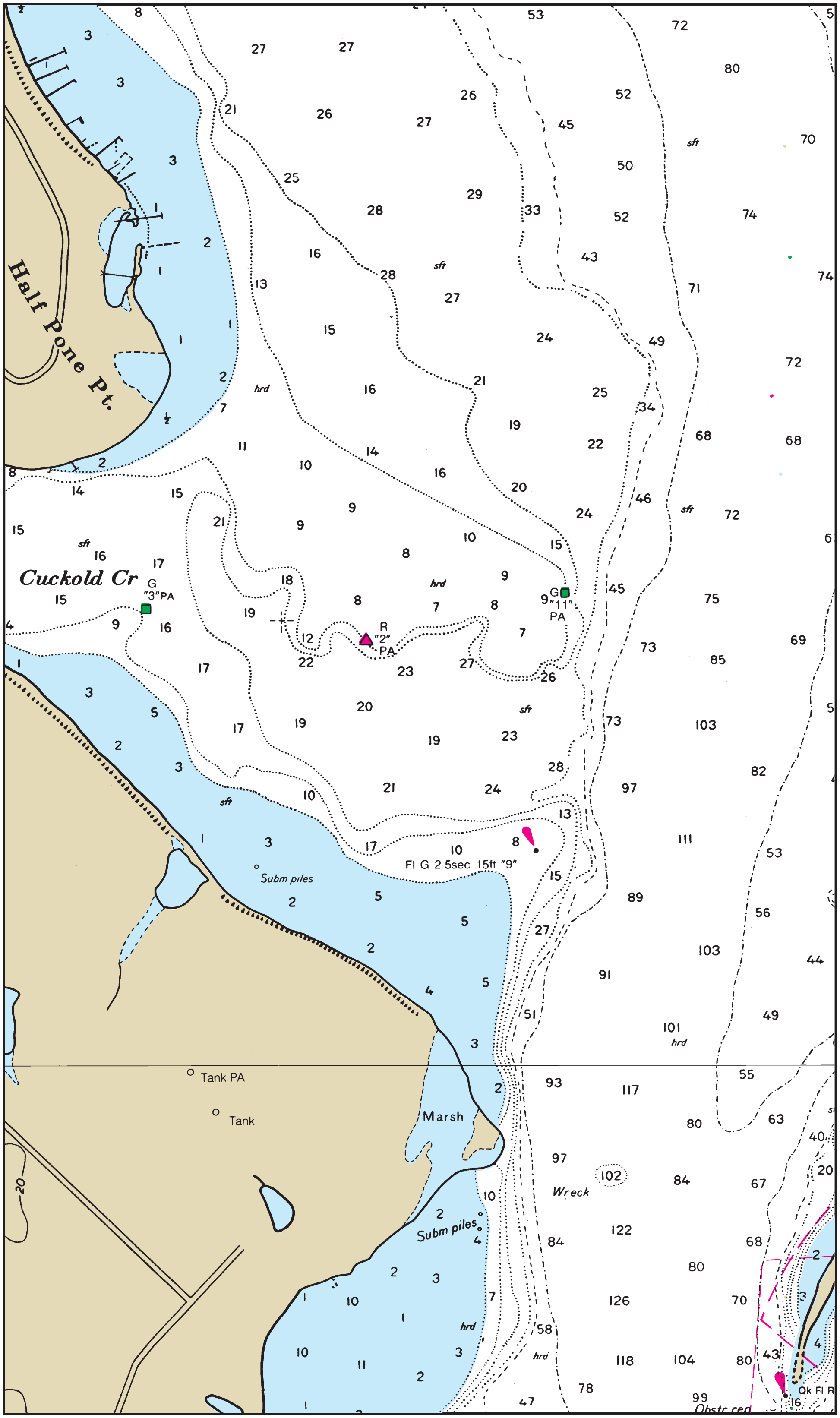

Fig. 3-3. Excerpt from NOS Chart No. 12284 (Patuxent River, Solomons Island and Vicinity) Showing Several Features of Interest

state of the tide in making precise distance-off calculations.)

The vertical distance between adjacent contour lines is termed the *contour interval.* The contour interval is not given explicitly on the chart, but can often be deduced from contour labels. Figure 3–4 contains an excerpt from NOS Chart No. 18650 (San Francisco Bay) showing a prominent hill west of Candlestick Park Stadium, home of the San Francisco Giants baseball team. Index contours (see below), drawn with a thicker line, are shown at 200-foot and 400-foot elevations. There are three contour lines between these index contour lines. Therefore, the contour interval is 50 feet, and the intermediate contour lines are at elevations of 250 feet, 300 feet, and 350 feet.

Contour lines are shown on a nautical chart only when considered useful for radar navigation or for identifying the land features and profiles from seaward. Landforms on the "back side" of mountains (i.e., those hidden when looking from seaward) add little to the utility of the nautical chart, and are often omitted.

Contour intervals are selected to maximize clarity in depiction—considering the chart scale, general slope, and the need to show the topographic relief of the land area. The contour interval varies from chart to chart, but is uniform on any given chart. Because the contour interval is constant for any given chart, the spacing of the contour intervals can be used to infer the shape of the land. Closely spaced contours imply relatively steep slopes; those further apart more moderate shapes. The mariner can use the distance between contour lines and the overall pattern of hummocks, hills, peaks, ridges, and saddles to form a mental picture of the profile view of the land (Eyges offers a particularly detailed discussion of this point).

Contours are depicted as solid black (intermediate contours may be dashed) lines. *Index contours,* usually every fifth contour, are

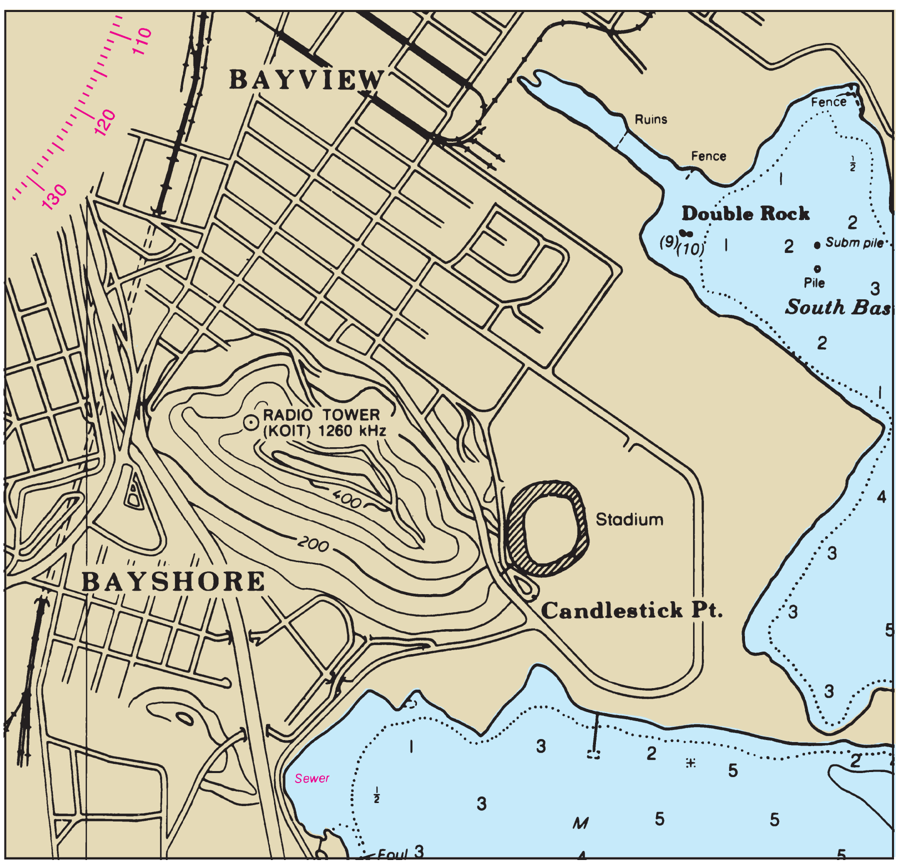

Fig. 3-4. Excerpt from NOS Chart No. 18650 (San Francisco Bay), showing contour lines on hill near Candlestick Park

emphasized by the use of a bolder line. In cases where slopes are steep—which would crowd contours—contour lines are not merged. Rather intermediate contours are omitted to leave a space of approximately 0.3 mm between those shown.

Labels are used to identify the elevation depicted by the contour line. Contour labels are printed in black vertical type. Labels are placed at suitable intervals parallel to, and centered on, the index lines (see figure 3–4). In flat areas where the index lines are relatively far apart, labels may be shown on each contour line, rather than on the index lines only.

Form lines (C 13), or sketch contours, are shown by broken lines and are contour approximations depicting the general form of terrain formations without providing exact contour information. (See approximate contour lines.)

–Approximate Contour Lines (C 12)

Approximate contours are shown using dashed (C 12) lines, rather than the solid lines used to depict accurately known contour lines.

–Peaks (C 10, C 11) and Treetop Elevations (C 14)

Prominent peaks are represented by the spot elevation dot and accompanying elevation label (C 11). An intermediate interval may be approximated by a dashed line and labeled to show a summit (C 10). Spot elevations of land on slopes are omitted because these would be of little value to the mariner.

The charted position of mountain peaks or other prominent topographic features can be used to take bearings (and, therefore, determine a LOP) using either radar or visual means (e.g., Pelorus or hand-bearing compass). Two bearings (if widely separated in azimuth, see Chapter 6) can be used to determine a fix. A bearing and a range (determined by radar, sextant, or stadimeter) also fix the vessel's position, as can two ranges from different objects. Elevation data enable calculation of the vessel's distance-off by visual means, but also can be used to aid in the identification of a particular peak.

Some peaks, such as Mt. Fujiyama on the Japanese island of Honshu, are visually prominent, and admit to little-or-no possibility of mistaken identity. However, other peaks are less distinct or unique, and it may be difficult to distinguish one from another. Errors in feature identification result in fix errors. Elevation data, even if not used for distance-off computations, can be valuable in identifying the particular peak used to determine a LOP. *Mariners should study the chart carefully if using natural features for determining LOPs, particularly in areas where similar features abound.* Positions determined from these features should be checked using all available means, such as by cross-checking with soundings or electronic fixes.

Treetop elevations may be charted on peaks in southeast Alaska only and are labeled "TT." A treetop height may also be useful to show the profile height of an island and may be charted if based upon a site inspection (C 14). However, just as trees are not typically selected as landmarks, because these may be only temporary, treetop elevation data are provided selectively.

–Hachures

Hachures (C f) are used to provide a qualitative indication of the steepness of a coast. As noted, these appear as wedge-shaped marks which are oriented perpendicular to contour lines. The length of the hachure is greatest where the slope is steepest. Hachures are not used to represent large areas of relief. Hachures are used to accentuate a spot elevation on very small-scale charts without contours.

–Height of Object

The distance at which an object can be seen depends upon several factors (see Chapter 6). In particular, this distance is limited by the curvature of the earth. Equations have been developed (see Chapter 6) to calculate the maximum distance at which an object can be seen including the effects of refraction and horizon geometry. Figure 3–5 shows the maximum distance at which an object can be seen as a function of the height of the object and the height of eye of the observer as calculated from the equation given in Chapter 6. Table 3–1 provides a table of these distances, which is more useful for voyage planning. As can be seen from either figure 3–5 or table 3–1, this distance increases with the height of the object and the height of eye of the observer. It follows that, other things being equal, taller objects can be seen at greater ranges, so high prominent peaks are likely to be sighted at a greater range and are more useful for position-fixing.

The distances shown in figure 3–5 and table 3–1 are *maximum* distances at which an object may be seen. The prevailing visibility limits this distance. On any given day, fog or low-lying clouds may obscure some of the tallest peaks in the area, so it is well to select both high- and low-objects for range or bearing determination.

–An Aside: Indirect Use of Terrain Information

In thinking how terrain information may be used, what may be termed *direct uses* come immediately to mind. A direct use of a charted mountain peak, for example, would be to determine a bearing and distance-off to fix the vessel's position. Many authors of texts on navigation (e.g., Graves, Kals, Mellor) note correctly that it may be difficult to identify charted terrain features. By implication, the utility of charting this information is questioned.

It is important to state that terrain features and related information can be used in less direct ways as well. The following three vignettes illustrate the concept of *"indirect uses":*

A tower is visible, but the mariner is uncertain of its identity; the vessel's position is not known with sufficient precision to decide which of two charted towers (landmarks) is being seen. Reference to the terrain features depicted on the chart in the vicinity of each of the candidate towers may enable one of these possibilities to be eliminated. In other words, the charted terrain features provide a context or setting for each of the landmarks which could be useful in identification, even if the terrain features are not sufficiently unique to be used alone. Put another way, what is seen is more than just a tower, it is a tower on a high bluff or a tower on low-lying land near a rise, etc.

A vessel is lying off a coastline marked by high but otherwise featureless cliffs. These cliffs are not sufficiently identifiable to fix the vessel's position, but do provide a useful radar return so that a distance-off can be determined. The navigator might consult the charted hydrography in the overall vicinity and compare this with the observed depth to narrow down the possible position(s) of the vessel. Alternatively, the vessel might proceed along the coastline—using radar to maintain a safe distance offshore—until a recognizable feature is encountered. As in

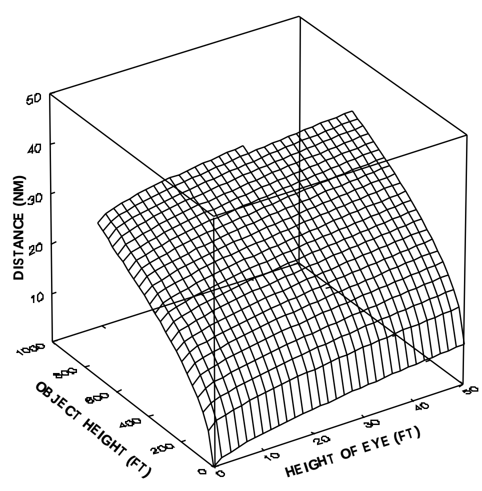

Fig. 3-5. Distance to the Visual Horizon

Table 3-1. Distance to the Visual Horizon (NM) as a Function of the Height of Eye (ft) and Object Height (ft)

Object Height (ft)	Height of Eye (ft) 8	10	12	14	16	18	20	25	30	35	40	50
5	5.9	6.3	6.7	7.0	7.3	7.6	7.8	8.5	9.0	9.5	10.0	10.9
10	7.0	7.4	7.8	8.1	8.4	8.7	8.9	9.5	10.1	10.6	11.1	12.0
15	7.8	8.2	8.6	8.9	9.2	9.5	9.8	10.4	10.9	11.5	11.9	12.8
20	8.5	8.9	9.3	9.6	9.9	10.2	10.5	11.1	11.6	12.2	12.6	13.5
30	9.7	10.1	10.5	10.8	11.1	11.4	11.6	12.3	12.8	13.3	13.8	14.7
40	10.7	11.1	11.5	11.8	12.1	12.4	12.6	13.2	13.8	14.3	14.8	15.7
50	11.6	12.0	12.3	12.7	13.0	13.2	13.5	14.1	14.7	15.2	15.7	16.5
60	12.4	12.8	13.1	13.4	13.7	14.0	14.3	14.9	15.5	16.0	16.5	17.3
70	13.1	13.5	13.8	14.2	14.5	14.8	15.0	15.6	16.2	16.7	17.2	18.1
80	13.8	14.2	14.5	14.8	15.1	15.4	15.7	16.3	16.9	17.4	17.9	18.7
90	14.4	14.8	15.2	15.5	15.8	16.1	16.3	16.9	17.5	18.0	18.5	19.4
100	15.0	15.4	15.8	16.1	16.4	16.7	16.9	17.6	18.1	18.6	19.1	20.0
120	16.1	16.5	16.9	17.2	17.5	17.8	18.0	18.7	19.2	19.7	20.2	21.1
140	17.2	17.5	17.9	18.2	18.5	18.8	19.1	19.7	20.3	20.8	21.2	22.1
160	18.1	18.5	18.9	19.2	19.5	19.8	20.0	20.6	21.2	21.7	22.2	23.1
180	19.0	19.4	19.8	20.1	20.4	20.7	20.9	21.5	22.1	22.6	23.1	24.0
200	19.9	20.2	20.6	20.9	21.2	21.5	21.8	22.4	23.0	23.5	23.9	24.8
250	21.8	22.2	22.6	22.9	23.2	23.5	23.7	24.3	24.9	25.4	25.9	26.8
300	23.6	24.0	24.3	24.6	24.9	25.2	25.5	26.1	26.7	27.2	27.7	28.5
350	25.2	25.6	25.9	26.3	26.6	26.9	27.1	27.7	28.3	28.8	29.3	30.2
400	26.7	27.1	27.5	27.8	28.1	28.4	28.6	29.3	29.8	30.3	30.8	31.7
450	28.1	28.5	28.9	29.2	29.5	29.8	30.1	30.7	31.2	31.7	32.2	33.1
500	29.5	29.9	30.2	30.5	30.8	31.1	31.4	32.0	32.6	33.1	33.6	34.4

the first example, the charted feature is not used directly to fix the vessel's position, but rather in an indirect manner.

A navigator reads the vessel's latitude and longitude from an electronic aid, such as a LORAN-C or GPS receiver. On plotting this position on the nautical chart, it is seen to lie close to low-lying featureless terrain with marshes and lagoons. However, a prominent headland is clearly visible where the marshes and lagoons are supposed to be. The observed terrain may not be sufficiently distinctive to enable the mariner to fix the vessels position directly; however, the discrepancy between the observed coastline and that charted indicates that the electronic fix is in error. Perhaps a digit was transposed in copying the coordinates from the display, perhaps the display should be checked for warning flags or error messages, etc. Even though the terrain evidence is inadequate to locate the vessel, it provides an important "reality check" on positions determined using other means.

Navigation is conventionally thought of as an exercise in geometry or mathematics. But in some cases it may be appropriately likened to fitting together the pieces of a jigsaw puzzle. Each piece contributes to the finished image, but no piece is sufficient in itself. It is well to remember that navigation is an art as well as a science.

Inland Waters

Shoreline bounding navigable inland waters is charted as fully as practicable, considering the scale of the chart. Shoreline bounding nonnavigable inland waters is charted only to provide a general picture of land and water areas. Features related to inland waters are discussed below.

–Glaciers (C 25)

For nautical charting purposes, a glacier is considered to be a landform and is outlined by a dashed line within which there is no tint (C 25). The label “Glacier” or the geographic name of the glacier is shown in black vertical type (initial capitals only) inside the feature in lieu of interior fill.

–Intermittent Rivers and Streams (C 21)

Intermittent rivers and streams, which are frequently dry, are represented by a symbol consisting of a series of three dots and a dash (C 21).

–Lakes and Ponds (C 23); Lagoons (C h)

Lakes, ponds, and lagoons are shown in blue tint on nautical charts if these are part of the course of major rivers or are close to the coastline. The shoreline is charted with a black line, and the lake, pond, or lagoon is normally tinted blue. (Hydrographic detail is not presented.) Names, if given, are shown in italic type placed inside the feature. Lakes and a lagoon are shown in figure 3–3.

–Rapids and Waterfalls (C 22)

Rapids and waterfalls that limit navigation are represented by one or more lines of dashes drawn parallel to the shoreline (C 22). Rapids and waterfalls can present a major hazard for vessels, and should be given a wide berth.

–Rivers and Streams (C 20)

Rivers and streams are shown with a solid black line. If no hydrographic detail is presented, the enclosed area is shown in a blue (shallow water) tint. Names of rivers, if given, are shown in black italic type along the course of the river. Figure 3–3 shows two small streams which feed lakes on the land area south of ***Cuckold Creek.***

–Salt Pan (C 24)

A salt pan is an area bounded by dikes in which sea water is evaporated. It is depicted by a unique symbol (C 24) or with a label “Salt pan” in lieu of the cross-hatched interior of the symbol.

Trees

Isolated trees are not generally charted as landmarks (see Chapter 6) because these are considered to be temporary features. Lightning, the logger’s axe, or the developer’s bulldozer could easily remove a charted feature. However, in areas without other conspicuous features these may be charted. If a conspicuous tree is charted, the landmark symbol and label (“TREE”) is used. Pictorial tree symbols (C 31) are not used on NOAA charts.

Lava Flow (C 26)

A lava flow is often conspicuous, and if so is outlined by a dashed line with the land tint shown within the enclosed area. The label “Lava” is charted in lieu of the symbol (C 26) shown in Chart No. 1.

Vegetation (C o, C j, C l, C i, C m, C n, C k, C 30)

Vegetative cover is generally of little importance to the mariner, except along an otherwise featureless shoreline, where the type and extent of vegetation may aid in shoreline identification. Mangrove vegetation is generally impenetrable, and is often charted to identify areas where access to the shore is difficult or impossible.

Although a variety of special symbols have been developed to depict various types of vegetation, current NOAA usage omits these symbols in favor of descriptive labels (e.g., "Bushes," "Coniferous Woodland," Deciduous Woodland," "Paddy (Rice) Fields," "Park," and "Tree Plantation").

Marshes and Swamps (C 32, C 33)

Marsh and swamp areas are depicted on NOAA charts as follows. The seaward limits of mangrove (C 32) are shown with the apparent shoreline symbol. A dashed line is used for the landward limits of the area. Gold tint and the label "Mangrove" in black vertical type (initial capital letters only) is shown within the charted limits. The pictorial mangrove symbol (C 32) is used only when space is at a premium.

Marsh areas inside the shoreline are represented by green tint and labeled "Marsh" or "Ma." Other symbols (e.g., for roads, railroads, levees, and bluffs) may be used for the inshore limits of the marsh area.

A swamp area inside the shoreline is shown with gold tint, to denote the inshore limit and labeled "Swamp."

Ports and Harbors

Ports and harbors are important features shown on the nautical chart. This section explains the chart conventions used for depicting these features. Many of the terms used in this section have very specific and technical meanings—often different from general usage. Some of these specialized terms are defined below. The reader is referred to appendix A for definitions of other terms. Figures 3–6 and 3–7 contain excerpts from Chart No. 1 illustrating hydraulic control and port/harbor features.

In general, manmade shoreline and structures (e.g., piers and breakwaters) are shown with a solid black line. Any feature, or portion thereof at or above the SPOR is depicted with a solid line and gold tint; the portion of the feature below the SPOR (such as the submerged end of a jetty) is shown with a dashed line and blue tint. The single-line/double-line criterion noted below for charting piers is also followed for depicting other structures of this type. New construction projects extending into the water area are charted (upon notification that construction has begun) using special symbols (F 31, F 32). The limits of the new construction are outlined with a black dashed line and labeled "Under construction." Charted detail, including the shoreline, is deleted from within the new area, and gold tint added when construction is complete. The dashed line is also changed to a solid line upon project completion.

–Berthing Structures

Berthing structures (including fixed and floating piers, wharfs, and gridirons) provide facilities for mooring a vessel. These adjoin berthing areas and are connected to the shoreline at one end.

A *grid* or *gridiron* is a flat frame structure erected on the foreshore so that a vessel may be placed on it at highwater for servicing at low water. The outline is charted and labeled *"Grid"* in black italic type.

A *pier* is a structure extending into the water to provide a mooring or landing. Piers are shown in their exact geographic location with a black double line (F 14) where space and scale permit, and filled with a gold tint. Figure 3–8 provides another excerpt from NOS Chart No. 18650 (San Francisco Bay) showing numerous large and small piers along the downtown San Francisco waterfront. Unlike many waterfront areas, these are all working piers—none are depicted in ruins.

If the centerline separation of the sides of a parallel double-line pier is less than 0.3 mm at chart scale, the pier is charted as a single line centered on the space between the two sides. Figure 3–3 shows numerous small piers north of **Half Pone Pt.,** which are charted with single rather than double lines, because of their size. Figure 3–8 shows many small piers in a marina just north of ***China Basin.***

Piers are not charted if less than 0.8 mm in their greatest dimension (typically length) at chart scale except if identified as essential to navigation in the source material used for chart compilation. "Essential" piers less than the minimum specified length at chart scale are extended to this minimum length in order to be recognizable. Essential piers include

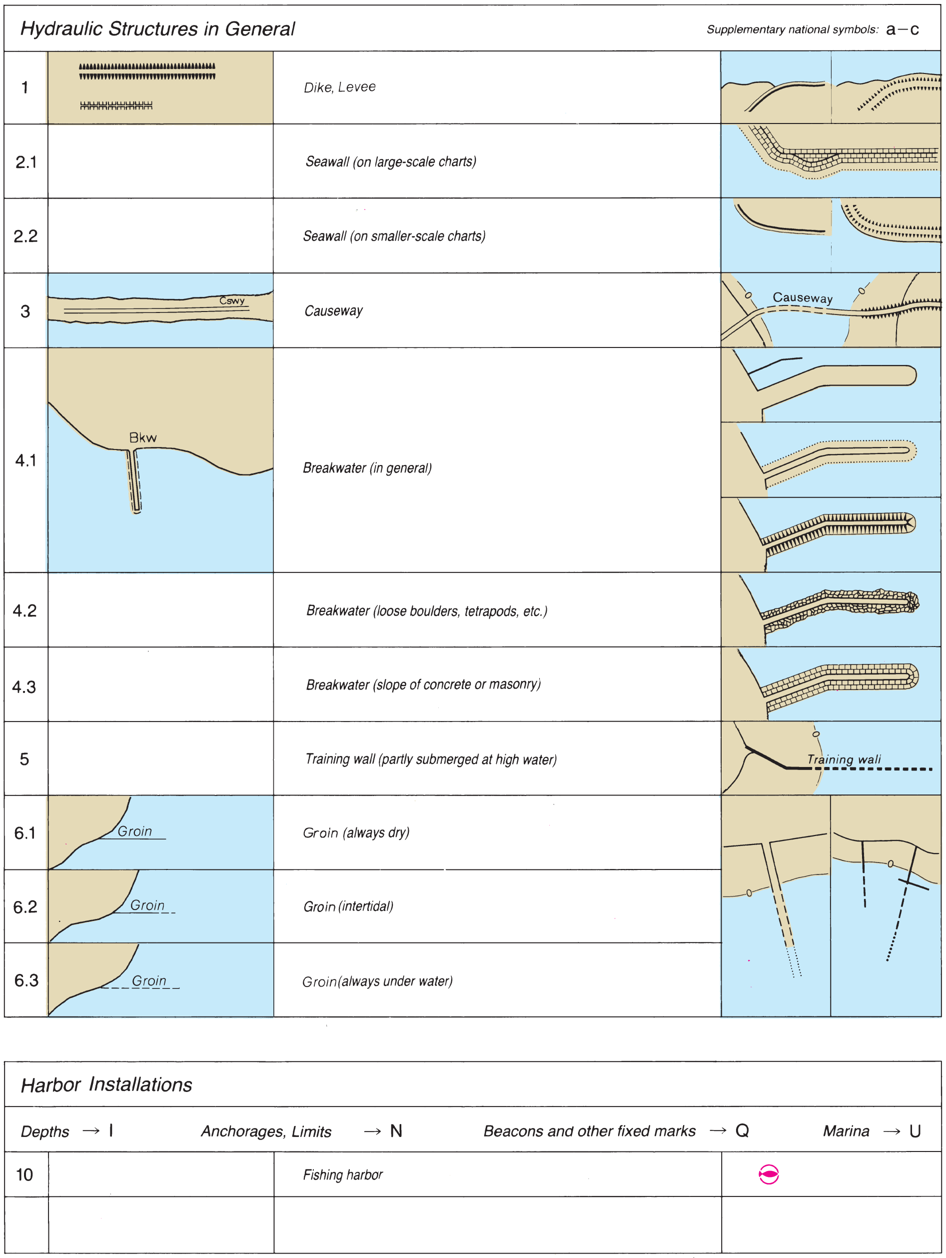

Fig. 3-6. Excerpt from Chart No. 1

piers of unusual commercial importance (e.g., a ferry terminal, oil terminal), piers at possible emergency facilities (e.g., USCG station, harbor police, hospital), piers which indicate the extension or termination of a primary (charted) road, piers limiting a harbor entrance or inlet, and conspicuous piers that could be used for navigational reference. (Incidentally, one of the questions often asked of NOAA personnel by mariners owning waterfront property with piers is "Why isn't my pier shown?" The answer is that it is probably too small at chart scale and not otherwise considered an essential pier.)

In some areas, piers are located so close together that unacceptable congestion would result if all piers were charted. In such cases the cartographer selectively "thins out" piers for inclusion in the chart.

Floating piers are charted in the same manner as other piers, except that the line symbol for a floating pier is detached from any fixed portion of pier or the shoreline by a gap of at least 0.3 mm. Where space permits, the

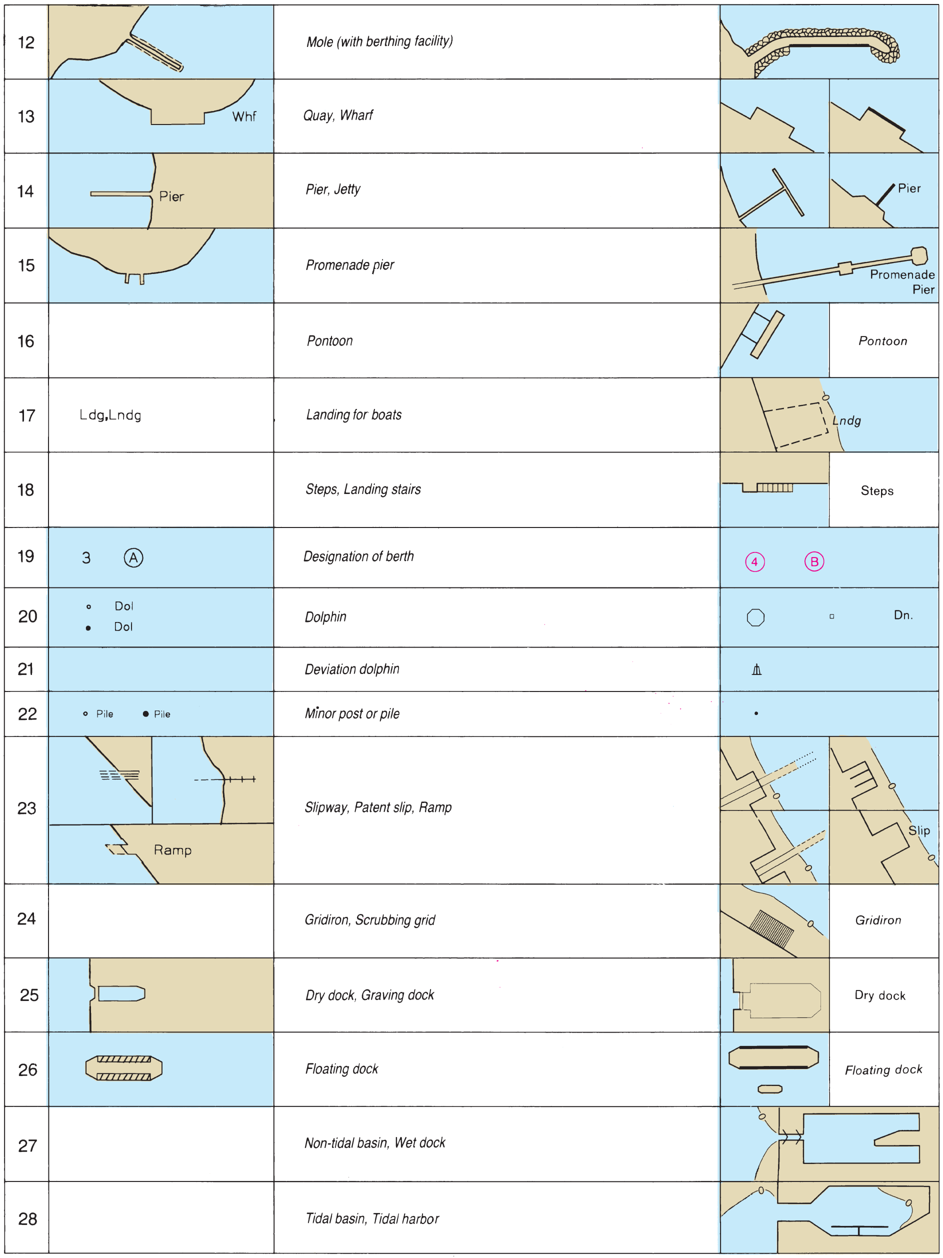

Fig. 3-7. Excerpt from Chart No. 1

label *"Floating pier"* is shown in black italic type.

Piers in ruins (F 33.1, F 33.2) are of particular concern to the mariner, because these may present a navigational hazard. A dashed line is used to depict these piers, or portions of these piers, that are submerged at the SPOR. The same symbol may also be used[5] for piers above the SPOR to alert the mariner that submerged debris may be nearby. A label "Ruins" may be added if space permits to alert the mariner that piers formerly deemed "essential" cannot now be used. If double-line, gold-tinted piers later become ruins, blue tint is substituted for the former gold tint. Piers in ruins which are 0.8 mm or longer at chart scale are considered potentially hazardous and are charted.

[5]Features in ruins are important to identify for several reasons. In some cases ruins can be readily distinguished, permitting positive identification. And, as noted, piers and harbor features in ruins also present navigational hazards to be avoided.

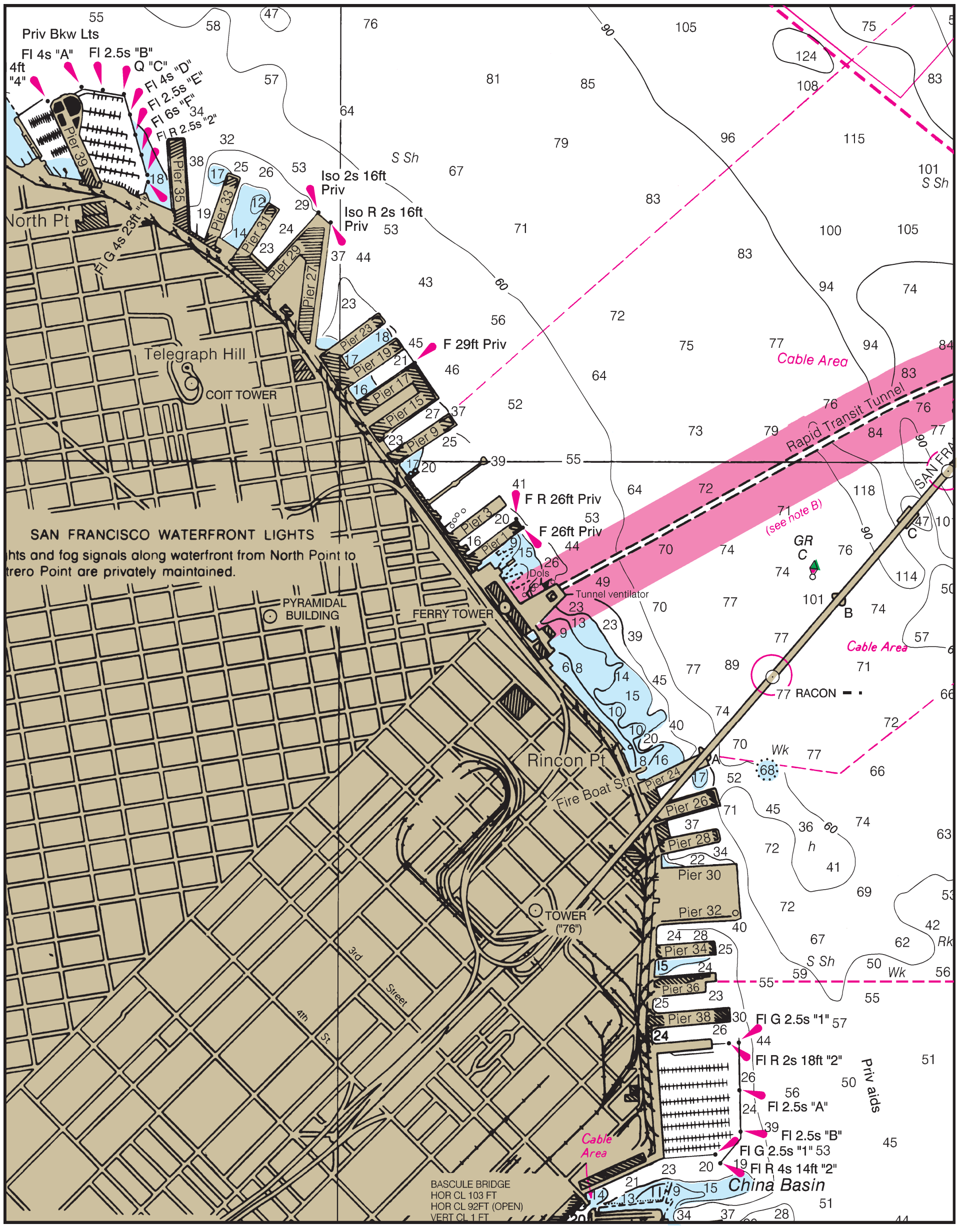

Fig. 3-8. Another excerpt from NOS Chart No. 18650 (San Francisco Bay), showing numerous small and large piers along the waterfront

A *wharf* usually runs parallel with the shoreline and is used for loading and discharging cargo. Its seaward face is charted using a special symbol (F 13), as well as the depth alongside.

–Additional Sources

The *U.S. Coast Pilot* provides valuable information regarding ports and harbors which supplements that presented in the nautical chart. According to the *Coast Pilot Manual*, port information presented includes such topics (in order to presentation) as charts, major features, major ATONS, shipping safety fairways, COLREGS, traffic separation schemes, vessel traffic services, routes, channels, anchorages, dangers, regulated navigation areas as defined in the CFR, cautions, local magnetic disturbances, bridges, tides/water levels, currents, weather/ice, coastal warning displays, pilotage, towage, quarantine, customs, immigration, and agricultural quarantine information, harbormaster/harbor regulations, wharves, supplies (deep-draft) repairs (deep-draft), small-craft facilities, ferries, and communications. The information presented in the *U.S. Coast Pilot* is applicable to commercial and recreational vessels alike. Depending on the size and commercial significance of the port, the discussion can run to several pages.

Erosion–Control Structures

Erosion-control structures are structures that extend into the water, or are solely within the water, constructed to protect a harbor or shoreline and not intended for berthing. Included in this general category are *breakwaters, jetties, groins, seawalls, dikes,* and *levees.* Some of these features are conspicuous and may be charted for their value in position fixing, but not all such features are conspicuous. Breakwaters, in particular, would appear to be a good reference point because of their large size in plan (top) view. However, experience soon shows that the relatively low height of the breakwater makes it difficult to see from any substantial distance (see Eyges, Mellor). As a practical matter, these structures are charted principally because they pose a hazard to navigation and create a potential harbor/ anchorage.

–Breakwater (F 4.1)

A *breakwater* is an artificial embankment protecting a shore area, harbor, anchorage, or basin from waves. A breakwater is typically a large and extensive structure (with only a low vertical profile, however) built of masonry and stone. The breakwater may extend out from shore in various configurations, or it may be placed roughly parallel to and separated some distance from the shore, providing access for safe anchoring in the protected area behind. Breakwaters are often associated with Harbors of Refuge (see Chapter 7).

Breakwaters detached from the shoreline usually represent a significant obstruction to navigation and are always charted. A *floating breakwater* is a structure consisting of floating materials connected by mooring chains or cables attached to anchors or stone blocks in such a manner as to form a basin within which vessels may be protected from the violence of the waves.

The breakwater is charted with a unique symbol (F 4.1). The line width used to symbolize a breakwater is increased on small-scale charts if a single line rather than a double line is used. The minimum charted length of the breakwater is 0.8 mm. Floating breakwaters are charted the same as fixed breakwaters, but with the addition of necessary symbols to depict retaining structures, and labeled *"Breakwater,"* in black italic type.

–Groins (F 6.1, F 6.2, F 6.3)

A *groin* is a low wall-like structure built from shore and designed to break the current and reduce erosion and fill out the shore by deposition of new materials. Different charting symbols are used to depict groins, according to whether they are always dry (F 6.1), intertidal (F 6.2), or always under water (F 6.3). Groins that are intertidal or always under water present the greatest hazard to navigation.

–Jetties (F a, F b, F c)

A *jetty* is a structure, ordinarily constructed of riprap, stone, and concrete, extending into the water perpendicular to the shoreline, typically used to protect a channel entrance (see also appendix A). Jetties at channel entrances often have ATONS located at the seaward end (e.g., lights or daybeacons, see Chapter 5 for details on how these are charted).

A jetty is charted using the same charting conventions as a pier.

–Seawall (F 2.1, F 2.2)

A *seawall* is a solid erosion-control device primarily designed to prevent erosion and other damage due to wave action. It is usually constructed of masonry, sometimes with a sloping face, and typically aligned with the shoreline.

On very large-scale charts, the feature may be outlined as shown on the source. On smaller scale charts, it is outlined with a solid black line.

–Dikes and Levees (F 1)

Dikes and *levees* are considered to be synonymous for charting purposes. Both are artificial embankments composed of earth rubble and constructed for shoreline protection, containment of landside material (e.g., dredged spoil), and protection from flooding.

Dikes and levees are depicted with a unique symbol (F 1) which may be slightly displaced so as not to overprint the shoreline. A half symbol may be shown in areas of chart congestion. A label "Road on levee" may be added if important.

–Additional Sources

The *U.S. Coast Pilot* provides additional information on breakwaters, groins, jetties, seawalls, and dikes and levees. This information includes materials of construction (if unusual), whether or not the structure is in ruins, a description of ATONs, whether or not the structure covers at any stage of the tide, tides and currents, and the protection afforded by the structure. Particularly valuable are qualitative comments on the efficiency of such structures as breakwaters. For example, the entry describing the breakwater at the southern entrance to the Delaware Bay notes that the Harbor of Refuge behind this breakwater "affords good protection during easterly gales," and that ***Breakwater Harbor,*** between the inner breakwater and the shore, "is excellent for light-draft vessels in all weather except heavy northwestern gales and even then affords considerable protection." No such information is provided on the nautical chart.

Docks and Tidal Basins

A *dock* is defined as the berthing slip between two piers or an area cut into land for the berthing of vessels. A *pier* is sometimes erroneously called a dock, but the two terms are not synonymous. A dock is also a basin or enclosure for the reception of vessels which has a means for controlling the water level. A dock (not otherwise classified), sometimes called a *slip,* is usually shown as the area between two piers.

–Dry Dock, Graving Dock (F 25)

A *dry dock* is a structure providing support for a vessel, and means for removing the water so that the bottom of the vessel can be exposed for servicing. A dry dock consisting of an artificial basin is called a *graving dock;* one consisting of a floating structure is called a *floating dock.*

A dry dock is charted (F 25) by its actual shape, with the gate closed. Floating dry docks are charted (F 26) by actual outline and gold tint only when known to be permanently moored in a fixed position.

–Tidal Basin (F 28)

A *tidal basin* serves as a dock, but has no gate to control the water level, which rises and falls with the tide. It is charted by its actual shape and labeled *"Tidal basin"* in black italic type.

–Wet Dock (F 27)

A *wet dock* (also called *nontidal basin)* is an enclosed basin separated from tidal waters by a caisson or flood gates. Ships are moved into the dock near high tide. The dock is closed when the tide begins to fall. If necessary, ships are kept afloat by pumping water into the dock to maintain the desired level. It is charted by its actual shape and labeled "Wet dock" in vertical black type.

–Additional Sources

The *U.S. Coast Pilot* provides additional information on piers, dry docks, tidal basins, and wet docks. For example, capacities of marine railways (see below), dry docks, floating docks, berth space, capacities of petroleum unloading facilities, deck heights, cranes, conveyer unloading systems, rail connections, open and covered storage areas, depths alongside piers, cargo limitations, bunkering facilities, and related information of relevance to freighters, tankers, and bulk carriers are provided in the *U.S. Coast Pilot.* Local, as well as federal, harbor regulations are also presented.

Bridges (D 22 – D 24, D d, D e)

Bridges over navigable waters present an obstruction to navigation and are charted principally for this reason. Bridges can also be used to determine a vessel's position. Passing under a bridge which spans a relatively narrow waterway is equivalent to a fix. Even if the waterway is quite wide, bearings can be taken on the bridge supports to determine a fix. Despite being carefully charted, bridges seem to be a tempting target for passing vessels.

Bridge symbols are shown as appropriate for roadways, railroads, and other crossings where they intersect navigable waterways on nautical charts. Bridges are not charted in cases where navigation is obviously not intended, e.g., drainage canals, cooling outlets, oil exploratory canals, and where the bridge is not listed in authoritative publications. (In these instances, the water crossing symbol is shown without the bridge symbol detail.) Charting conventions for bridges consist of a bridge *symbol*, *labels*, and *notes*. The symbol identifies the bridge type and generally provides a scale drawing of the bridge. The label identifies the type of bridge, and provides clearance data (see below), and the note(s) identify the basis for measurement of vertical clearances ("HEIGHTS" note) and a note of caution regarding bascule bridge clearances.

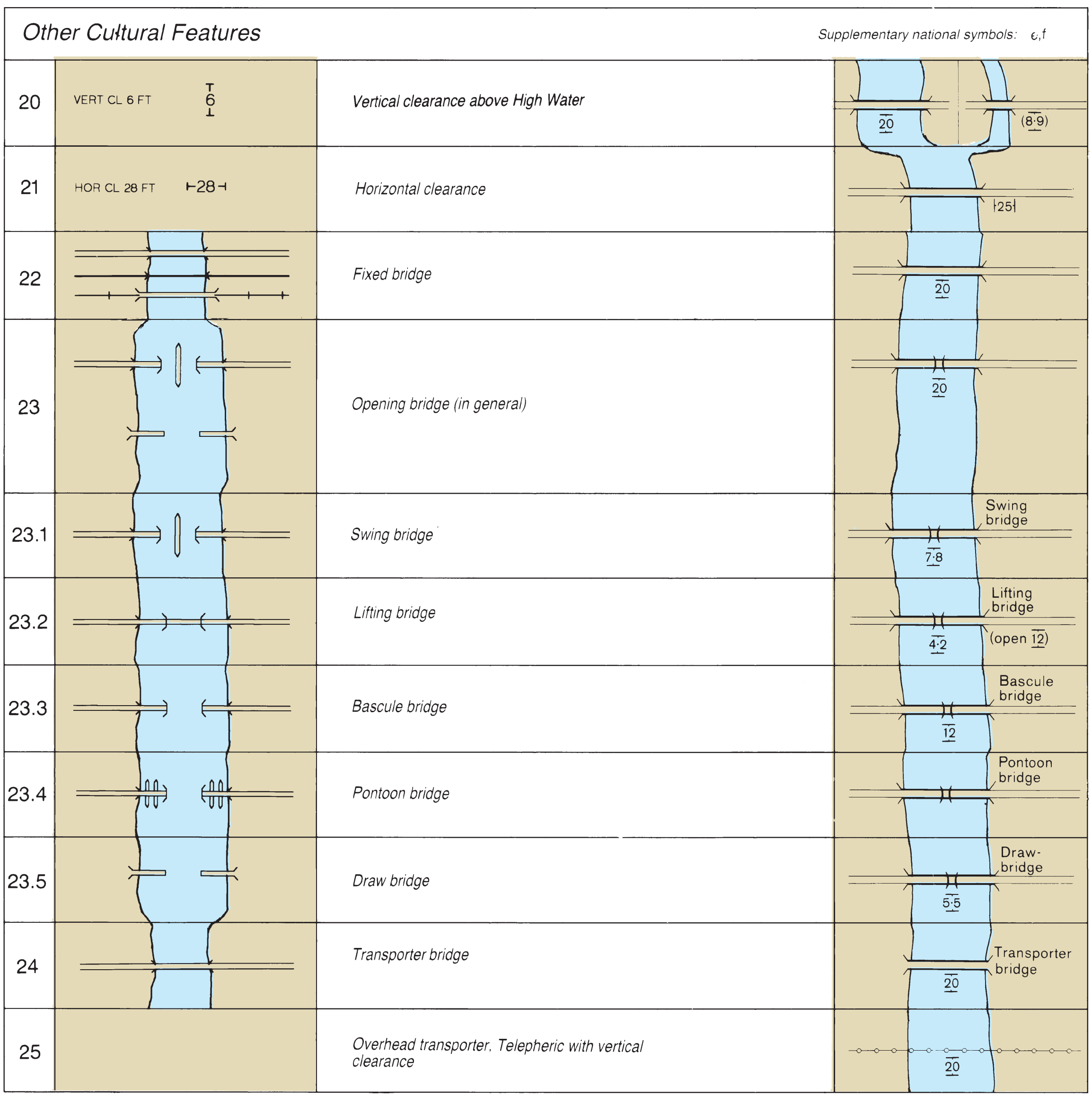

Fig. 3-9. Excerpt from Section D of Chart No. 1 Illustrating Various Bridge Symbols

–Bridge Symbols (D 22 - D 24, D d, D e) and Related Symbols

Figure 3-9 contains an excerpt from Chart No. 1 illustrating a variety of symbols used to depict several types of bridges. (These symbols are a great help in identifying bridges in some areas. For example, of the many bridges that span the navigable portion of the Delaware River, there is only one railroad bridge, one bascule bridge, and one vertical lift bridge designed for road traffic. Identification of any of these bridge types uniquely determines the vessel's location.)

Selected definitions, labels, and symbols of charted bridges include:

Fixed Bridge : A fixed bridge ("FIXED BRIDGE") is one that has no provision for opening, closing, raising, or lowering. The vertical clearance under this bridge is constant, except for the fluctuation of the water level.[6] Fixed bridges over waterways used by large commercial vessels typically have large vertical clearances. Fixed bridges are depicted with one of three symbols (D 22).

Swing Bridge: A swing bridge ("SWING BRIDGE") can be rotated (swung) in the horizontal plane to allow tall ships to pass. Swing bridges are depicted with a unique symbol (D 23.1).

Lifting Bridge: A lifting bridge, also called a vertical lift bridge ("LIFT BRIDGE"), is equipped with a movable span between two lift towers such that the entire span can be raised uniformly in the vertical direction. A lifting bridge is depicted with a unique symbol (D 23.2).

Bascule Bridge: A bascule bridge ("BASCULE BRIDGE") is a single- or double-leaf span, with the shoreward ends hinged, allowing the span to be elevated vertically. It is depicted with a unique symbol (D 23.3).

Pontoon Bridge: A pontoon bridge ("PONTOON BRIDGE") is a bridge supported by a flat-bottomed boat or a number of flat-bottomed boats or other floating objects, such as hollow cylinders. It is depicted by a unique symbol (D 23.4).

Draw Bridge: A draw bridge ("DRAW BRIDGE") is a generic term for a bridge that can be raised or lowered or drawn aside. It is depicted by a unique symbol (D 23.5).

Viaduct: A viaduct ("Viaduct")[7] is a structure consisting of a series of arches or towers supporting a roadway, waterway, or pathway across a depression, or other obstacle. It is depicted using a unique symbol (D f).

For additional definitions regarding bridges, see the *Coast Pilot Manual,* or appropriate sections of the *Desk Reference Guide.*

–Hazards Under Bridges

Critical dangers to navigation located under bridges (such as rocks and shoal soundings, see Chapter 4) are charted in their exact geographic position on the largest scale chart coverage. The bridge symbol is "broken" (interrupted) if these dangers are charted beneath the bridge structure. Deletion of a portion of the bridge symbol not only exposes these features, but also serves to emphasize the potential dangers. Dolphins, piles, snags,

[6]Actually, the clearance of a fixed bridge may vary with temperature and road traffic. If material, this is mentioned in a separate note, as discussed later in the text.

[7]The reader may wonder that the word "Viaduct" is shown in initial capital letters only, whereas labels such as "FIXED BRIDGE" are in all capitals. "Viaduct" is used merely to identify a feature. "FIXED BRIDGE" is in capital letters to draw attention to the label giving important clearance data.

etc., charted prior to bridge construction are deleted from the chart when bridge construction is complete only upon receipt of authoritative information that these obstructions have been removed.

–Bridge Clearances (D 20, D 21)

Clearance data, both vertical and horizontal, are critical for mariners using the waterways spanned by bridges. Although operators of sailboats are particularly concerned with clearances, other mariners also use this information. Horizontal and vertical clearances are provided on nautical charts for all bridges where there is information showing that navigation can take place on both sides of the structure. On charts using conventional units (e.g., feet) charted clearances are rounded down to the nearest foot—on metric charts to the nearest tenth of a meter (rounded down).

Vertical clearances are charted relative to MHW, and thus tend to *understate* the actual vertical clearance—that is, the charted clearance is somewhat conservative.[8] The actual vertical clearance at any time in any location (see Hobbs) is given by adding the mean range of the tide (available from the *Tide Tables*) to the charted vertical clearance, and subtracting the calculated height of the tide at that time (also determined from data given in the *Tide Tables*) at that location. Thus, for example, if the charted clearance were 25 feet, the mean range of tide 5 feet, and the estimated height of the tide 1 foot, the actual clearance would be 25 + 5 - 1 = 29 feet. Mariners should use an ample safety factor to allow for the possibility that the calculated height of tide may be in error. Many bridges, particularly draw bridges, are equipped with "board gauges" (painted white with black figures) to indicate the vertical clearance at all stages of tide.

The general format for the bridge label is the bridge name (see below), the bridge type, the horizontal clearance (including horizon clearance in the up position if not a fixed bridge), the vertical clearance (or vertical clearance in the down position if not a fixed bridge), VHF radio information (see below), and clearance data for overhead power cables (see below) if any. For example, the label describing the ConRail lift bridge that crosses the Delaware River near Delair, NJ, reads as follows:

CONRAIL LIFT BRIDGE
HOR CL 500 FT
VERT CL 49 FT DOWN
VERT CL 135 FT UP
OVHD POWER CABLE
AUTHORIZED CL 140 FT.

If there is more than one draw, information is provided for each. For example, this is the label describing the swing bridge across the Rancocas Creek bridge near Delanco, NJ:

SWING BRIDGE
HOR CL N DRAW 50 FT
HOR CL S DRAW 50 FT
VERT CL 4 FT.

(Vertical clearances for swing bridges are in the closed position.)

With certain long-span fixed bridges, the vertical clearance depends upon temperature and vehicular traffic as well as the water level. In these cases a cautionary note may be added to this effect. For example, the note corresponding to the Bay Bridge linking San Francisco with Oakland, CA, reads as follows:

> "CAUTION—Mid-span clearance under the long spans of the San Francisco–Oakland Bay Bridge are approximate and at a temperature of 55°F. These clearances may be reduced several feet due to extreme traffic conditions and a prolonged period of abnormally high temperature."

[8]This convention is in keeping with the convention of showing soundings with respect to MLLW discussed in chapter 4. However, the actual water level is sometimes higher than MHW, so the prudent mariner makes the more exact calculations shown in the main text if the clearance is at all marginal.

Many bascule bridges do not open to a fully vertical position as a result of operator action, physical limitations of the design, and/or capability of the operating machinery. However, if the source data do not indicate any restricted horizontal clearance information for the bascule bridge in the open position, the bridge label text provides clearances for the bridge in the closed position only. These clearances are charted as shown in the following example:

BASCULE BRIDGE
HOR CL 46 FT
VERT CL 10 FT.

Many bridges do not provide the same horizontal clearance between the open ends of the drawspan(s) as is provided between the bridge fenders at the water surface. The drawspan(s) may overhang the bridge fenders when the bridge is open. If such clearance data are available for the bascule bridge in the open position, the restricted horizontal clearance is incorporated into the bridge clearance text following the closed horizontal clearance as shown in the following example:

BASCULE BRIDGE
HOR CL 173 FT
HOR CL 102 FT (OPEN)
VERT CL 44 FT.

In addition to adding restricted horizontal clearance information to the bascule bridge label text, the following cautionary note is added to all nautical charts depicting bascule bridges:

"CAUTION
BASCULE BRIDGE CLEARANCES

For bascule bridges, whose spans do not open to a full upright or vertical position, unlimited vertical clearance is not available for the entire charted horizontal clearance."

This cautionary note is typically placed somewhere in the land area of the chart.

–Names

Bridge names known to NOAA are also charted. These names are sometimes used to separate channel reaches and, in any event, are often used as a position reference by mariners (e.g., in bridge-to-bridge communications). Bridge names are printed in black vertical type as shown above.

Names for railroads, major streets and highways, and routes at bridges are labeled with the name and route number.

–VHF Radio Capability

For bascule bridges, vertical lift suspension bridges, swing bridges, and others capable of opening, bridge tenders are equipped with VHF radios for communication with mariners. Radio communications are both safer and more convenient than whistle signals. Using radio, opening arrangements can be made from a greater distance and with greater clarity. Sound signals may be inadequate, especially if there is to be a delay in opening the bridge. For this reason, bridge call letters are given as the last line of the charted bridge clearance note in black vertical type. The last line reads "VHF," and gives the bridge call sign.

–Additional Sources

The *U.S. Coast Pilot* also provides relevant bridge information. This publication provides a description of the bridge, the location, radio call sign, VHF channel for communications. Chapter 2 of the *U.S. Coast Pilot* provides the *Drawbridge Operation Regulations,* both general and specific to each bridge, as taken from the CFR.

–Illustration

Figure 3–10 provides an excerpt from NOS Chart No. 13225 (Providence Harbor). This excerpt illustrates three different types of bridges: two fixed-road bridges, a bascule railroad bridge, and a railroad swing bridge. Shown also is an overhead power cable stretching between **Fort Hill** and **India Pt.** The towers from which the cable is suspended are charted as accurate landmarks. Principal

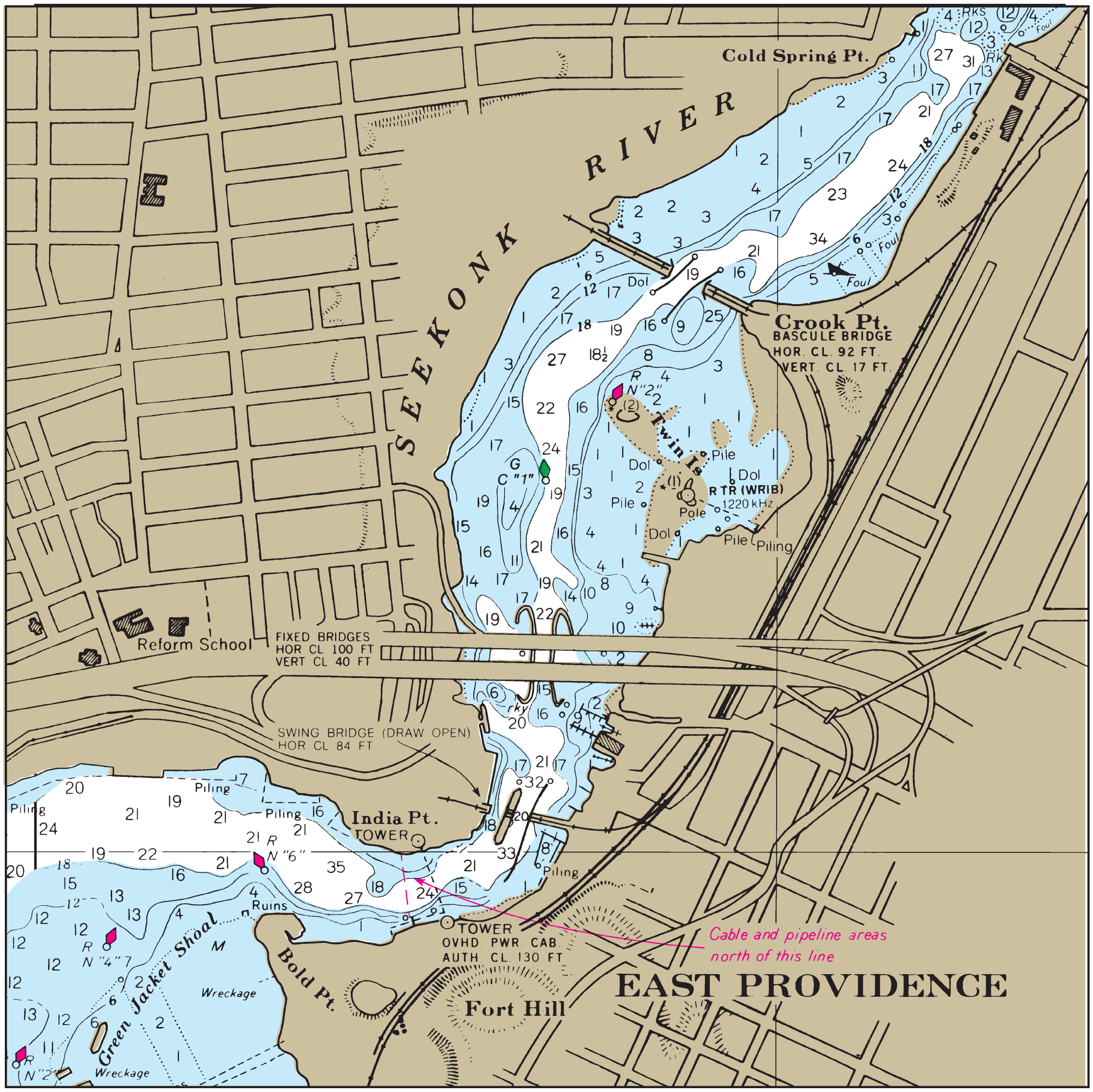

Fig. 3-10. Excerpt from NOS Chart No. 13225 (PROVIDENCE HARBOR) Showing Various Bridges

roads and streets are charted, together with selected buildings, including a reform school—one of the few found on a nautical chart.

Locks and Other Barriers

Locks, gates, barriers, and other manmade structures are used to control the height and flow of water. Structures that can prevent navigation under certain conditions and/or close an otherwise navigable waterway are charted. (For a useful discussion of locks and how these are used, see Chapman.)

Clearances are shown using the same conventions as those for bridges (see above), giving the lock dimensions, sill clearances, traffic control lights and information, appropriate references to the CFR, and other pertinent information. Radio information is given for these facilities in the same format as that given for bridges.

–Locks (F 41.1, F 41.2)

Navigation locks are charted in the closed position by a solid black line. Where possible, locks are charted to scale. Otherwise a symbol is used. Caissons and gates for controlling the water level in a wet dock or nontidal basin are also shown in the closed position by a solid line.

The *U.S. Coast Pilot* provides valuable additional information regarding locks. This information (see *Coast Pilot Manual)* includes the length and width of each lock, depth, vertical lift, and details on communication with lockmasters, traffic signals, and applicable excerpts of the CFR where navigation is governed by federal regulations.

–Floodgates, Sills, and Miscellaneous Other

Floodgates and saltwater intrusion barriers are shown in the open position, with the closed position shown by a black dashed line. *Sills,*[9] when charted as part of these structures or as a separate structure for controlling a water level, are also depicted by a dashed line as these are submerged at some tide stage. Power plant cooling water intakes and discharges, barriers for dam spillways, intakes, and overflows are charted with a solid black line (0.15 mm).

Landing and Launching Sites

Nautical charts also present information on landing and launching sites.

–Marine Railway (F 23)

A *marine railway* is used to haul vessels from the water, usually to expose the hull as in a dry dock. It is charted with the hatched railroad symbol (F 23) for the visible portion and a dashed line for the submerged portion, and is labeled "Marine railway." The term "Patent slip" is used on foreign charts.

–Ramps (F 23)

Ramps are sloping runways, often hard surfaced, used for launching boats from a trailer. An outline is shown, appropriate to the chart scale, and labeled "Ramp." If included on a small-scale chart, the name may also be charted.

Artificial Features

On large-scale charts, artificial features along the coastline, such as roads, railroads, embankments, levees, power lines, etc., are charted if scale permits. Major features may be charted inland to give an indication of the extent of development. Symbols for these features are shown in Section D of Chart No. 1. A representative sample of these features are discussed below.

–Roads and Related

Major railroads, streets, and highways are shown in port areas, adjacent to the coast, and approaching bridges over navigable waterways. These are charted, named, and numbered as appropriate. In major cities, such as San Francisco, CA (see figure 3–8), road and street names are seldom charted.

–Cable Ferry (M 51)

A *cable ferry* is a ferry guided across navigable waters by a cable attached to each shoreline. It is charted with a black dashed line and black label "Cable ferry." To emphasize the possibility of fouling the cable, which is raised when the ferry is in operation, a magenta screened band is centered on the cable alignment. Details on the operating procedures for cable ferries can be found in the *U.S. Coast Pilot.*

–Canal (F 40)

A *canal* is generally shown by a double line with a blue tint between the lines. If the scale is too small to use the double line, a single line is used with the label *"Canal"* in italic type. As a point of interest, canals often have bridges over them, but in the Netherlands, there are some canal bridges that pass over roadways. It is disconcerting to drive on the motorway and see a sailboat floating on an overhead canal! No such canals are depicted on NOS charts, however, which spares the U.S.

[9]A sill is the foundation at the bottom of the entrance to a dry dock or lock against which the caisson or gates close. The depth of water controlling the dock or lock is measured from the sill to the surface.

mariner the task of having to learn yet another symbol.

–Dam (F 44)

Dams across navigable waters are a significant obstruction/hazard to navigation and are always shown on nautical charts. A dam is charted to scale whenever possible. At small scale, a comb-shaped symbol is substituted for the scale depiction. This symbol is drawn across and slightly overlapping the banks of the river, with the “teeth” pointing in the direction of the river flow.

–Ditch (F 40)

A ditch is drawn as a single line with the label *“Ditch”* in italic type.

–Pipelines on Land (D 29)

Pipelines on land are generally not charted, but are shown in black if they cross above navigable waters. Buried pipelines are not charted. For information on charting conventions for underwater pipeline areas, see Chapter 4.

–Railroads (D b)

Trains may be visible from seaward. Even if not visible, train whistles or horns can sometimes be heard, which may be helpful in identifying this feature (Markell). A single 0.20 mm hatched line is used to symbolize both single- and double-track railroads. The initials of the railroad name (if known) is charted along the track in black vertical type. In the case of railroad yards, enough of the tracks are represented to indicate the area covered (e.g., the limiting tracks) and an appropriate legend may be given. Electric railways in cities are generally not charted.

–Roads and Road Patterns (D 1, D 2, D 10, D 11, D a)

Roads are generally not shown on charts smaller in scale than 1:250,000. At larger scales, only through or connecting public highways and roads leading from highways and terminating at the shore are generally shown. Private roads leading from public highways to buildings are omitted. In urban and suburban areas, streets are often shown, but may be omitted where necessary for clarity. Numbers and names of important U.S. highways are charted when the information is available. Lesser routes may also be labeled, depending upon chart congestion.

Primary transportation routes in cities, towns, and rural areas are symbolized by single or double lines depending upon the chart scale. Generally the double-line road symbol is used only on charts of scale 1:20,000 and larger. Roads may be shown to scale at charts of scale 1:10,000 where this will be useful to the chart user. Figures 3–8 and 3–10, for example, shows roads and highways charted to scale.

Streets and roads providing access to marine facilities and potential waterfront landing sites are shown if practical. Roads in rural areas that serve as connectors to major highways are also shown, even if these are not major arteries. However, extensive street patterns serve little purpose on charts and are difficult to update—raising problems of chart credibility. The urban screen (see below) is used in lieu of street patterns to denote built-up areas.

–Trails (D 12)

Trails are not generally shown on nautical charts. However, portage trails are shown on canoe charts.

–Tunnel Entrances (D 16)

Tunnel entrances are indicated by a symbol similar to a bracket (D 16); the path of the railway or road underground is represented by dashed lines.

Buildings and Structures

The purpose of charting buildings in urban and suburban areas, villages, and other built-up areas, is to leave a correct impression of the extent of the built-up area and the density of the buildings. Within built-up areas, only waterfront, landmark (see Chapter 6), and certain public buildings of interest are shown individually. The extent of the built-up area is shown by an urban screen (see below).

Referring to figure 3–8, for example, note how few buildings are shown in San Francisco, CA. Only the TransAmerica Tower (referred to as a "PYRAMIDAL BUILDING") and a few buildings located on piers are shown.

Away from ports and other built-up areas, even minor buildings (such as boathouses) may be charted individually if they lie close to the coastline and could be used by the mariner for orientation. In ports, buildings along the waterfront considered of significance to commercial shipping or recreational boating are individually represented if scale permits. Conspicuous buildings may be charted as landmarks to aid in navigating the adjacent waters. Landmarks are prominent as viewed from seaward and are useful for position fixing.

The prudent mariner realizes that it may not always be possible to detect and identify all charted buildings. New construction may mask buildings formerly visible from seaward. Waterfront areas are often the site of urban renewal projects, which may result in older buildings being torn down and new buildings erected. Of course, charts are continually being revised, and any such changes will ultimately be reflected as new charts are issued. Nonetheless, the time required to incorporate these corrections may be substantial. This is particularly a problem in cities undergoing rapid change.

–Airports (D 17, N e)

On large-scale charts, the limits of runways of commercial airports may be shown. Pictorial symbols are not used for airports.

–Buildings (D 5, D 6, E d, F 61, F 62.2, F 63) and Tanks (E 32)

Prominent buildings along the waterfront and large individual buildings away from the waterfront are shown by actual shape on charts of scale 1:40,000 and larger if these can be used for navigation. Not all such buildings are shown, however. Rather, the cartographer charts enough buildings for position-fixing purposes. *Therefore, the mariner should not expect the chart to provide a literal representation of the city skyline.*

A landmark symbol (see Chapter 6) and label is charted for selected buildings on small-scale charts. Note how few buildings and other structures are charted on figure 3–8.

Charting conventions for buildings are as follows:

> the line thickness is 0.15 mm,
>
> structures are shown to scale, subject to minimum size criteria (see below),
>
> ruins are labeled for identification,
>
> land or urban tints are shown as required, and,
>
> crosshatching is used to fill in buildings and tanks. This cross–hatching is normally oriented at an angle of 45°.

The minimum size criteria referred to above include:

> noncylindrical structures not in ruins are charted to scale by solid outline and crosshatching if the size at chart scale is at least 1.3 mm in any dimension. The smallest dimension for an outlined symbol is 0.3 mm. Buildings that do not satisfy the above criteria are charted with a minimum-size black square 1.3 mm on a side,
>
> ruins are labeled and shown with a dashed outline without crosshatching—minimum size constraints also apply for ruins, and
>
> cylindrical structures or tanks (not in ruins) are charted to scale by solid outline and crosshatching if the diameter is at least 1.6 mm at

chart scale. If smaller than this diameter at chart scale, a solid black circle with 1.6 mm diameter is shown instead. Ruins are labeled and shown by a dashed outline without crosshatching. Tanks in ruins with a diameter of less than 1.6 mm at chart scale are charted using an open black dashed circular symbol 1.6 mm in diameter.

At smaller chart scales, the minimum-size symbols for tanks or buildings in a dense group may become too closely spaced. Rather than deleting some of the symbols where the individual structures cannot be symbolized distinctly, a dashed area outline replaces the group of symbols and is appropriately labeled (e.g., "Tanks (oil)") so that active buildings are not mistaken for ruins. The dashed area outline for such groups of tanks or buildings is never smaller than 1.3 mm on any side.

–Illustration

Figure 3–11 shows another excerpt from the 1:10,000 scale NOS Chart No. 13225 (Providence Harbor). Note that certain buildings and tanks are drawn to scale and crosshatched. Selected other buildings are shown using the minimum-size symbol. Active piers and piers in ruins are shown along the waterfront. Dolphins, pilings, and foul grounds are also in evidence. The ConRail railroad runs along the waterfront, depicted by the railroad track symbol. Numerous streets and an elevated highway are found. Rhode Island Hospital, charted as an emergency facility, is drawn to scale on this chart.

–Cemeteries (E 19)

Cemeteries are not normally conspicuous features. Headstones and other markers are not often prominent when viewed from seaward. However, cemeteries on sloping ground near the shoreline may be readily identifiable and, thus, would be charted.

On large-scale charts, the limit of charted cemeteries is shown and labeled "Cemetery" or "Cem" in black vertical letters.

–Church Buildings (E 10.1 - E 18)

Church buildings considered to be prominent, but not selected as landmarks, may be charted using one of several symbols. Minimum size criteria (see above) apply.

–Hospitals (F 62.2)

Hospitals and related emergency facilities are shown on nautical charts. The label "Hospital" is added in black vertical type. Note the hospital in figure 3–11.

–Urban Screen

The urban screen (a dark gold tint, rather than the buff or lighter gold land tint) is charted primarily to enable the mariner to identify developed areas at night by the projection and reflection of lights in the low atmosphere—a phenomenon termed "nightglow." These lighted areas of sky can be seen from great distances offshore under many atmospheric conditions and may provide assistance to mariners making a landfall.

Figure 3–12 contains an excerpt from NOS Chart No. 12278 (Approaches to Baltimore Harbor) showing the dark gold urban screen to the east and northwest of SPARROWS POINT. Note also the bridge being removed south of **Long Pt.**—dashed lines with gold tint are used to depict this bridge. Subsequent editions of this chart will, no doubt, eliminate this feature. The dark gold urban screen indicates a built-up area with many buildings, none of which are specifically charted because SPARROWS POINT contains so many prominent features. Silos, stacks, a tower, and tanks are charted as landmarks in this excerpt—more than enough for position fixing.

Miscellaneous Stations

There are a number of other structures shown on the nautical chart of particular interest to the mariner. Several of these are explained below.

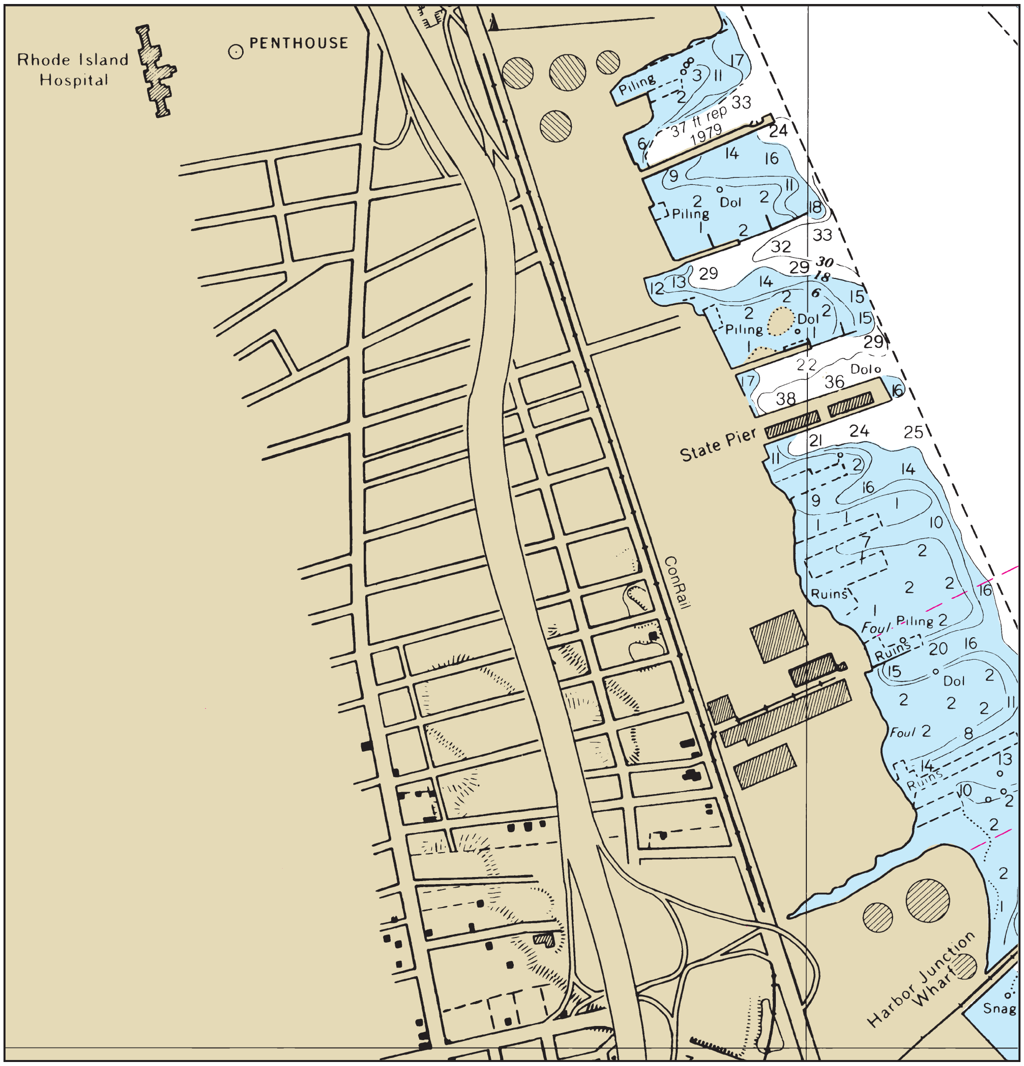

Fig. 3-11. Another Excerpt from NOS Chart No. 13225 (PROVIDENCE HARBOR) Showing Building Conventions

–USCG Stations (T 10, T 11)

USCG stations are particularly relevant to the mariner. These stations often have a commanding view and are visually prominent. Stations with lifesaving equipment are usually in relatively sheltered positions. The name of the station is shown on coastal series and larger scale charts (T 10). If the station is not a recommended landmark, a pictorial symbol (T 12) is used in lieu of the landmark symbol. On charts with smaller scales than the coastal series, the abbreviation “CG” is used with the pictorial symbol.

Some mariners (see Emery) have suggested that, since USCG stations are charted, it should be possible to obtain radio bearings on these facilities using direction-finding equipment, and thus obtain a line of position. *Mariners should avoid this practice! The location of the transmitting antenna may be located some distance from the Coast Guard station* (see Johnson), *and may or may not be charted.* Lines of position developed on the assumption that the antenna is at the USCG station could be seriously in error!

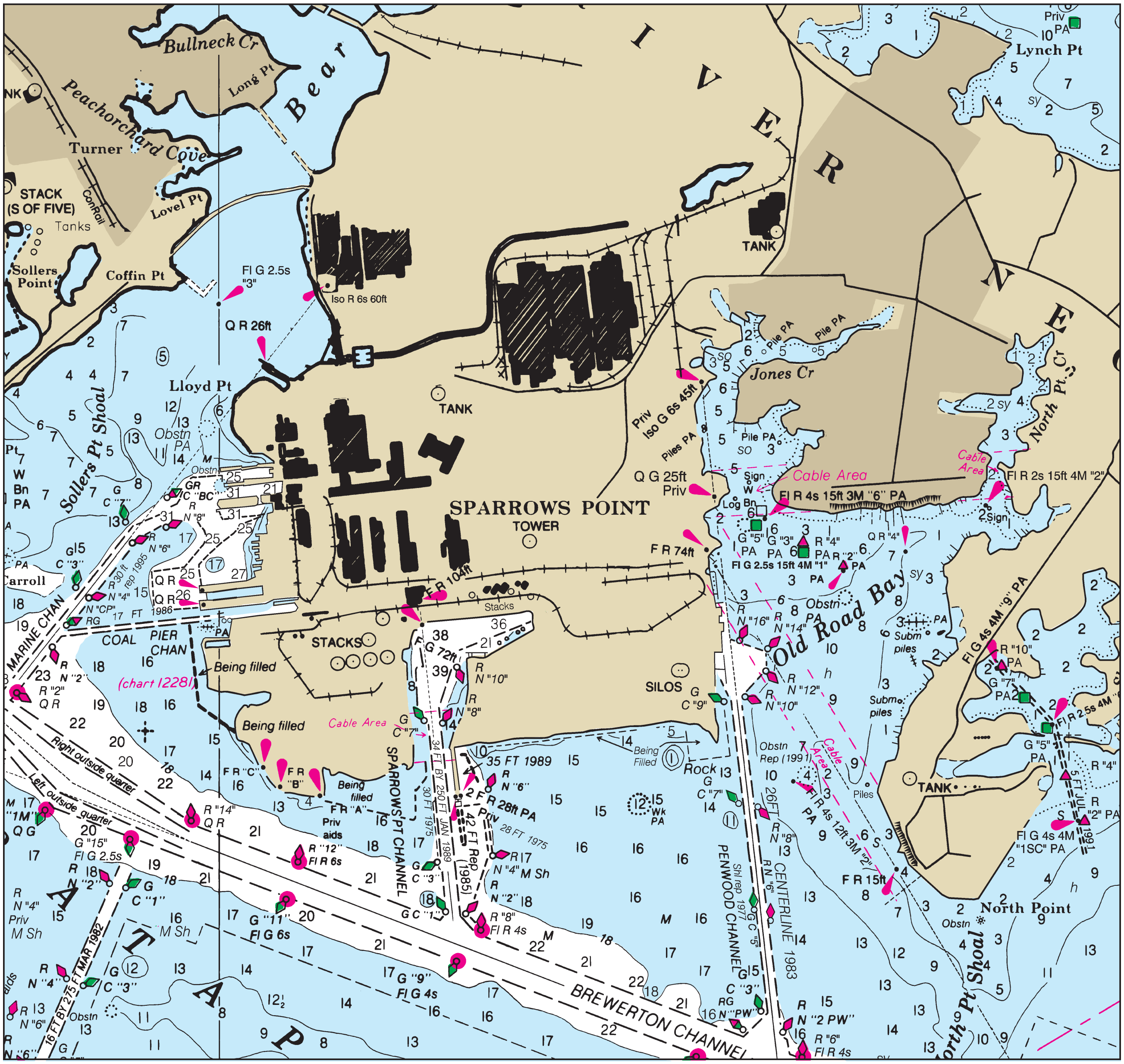

Fig. 3-12. Excerpt from NOS Chart No. 12278 (Approaches to Baltimore Harbor) showing dark gold urban screen and other features of interest

–Fireboat Station (T d)

These stations are shown on the largest scale charts of the area and labeled "FIREBOAT STATION" in vertical black capital letters.[10] The landmark symbol or approximate landmark symbol (see Chapter 6) may also be used as appropriate.

–Marine Police Stations (T c)

These stations are also shown on the largest scale charts of the area and labeled "MARINE POLICE" in vertical black capital letters. The landmark symbol or approximate landmark symbol may also be used.

[10]For eagle-eyed readers, the "Fire Boat Sta," shown on figure 3–8, is in error. It should be shown in capital letters. Presumably this minor error will be corrected in subsequent editions.

–Pilot Stations (T 3)

The most important feature of a pilot station is the position of the meeting or boarding place (see Chapter 7 for charting conventions). The shore station may also be charted with a landmark symbol and the label "PIL STA," in vertical black capital letters.

Overhead Cables and Crossings (D 26, D 27)

Overhead cables are shown across all charted waterways, even those so small as to be shown by a single line at chart scale. Overhead cables are charted with a black dashed line (D 26 or D 27). An identifying label is charted with each cable, or group of cables. The label identifies the type of cable, e.g., "OVERHEAD POWER CABLE" or "OVERHEAD TELEPHONE CABLE," "OVERHEAD TV CABLE," etc., in vertical black lettering, all capitals. Labels may be abbreviated, e.g., "OVHD PWR CAB." Mariners should be aware that cables differ significantly in terms of hazard potential; power cables involve thousands of volts and sometimes high amperage as well, telephone cables 0.95 volts and 0.3 milliamperes while ringing. Clearances are added, using the same conventions as those used for bridges, if the waterway is known to be used for navigation.

Figure 3–10 provides an illustration of how power cables are charted. Note the power cable running from the vicinity of **Fort Hill** to **India Pt.** This cable is labeled:

OVHD PWR CAB
AUTH CL 130 FT.

In this example, each of the towers are marked as a landmark, using the accurate landmark symbol explained in Chapter 6.

–Overhead Cable Cars (D 26)

Overhead cable cars are charted using the same short dashed black lines used for an overhead power cable. If the source material indicates that the cable suspending the car does not carry electric power, it is labeled "OVERHEAD CABLE" in vertical black lettering, all capitals. Otherwise, it is assumed that the cable may carry power and is labeled "OVERHEAD POWER CABLE" in vertical black lettering, all capitals. The vertical clearances of both the car and the cable are charted if available as follows:

OVHD CABLE CAR
AUTH CL 37 FT
OVHD PWR CAB
AUTH CL 49 FT.

Land Boundaries and Limits

Boundaries and limits are discussed in more detail in Chapter 7. However, it is appropriate to mention land boundaries in this chapter. These are shown in black on nautical charts. State boundaries are shown over land areas only, stopping at the shoreline. International boundaries are shown over land areas and may extend over water areas as well. Along this border line, the name of the state or nation is shown at appropriate intervals in vertical type.

State boundaries are shown by a dashed line, and international boundaries are shown by a black dashed line of crosses (N 40, N 41).

Key Points and Miscellaneous Comments

There are some differences in the key points applicable to each chapter of this manual, but many are common and bear repetition:

Take time to learn the various chart symbols for topographic and other features. Although numerous, these are relatively intuitive and easily learned.

Always use the latest edition of a nautical chart, and keep the chart updated with information from the NM (see Chapter 1). It is true that some gross terrain features change little over time; Gibraltar looks more or less the same today as it did to Admiral Nelson, and the White Cliffs of Dover differ little from the telescope view of German soldiers contemplating the invasion of England during the early days of World War II. But manmade features are in a constant process of change. Buildings are constructed and demolished, piers and wharfs fall into ruin, overhead power cables are added, ATONs are moved, etc. Natural forces working upon inlets create a constantly shifting arrangement of channels; these cause inlets to open, move, or close and readjust the shoreline.

Always use the largest scale chart of the area. Large-scale charts present more detail and are easier to use. A minimum chart complement includes large-scale charts of each harbor to be visited and smaller scale charts appropriate to the enroute segment. This selection of charts may be adequate in the event of a routine passage, with no diversions for weather, mechanical difficulties, etc. Unplanned diversions to alternate harbors can be a real problem to the mariner who takes only the "minimum" number required. Consider taking extra large-scale charts of alternate destinations as an insurance policy.

Recognition and identification of topographic and other related features discussed in this chapter using radar, rather than visual means, requires specific training and experience. Mariners sometimes ask why special charts are not produced which portray shoreline and terrain features as observed using radar. The answer to this question is that the appearance of these features on radar is a function of many variables, such as the distance-off, angle, antenna height, and specific technical characteristics of the radar (such as the horizontal beam width). No one chart could capture this dependence, so there is no series of "radar charts" produced. Mariners should note the correspondence between charted features and their appearance on radar to learn "first hand" the "radar signature" of these features under varying conditions. Radar is an invaluable navigational aid as well as collision-avoidance system.

Mariners relying on charted terrain features for navigation soon learn that there areas which are "feature rich" (i.e., have an abundance of readily identifiable features, such as are depicted in figure 3–12) and areas with few prominent or "chartworthy" features. Most voyages involve a combination of "feature rich" legs interspersed with "barren" legs. Maintenance of a DR plot, updated with fixes whenever available, provides DR position estimates even in the "barren" stretches which facilitate orientation and position fixing. (DR is discussed in nearly every text on marine navigation, including most of the references given at the end of this chapter.) Even if the mariner is fortunate enough to cruise only in "feature rich" environments, the DR plot is invaluable. Fog, rain, darkness, or other phenomena that reduce visibility can transform any environment into a "barren" area in less time than it takes to read this paragraph; the DR plot is essential in such cases.

The prudent mariner studies the nautical charts beforehand to become familiar with the waters to be travelled, identifying hazards to be avoided, ATONs to be encountered, and features suitable for orientation and position fixing. With practice, the "Gedanken" or "armchair imagination" voyage serves as a useful simulation for the real voyage, without the distracting inconveniences of inoperative heads, failed electronics, rough running engines, spray on the chart table, etc. Do not be afraid to place marks and notes on the chart—it is after all a tool to be used, rather than an object to be framed and venerated. Pick out candidate landmarks for LOPs, look up unfamiliar symbols in Chart No. 1, and read the commentary in the *U.S. Coast Pilot*.

Further to the above point, valuable as they are, charts do not present all the information useful for a voyage. Do not overlook the *U.S. Coast Pilot* and other sources of supplementary information.

In identifying candidate terrain features, landmarks, etc., for navigation, allow for contingencies and do not focus on only a few features. Locally reduced visibility, confusion over landmark identification, and other contingencies may mean that other features are ultimately used for navigation.

It is important to emphasize a point made throughout this manual that the prudent mariner does not rely on any one means of navigation. LOPs and fixes based upon topographic and related features should be compared with information derived by other means, e.g., soundings, observation of ATONs, and electronic aids.

Finally, another point repeated in subsequent chapters: mariners should note any discrepancies or possible errors in charts and forward these to NOS for possible incorporation in the NM or corrections to subsequent charts.

Concluding Comments

This chapter presents a wealth of detailed information on the cartographic depiction of land features on nautical charts. The features discussed help the mariner (directly and indirectly) determine the vessel's position at sea in relation to various fixed objects. Features included in this chapter also acquaint the mariner with various port facilities and other services. Valuable collateral information is contained in the *U.S. Coast Pilot.*

To beginning mariners, the vast array of symbols used to depict these features is formidable. With experience, mariners are able to recognize and interpret more and more of these symbols. More important, the experienced mariner is able to visualize an unfamiliar coastline and relevant land features from a study of the chart.

The ability to correlate the charted feature with a mental image of the physical object comes with experience. But, the learning process can be expedited; time alone provides no guarantee of learning. As the old saw goes, there is a vast difference between 20 years of experience and 1 year repeated 20 times!

Mariners should use each voyage as a learning opportunity by continually comparing the observed land features with those shown on the chart. The mariner should also learn the important lesson that, although most features are drawn to scale on the chart, the size of the charted feature is not always an indication of the visual prominence of the object or suitability of the object for orientation and position fixing. Some large features on the chart (e.g., breakwaters) are not prominent features as seen from the vessel. Some small features (e.g., certain landmarks) may appear small on the chart but are readily observed and identified. Other features are virtually invisible (e.g., a dock in ruins, a partially submerged groin or other erosion control device), but critically important to avoid. Charts depict features in plan (overhead) view, but mariners see these features in profile view. It requires experience and study to translate one view to another.

"Sight is a faculty,
but seeing is an art."

Anonymous

"I am told that there are people who do not care for maps, and I find it hard to believe."

R.L. Stevenson, quoted in Heinl

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———: *Boundary.*
———: *Breakwater.*
———: *Bridge.*
———: *Buildings.*
———: *Dam.*
———: *Dike.*
———: *Dry Dock.*
———: *Jetty*
———: *Landmark.*
———: *Marine Railway.*

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CHAPTER 4

"Any ship can be a survey ship,... **once**.*"*
Richards

Hydrography and Related Information

Introduction and Overview

The scope of this chapter includes hydrography (e.g., depth curves, soundings, nature of the bottom) and various specific hazards to navigation. Hazards can be either *natural* (e.g., rocks, reefs, shoals, tide rips, breakers) or *artificial* (e.g., wrecks, marine structures, unexploded ordnance, cable, and pipeline areas). This chapter provides essential background (e.g., definitions, historical asides), summarizes the utility of this information, describes the charting conventions used to depict hydrographic information (e.g., symbols and notes), highlights possible limits to the accuracy of this information (some made explicit in chart information), identifies other relevant sources (e.g., the *U.S. Coast Pilot,* the *Tide Tables* and *Tidal Current Tables,* NM, and LNM), and contains practical pointers on how hydrography and related information can be used by the prudent mariner.

In broad terms, the chapter addresses *hydrographic features* (e.g., soundings, depth curves, channels, nature of the bottom) and the *cartographic depiction of several specific hazards* to navigation (e.g., rocks, shoals, obstructions, wrecks). Because the scope of this material is so broad and the information so important, this chapter is long and detailed.

Many specialized terms used in this chapter are defined in the Glossary in appendix A. Names enclosed in parentheses (e.g., Bowditch) denote references listed at the end of this chapter that contain additional relevant detail or useful general discussions.

–A Brief Aside: Dual Units

As of this writing, NOAA is in the process of converting charts from traditional or "English" units (e.g., feet, fathoms) to metric units (e.g., meters). The Metric System has been established by the Metric Conversion Act of 1975 and the Omnibus Trade Act of 1988 as the preferred system of weights and measures in the United States. For U.S. nautical charts, the conversion to metric units is a multiyear effort with full implementation expected after the year 2000. Admiralty charts will be fully converted to metric units by the year 2010 (Bunyon). In the interim, charts in both systems of units will be available, so this manual treats both systems. The changeover to metric units is complex for many reasons, but users should have no difficulty converting from one system of units to the other. Illustrations provided in conventional units (e.g., soundings) can be mentally converted to metric units (meters and tenths) so no particular emphasis has been placed on the use of metric illustrations in this manual.

Utility of Hydrographic and Related Information

Approximately 71percent of the surface of the earth is covered with water (Kember), and it is reasonable to believe that (on an overall basis) water would encompass at least this percentage of the area of the average nautical chart (excluding harbor charts). Regardless of the accuracy of this assertion, it is certainly true that the depiction of hydrographic and related information is one of the defining characteristics of the nautical chart as opposed to the landbound map.

In a sense, any question relating to the utility of hydrographic and related information on the nautical chart is almost rhetorical. Nonetheless, it is instructive to set forth some of the uses of hydrographic and related information. Table 4–1 outlines both general and specific uses of this information to the mariner. Simply put, this information is essential to effecting a safe and efficient voyage—determining a relatively direct course from origin to destination while avoiding hazards to navigation.

Depth information (particularly in areas of substantial gradient) can often be valuable as an aid in fixing the vessel's position. And following a depth contour (using the vessel's depth sounder) can be a useful technique in circumstances of restricted visibility. Charted islets (rocks which are above water) can also be used for position fixing—rather like a landmark (see Chapter 6) in the water.

Some of the features normally classified as hazards to navigation, such as fish havens, wrecks, and offshore drilling platforms, are of interest to particular chart users. The recreational or charter fisherman, for example, is vitally interested in the accurate location of fish havens and wrecks (where fish often

Table 4-1. Uses of Hydrographic and Related Information

Specific Illustrations:

- To voyage expeditiously without running aground (e.g., depth information, limits to channels, presence of shoals, reefs, submerged rocks, etc.).
- To ascertain whether anchoring is possible (e.g., depth, type of bottom, absence of restrictions, absence of unexploded depth charges, etc.) or desirable (e.g., designated anchorage areas[1]) and aid in the determination of the proper amount of anchor line to deploy (depth) or even type of anchor to deploy (type of bottom).
- To identify which slips/piers are suitable for berthing (depth, nearby hazards).
- To be used as an aid in fixing the vessel's position (e.g., depth curves, bare rocks, stranded wrecks, etc.).
- To facilitate tracking during times of reduced visibility and/or when operating in areas with few ATONs or distinguishing topography/landmarks (e.g., depth). For example, in waters with a relatively steep depth profile, a depth sounder can be used to track along a depth curve.
- To provide information relevant to fishing activities (e.g., locating wrecks or fish havens). Also, to avoid areas where fishing nets or other equipment might be damaged.
- To avoid possible hazards to operation (e.g., fish trap or stake areas, log booms, pilings, wrecks, deadheads, stumps, snags, tide rips, etc.).
- To identify areas of special interest to various user-community segments (e.g., drilling platforms, artificial islands, hunting and fishing structures, etc.).

[1] See chapter 7.

congregate). Vessels or aircraft that service offshore rigs need to know where these are located—not to avoid them but to travel to these structures.

Yet other features, such as foul areas, areas where unexploded depth charges lie, and cable or pipeline crossings do not necessarily present hazards to transiting vessels, but rather mark areas where certain activities may be restricted or ill-advised. For example, foul grounds may snag fishing nets or lines, anchoring is prohibited in the vicinity of submerged pipelines and cables, and anchoring is unwise in areas where unexploded ordnance is reported.

Finally, the bottom characteristics are relevant for several reasons. Bottom samples, drawn with tallow attached to a leadline, were used in bygone times as an aid in determining the vessel's position (Cohen). Nowadays, knowledge of the nature of the bottom is chiefly important in selecting a suitable place to anchor and the type of anchor to use (Hinz).

As noted above, hydrographic information is first discussed, followed by specific hazards to navigation.

Hydrographic Information

Hydrographic information, as portrayed on the nautical chart, consists of depth soundings, depth contours or curves, depth-dependent color designations (blue tints), notes showing the controlling depth of improved channels, and descriptions of the nature of the bottom. Taken together, this information enables the mariner to navigate safely and efficiently.

–Common Plane of Reference and Survey Scales

Hydrographic surveys are the basic source of soundings and related information. These surveys, conducted by NOAA and other vessels, utilize information derived from a wire drag apparatus (earlier technology), echo sounding, and side-scan sonar. Sounding data derived from these surveys are adjusted to reflect a common horizontal plane of reference, *mean lower low water* (MLLW), as shown in figure 4–1. By definition MLLW is an average (generally over a 19-year epoch) of all lowest

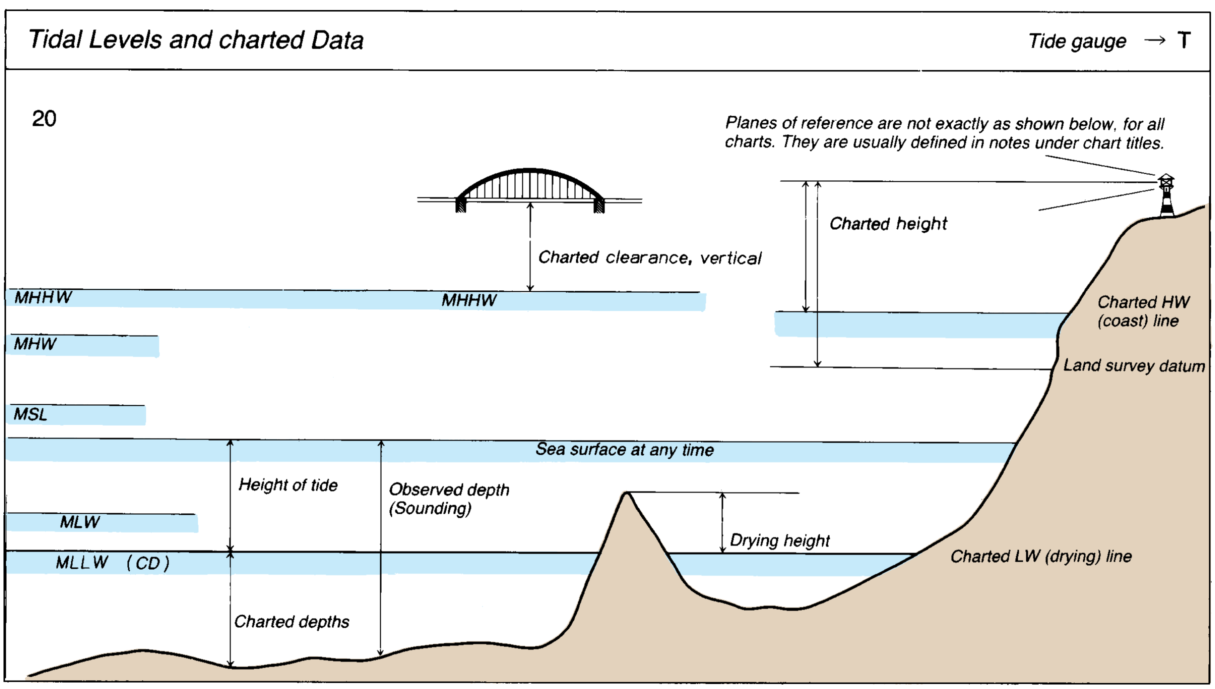


Fig. 4-1. Diagram taken from Chart No. 1 illustrating conventions used for charting soundings, drying heights, charted clearance of bridges, and the charted height of lights. Soundings determined from surveys are first reduced to depths relative to mean lower-low water before being charted. MLLW also serves as the reference plane for drying height.

water levels for tidal days.[1] Viewed from this perspective, charted soundings are *conservative,* in the sense that depths are typically greater than shown by soundings data. Even though the datum is based on averages of low water (lower low water in cases where there are two low-water periods in a day), *the actual water level at any time can be lower than this average—which means that the actual water depth can be less than the charted depth.* On days with spring tides (tides having a greater range than normal), prolonged winds from certain directions, or persistent extremes of barometric pressure, the actual depth of water can be less than the charted depth.

The basic scale for hydrographic surveys performed by NOAA is 1:20,000—other scales are multiples or fractions of this basic scale. As noted in the *NOS Hydrographic Manual,*

> "The criteria used for scale selection are based on the area to be covered and the amount of hydrographic detail necessary to depict adequately the bottom topography and portray the least depths over critical features. A cardinal rule of nautical chart construction is data from a hydrographic survey should always be plotted at a scale ratio larger than that of the chart to be compiled. The survey scale is generally

[1]In locations with two low tides each day, this is the average of the lower of the two.

The *Rainier* is one of the hydrographic survey ships in NOAA's fleet. Survey data are also provided by other government agencies and firms under contract to NOAA.

at least twice as large as that of the largest scale chart published or proposed for the area... Inshore surveys, defined as those conducted adjacent to the shoreline and in general depths of 20 fathoms or less shall be plotted at scales of 1:20,000 or larger . . . In contrast, offshore surveys are those conducted in waters of general depths between 20 and 110 fathoms not adjacent to the shoreline.

"Basic hydrographic and navigable area surveys of all important harbors, anchorages, restricted navigable waterways, and areas where dangers to navigation are numerous shall be plotted at scales of 1:10,000 or larger."

Cartographers, therefore, always have hydrographic information available at a larger scale than are plotted on the nautical chart (more below).

–Source Diagrams

A *source diagram* is included in all new editions (after November 20, 1992) of NOAA nautical charts at a scale of 1:500,000 or larger. (A source diagram is included on similar Admiralty charts.) It provides information on the source, date, and scale of the survey(s) used in the preparation of a given chart. The source diagram provides an indirect indication of the quality of the data (older surveys used less modern equipment, may not have been as complete, and the depth profile of the bottom may have altered over time as a result of suspension and deposition processes). This information allows users to make their own judgments of the data's fitness for a particular purpose. The date of the survey may prove useful in selecting a route—transiting areas more recently surveyed in preference to others.

Large-scale charts compiled exclusively from a single survey do not contain a source diagram. Instead, this information is provided in a parenthetical expression (e.g., from surveys of 1982 to 1984) to the AUTHORITIES note shown on each chart.

Figure 4–2 provides an illustrative source diagram, taken from NOS Chart No. 13218 (Martha's Vineyard to Block Island). The *Queen Elizabeth II* (*QE II)* ran aground (Brogden, Sabellico, Walsh, *Ocean Navigator*) in August 1992 on an uncharted rock in area "d" (plotted with soundings from a 1939 survey) on this source diagram. The *QE II,* drawing 32 feet, went aground in an area having a shoalest charted depth of 39 feet. A full discussion of the incident is beyond the scope of this manual, but it does serve as a cautionary tale and illustrates the wisdom of providing an ample margin of safety beyond the minimum depth required to accommodate the vessel's dynamic draft.

The master of the *QE II* might have selected a route which provided a greater margin of safety had a source diagram been available. Inspection of this source diagram and the chart itself indicates that, in general, the shallower areas have been the subject of more recent (and larger scale) surveys by NOAA.

Soundings

As noted, the inclusion of individual soundings is one of the ways in which hydrographic information is represented on the nautical chart. Individual soundings are expressed in meters and tenths (decimeters) on new charts, and in feet and fathoms on older charts, measured relative to MLLW. The source of the soundings data is the hydrographic survey(s) of the area to be charted.

As noted above, surveys are normally conducted at a scale larger than the largest scale chart of the area. Depicting all of the survey soundings on the chart—particularly at a smaller scale—would be difficult or impossible. Recall all the other features, such as ATONs, hazards, and areas and limits (Chapter 7) that compete for space on the nautical chart (Kember). Even if physically possible to prepare, a plot showing all hydrographic survey data would be very cluttered and difficult for the mariner to interpret—at least for the well-surveyed coastal areas. Figure 4–3 illustrates the differences between detailed hydrographic survey soundings (on the left side) and those generalized and plotted on a typical nautical chart (on the right side).

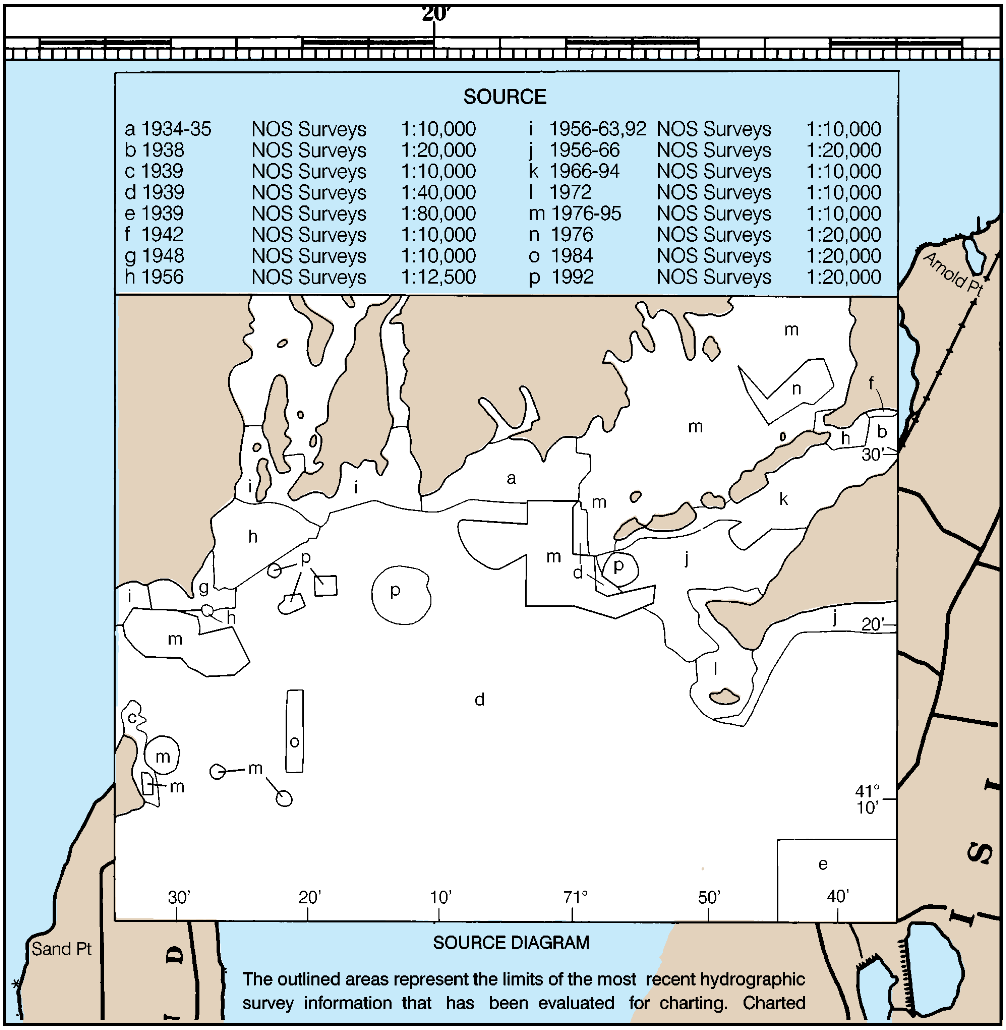


Fig. 4-2. Source diagram taken from NOS Chart No. 13218 (Martha's Vineyard to Block Island). The diagram provides an outline of the land areas and the areal limits of the various surveys used in the preparation of the chart. The date, source, and scale of the survey are shown at the top of the source diagram.

As a practical matter, therefore, the cartographer is faced with the important task of selecting a subset of the available soundings for depiction on the chart (e.g., Zoraster, Ekblom). The objectives of the selection process are to ensure that the overall presentation of depth data is accurate, as complete as feasible, and is easily understood by mariners.

–The Soundings Selection Challenge

To explain the particular selection rules and guidance followed by cartographers, it is well to remember that the primary function of soundings and depth curves on nautical charts is to present an accurate portrayal of the bottom configuration. Key bottom features that are charted include shallow areas, shoals, banks, and bars, irregular bottoms, smooth bottoms, deeps, and navigable natural channels and passages. These features are defined in table 4–2. (Additional material can be found in appendix A.) Briefly, these features serve to define preferred routes (e.g., navigable channels or passages), areas to be avoided (e.g., shoals, ledges), opportunities for position fixing (e.g., deeps, irregular bottoms), or other relevant detail (e.g., smooth bottoms).

The aim of the selection process, therefore, is to reduce the total number of soundings (so as to improve chart clarity) yet still provide a sufficient number of soundings to identify and locate the features described in table 4-2. The selection process does not operate by merely deleting a certain number of survey soundings e.g., by deleting every second point. Rather, the process takes cognizance of the information content of each sounding, and preferentially retains "significant" soundings. A sufficient sounding density is retained to depict natural channels, shoals, or other hazardous areas to highlight these features for quick recognition by the mariner. Additional (but fewer) supportive soundings are selected to complete the bottom description. The spacing of soundings on the nautical chart is also relevant. Fill soundings (see below) over flat bottom areas are relatively widely spaced. Soundings in shoal areas are provided in greater density, which serves to draw the attention of the mariner to these potentially dangerous areas (Magee).

In general, cartographers first select soundings from shoal areas and natural channels and work toward deeper water so as to identify all shoal areas that might impede surface navigation, provide information about natural channels between or through shoal areas, and portray the configuration of the bottom (*Nautical Chart Manual,* Kember). As of this writing, the selection of soundings is still a manual process, although computer models (Zoraster) show promise.

–Selection Criteria for Soundings to be Charted

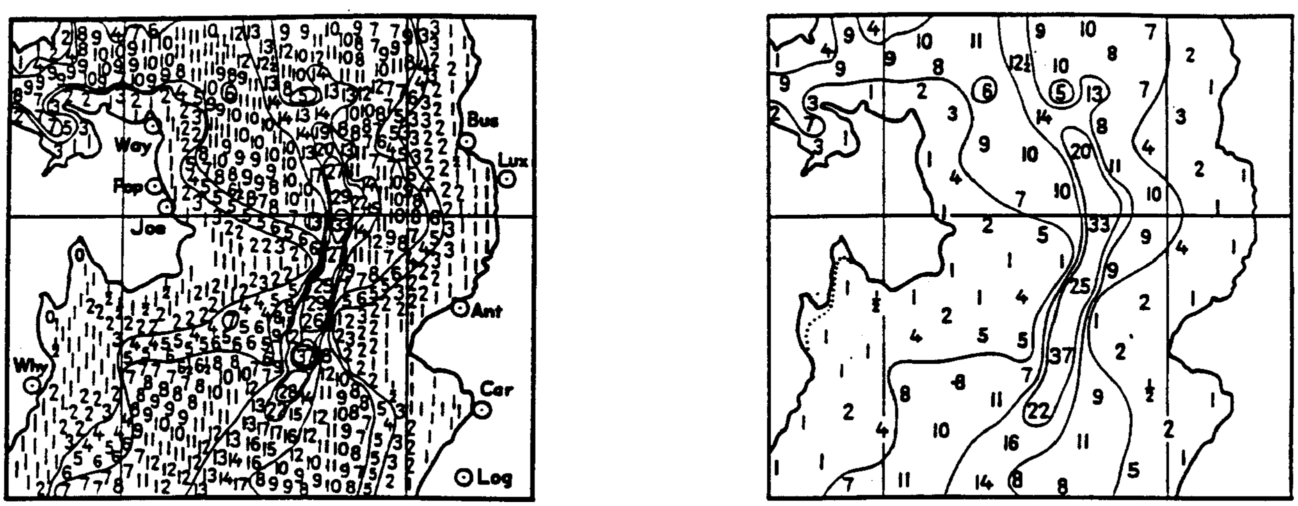
The above discussion summarizes the objectives and overall importance of the selection of appropriate soundings for depiction on nautical charts. This section summarizes the specific criteria and guidance used by cartographers for selection of soundings.

These criteria, and supporting guidance, are summarized in table 4–3. In brief, the emphasis is on selection of soundings which present information on least depths, critical soundings, deep soundings, supportive soundings, and fill soundings. Additional specific guidance is also given in table 4–3 for selection of channel range soundings, nonjunction soundings, changeable soundings, soundings in slips and around piers, depths over rocks, areas where the survey has not been able to detect the bottom, and river depths.

Broadly, the criteria offered in table 4–3 identify soundings to be emphasized (e.g., least depths, critical soundings, deeps), soundings of lesser importance (e.g., supportive soundings, fill soundings), and circumstances where the depiction of soundings is ill-advised (e.g., depiction of soundings in changeable areas).

Skippers of recreational craft often express

SOUNDING DENSITY



HYDROGRAPHIC SURVEY **CHART**

Fig. 4-3. Differences between hydrographic survey information and that provided on a typical chart. The chart on the right is much easier to read, yet does not sacrifice any information critical to navigation.

TABLE 4-2
Bottom Features Depicted on Nautical Charts

Shallow areas: Shallow areas are large expanses of shoals or of shallow water where the changes in depth are relatively slight. Some bays fed by river systems are shallow throughout.
Shoals, Banks, and Bars: Shoals are shallows that constitute offshore hazards to navigation. They are defined as having a depth of 10 fathoms or less and may be composed of any material except rock or coral. A shoal may be an isolated feature or part of a shoal area composed of two or more shoals. A bank is an area of relatively shallow water which is, however, of sufficient depth for safe navigation. Bars are ridges of sand or gravel, often at the mouth of a river, which may obstruct navigation. Note that shallow areas of rock and coral are charted as ledges and reefs and labeled, rather than being delineated solely by depth indicators.
Irregular Bottoms: Irregular bottom areas may consist of shoals, shallows, passages, deeps, etc., and are characterized by relatively large and abrupt depth differences throughout the region.
Smooth Bottoms: Smooth bottom areas are expanses where variations in depth are gradual and are relatively small compared to the size and depth of the area as a whole. Smooth areas in relatively deep water are the least important feature shown on charts. Generally, they pose no navigational hazard. These are depicted to provide "bottom detail" to navigators, rather than to enhance boater's "safety."
Navigable Channels and Passages: A channel or passage is a relatively deeper navigable route through an otherwise shallow area. Natural channels or passages are important features which contribute to the navigational value of a chart. Natural channels may constitute routes from deep water into shore or harbor areas, or routes between deep water areas through shoals or bordering shallow areas.
Deeps: Deeps are local deformations in the bottom configuration characterized by a significant increase in depth when compared to the surrounding areas. The boundary of a deep is the zone which separates the deep area from the surrounding shallower water. The size of the zone depends on how well the deep can be distinguished from the surrounding area.
SOURCE: *Nautical Chart Manual.*

puzzlement at some of the deeper soundings included on the nautical chart. After all, most recreational power boats draw 4 feet or less, and most recreational sailboats probably draw 6 feet or less. Why, they ask, include chart depths much greater than this? There are several reasons for inclusion of deeper soundings—but two are particularly relevant. First, as noted in Chapter 1, the nautical chart is prepared for several types of users. Although recreational vessels may draw 6 feet or less, large commercial vessels draw much more. Super tankers, for example, draw 40 feet or more (the ultra-large crude carrier, *Seawise Giant,* built in 1979 reportedly draws almost 100 feet!), and a submarine at periscope depth draws 100 feet (submarines operate at depths considerably greater). Second, operators of all types of vessels can use depth information as an aid in position fixing and for tracking along a depth curve (see below).

TABLE 4-3
Selection Criteria For Charted Soundings

Least Depths:
Least depth soundings over features (e.g., pinnacles, domes, ridges), which are delineated by depth curves should be identified because they are typically associated with hazardous shoal areas. When applying hydrography from larger to progressively smaller scales, a series of shoals may have to be generalized into a single-shoal feature. In this case, the most shallow sounding is selected to represent the least depth over the generalized shoal. The least depth of a natural channel (also termed the *controlling depth*) is also charted. Every natural channel has at least one controlling sounding, which identifies the minimum depth of the channel.

Critical Soundings:
Within each isolated feature bound by a depth curve, the shallowest seaward sounding must be selected. By definition this is a critical sounding and is given even if the same as the depth curve. Critical soundings represent least depths in proximity to known or potential navigational routes. Note that while a critical sounding is almost always a least depth, a least depth is not always a critical sounding; the location of the sounding is also an important factor.

Deep Soundings:
Deeps, like shoals, are local deformations of the bottom shape. Soundings which are approximately 10% to 20% deeper than their surroundings are considered important soundings and will usually be selected by cartographers. If chart space is constrained, however, a deep sounding does not normally take precedence over an adjacent critical shoal sounding.

Supportive Soundings:
Supportive soundings (also termed *developmental soundings*) supply additional information to the user about the shape of the bottom. These are also used to provide periodic identifiers for depth curves and to show changes in bottom slope away from shoals or deeps.

Fill Soundings:
Fill soundings are used to portray smooth bottoms or deep areas between shoals that are not adequately defined by supportive soundings. Normally, fill soundings provide information about large, gradually sloping depressions that are not deep enough to be enclosed by a depth curve. Ideally fill soundings radiate away from the deep sounding.

Channel Range Soundings:
When a range is charted to show the centerline of a channel, a line of soundings is selected on the range. This policy does not apply to improved (dredged) channels.

Nonjunction Soundings:
When the application of a recent survey to a chart reveals conditions so changed that a satisfactory junction cannot be made with the hydrography of former surveys, a blank band of approximately 5mm shall be left beyond the limits of the more recent survey and a note added, such as: “Hydrography to (eastward) from surveys of 1984.”

Changeable Areas:
All hydrographic detail, including soundings and floating aids, may be omitted from all areas known to undergo continual and rapid change, such as ocean inlets and openings between barrier islands. (See figure 5-7 in chapter 5.)

Continued on next page

Table 4-3—*Continued*
Selection Criteria For Charted Soundings

Soundings in Slips and Around Piers: Soundings in docks, slips, and around piers should be shown where space allows. The cartographer should select soundings far enough off piers to provide depths at the keel lines of vessels which use these piers.
Depths over Rocks: A sounding over an isolated rock shall have the label *"Rk"* placed next to it.
No Bottom Soundings: When no bottom is reported in the survey, the measured depth shall be shown under a bar with a small dot over it. (This type of fill sounding shall be avoided whenever possible.)
River Depths: The shoreline shall be broken to accommodate soundings for narrow rivers where the sounding units would touch the shoreline because of the size of the feature at chart size. When portraying hydrography in navigable tributaries, the cartographer must select soundings that indicate controlling depths in conjunction with those that portray the best navigational channel. Where feature size or chart scale do not allow for the representation of both controlling depths and channel depths, the controlling depths take precedence.
SOURCE: Adapted (with minor word changes) from *Nautical Chart Manual.*

–Charting Practices

Soundings information is shown on the chart by many small printed figures, each denoting a particular sounding. Soundings in traditional units (fathoms, feet) are shown in conventional (vertical) type, soundings in metric units (meters and tenths) are charted in italic type.[2] Soundings are charted in their exact geographic location, and oriented parallel to the base of the chart, even if the chart projection is skewed.

All hydrographic detail and floating ATONs are removed from certain areas undergoing continual and rapid change, such as ocean inlets and openings between barrier islands if inclusion of this information might present an unreasonable risk to mariners. The area of omitted soundings is tinted in blue, and an explanatory note charted, as shown in figure 5–7 in the following chapter. Normally, only small-draft vessels would consider using such areas, but some of these areas are frequented by larger draft commercial vessels—sometimes with unpleasant consequences (see Walsh, *Professional Mariner,* Issue No. 5). The safest course of action is to imagine these areas have "Keep Out" signs posted. On small-scale nautical charts, soundings within a group of rocks or coral heads through which there is no well-defined channel are also omitted.

Depth Curves (Section I of Chart No. 1)

In addition to sounding data, depth information on nautical charts is summarized by charted *depth curves* and *labels*. According to the *Desk Reference Manual,* a *depth curve...*

> "...is a line connecting points of equal water depth which is sometimes significantly displaced outside of soundings, symbols, and other chart detail for clarity as well as safety. Depth curves, therefore, often represent an approximate location of the line of equal depth [a depth contour] as related to the

[2]The difference in type face serves to alert mariners to the difference in depth units.

> surveyed line delineated on the source. The term curve is often used collectively for both depth curves and depth contours." [Material in brackets added for clarity]

Depth curves complement the sounding data and enable the mariner to form a better mental image of the shape of the ocean bottom. Griffin and Lock, writing in the *Cartographic Journal,* offer the following comments on contours,

> "The origins of the contour may remain indistinct, but in its earliest known (submarine) form it manifested two major advances from the earlier sporadic use of spot heights (soundings). Firstly, it provided spatial continuity of information, developing a statistical surface from a set of discrete control point data, thereby introducing additional information by the process of interpolation. Secondly, it simplified the symbol array and stressed the need for visual integration of the contours to form a mental image of the configuration of the surface of the lithosphere."

Depth curves (or contours) resemble elevation curves used to depict topographic relief (see Chapter 3), but there are subtle conceptual differences between these terms. Kember, also writing in *The Cartographic Journal,* offers these colorful insights on the use and interpretation of depth contours on Admiralty nautical charts; comments equally applicable to NOAA charts,

> "Depth contours also receive treatment that may surprise topographic cartographers. For years, in hydrographic departments all over the world, these were hardly regarded as contours at all but as danger lines meaning precisely 'keep out.' Each depth contour said 'keep out' to a particular type of vessel. The 1-fathom line warned small river and fishing vessels; 2 fathoms—many coasters, colliers, small ocean-going ships; 3 fathoms—the majority of ocean-going ships. For the mighty few, the largest battleships and the proudest ocean liners, the 5-fathom line was specially provided. As 'keep out' lines they were drawn to embrace all depths that might possibly offer danger to a vessel of the appropriate type. Caught in the contour's net were often a large number of depths greater in value than the contour itself, but nobody minded the ninety and nine greater depths caught inside so long as there was not one lesser depth left in outer darkness.
>
> "Today marine cartographers are more inclined to treat contours in the manner of our topographic colleagues and to allow contours to play their part in revealing underwater topography. But when it comes to the crunch—and we must simplify or generalize—we do, deliberately and knowingly, and on behalf of the navigator, include all lesser depths within a contour even if it means that our catch includes many deep ones as well.
>
> "So on the Admiralty Chart the depiction of depth is a curious mixture of the exact (high accuracy of spot soundings for example) coupled with this danger fixation which gives great prominence to lesser depths. The result is a navigator's bathymetry—a very different thing from a bathymetrist's bathymetry. In spite of appearances the chart is not a navigational document of the superimposition type. It has something of the underground map's ruthless selectivity and single minded user orientation."

Depth curves are used on charts to illustrate shallow areas, shoals and banks, irregular bottoms, navigable channels and passages, and deeps—much the same information as that identified in table 4–2 for soundings.

Depth curves are particularly relevant to navigators using electronic depth sounders. Of course, the mariner must make adjustments for the placement of the echo sounder with respect to the surface of the water and for the state of the tide in order to compare the observed depth with the charted depth. For example, assume that the observed reading on the echo sounder is 15 feet of water under the keel, the position of the transducer is 3 feet beneath the vessel's water line, and that the calculated height of tide is 7 feet (relative to chart datum). To reduce these data to a figure comparable to the charted depth, it is first necessary to add the difference between the location of the transducer and sea level, and then subtract the calculated height of tide, so the comparable figure would be 15 + 3 - 7 = 11 ft.

Guidelines for charting depth curves abstracted from the *Nautical Chart Manual* include:

> The development of curves varies according to the particular bottom feature being charted. Large shallow areas are generally represented by a sparsity of depth curves, while banks and bars and isolated shoals are represented by a series of closely spaced contour closures.
>
> In areas with irregular bottoms, contours are selected for each isolated shoal's least depth. Supportive soundings and curves are then selected to reinforce this least depth as well as to define the zones between the shoals. This helps to convey to the user the large depth variations in the area.
>
> Smooth bottom areas are characterized by smoothly flowing and relatively widely spaced contours with only occasional closures identifying shoals.
>
> Depth contours are particularly useful in showing natural channels from deep water into shore or harbor areas and routes between deep-water areas through shoals. If the chart scale is too small to illustrate all the channels shown on the survey, the most important routes are retained in preference to less important routes.
>
> Depth curves are not typically shown around charted isolated deeps in shallow areas, unless the deep is part of a natural channel. Depth curves will usually be shown with charted deeps in deeper water. Isolated deep curves are always supported with a sounding inside.
>
> Depth curves around depressions are of little value, and are not typically charted. However, these are shown if they reveal features which may have some navigational value, or if they indicate the deepest side of a river.
>
> Very steep slopes would entail numerous closely spaced depth curves and create a problem in terms of chart clutter. In this case the shallowest and the deepest curves are retained in lieu of less important intermediate curves.
>
> A series of standardized values for depth curves is employed. For example, the standardized curve intervals when depth is given in feet includes (in feet), 6,[3] 12, 18, 24, 36, 60, 120, 180, 240, 300, etc. For metric charts the standard intervals (in meters) are, 2, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 200, 300, etc.

–Charting Practices

On earlier charts, depth curves were depicted using a variety of symbols (see Section I 30 in Chart No. 1), line weights, and colors. This section details *present* charting practices. Charting conventions for the depiction of depth curves include *lines or curves, labels,* and a *blue tint.*

[3] In addition to the "standard" curves, a 3-foot curve is also used in some shallow water areas, such as the Florida keys.

–Symbol

Depth curves are charted with a solid black (blue on some charts) line of 0.10 mm thickness. Approximate depth curves are charted with a dashed line. These curves may be broken for curve labels (the depth) and chart notes. However, curves do not overprint any other charted feature. Depth curves are charted to scale as depicted on source documents, but may be generalized. (Where generalization is necessary, a curve is always displaced toward deeper water, unless this closes or seriously reduces the width of a navigable channel. The minimum width between depth curves identifying a natural channel is 0.3 mm.)

–Labels

Depth contour/curve labels are shown in italic type for charts where depths are given in feet/fathoms. Labels for depth contours and curves on metric charts with italic soundings are printed in conventional type. The convention of printing soundings and curve labels in different type (e.g., vertical if soundings printed in italic) prevents any confusion between the estimated contour level and actual soundings. The contour or curve line is broken for the labels with the label centered on the line. As a general rule, labels are placed along the lines at 10 cm to 15 cm intervals so as not to interfere with soundings and other charted data. In congested areas, labels may be staggered along the lines if this improves the legibility of the chart. All depth contours and curves are labeled in the same unit as the soundings shown on the chart (e.g., in meters for metric charts, in feet if soundings are given in feet, etc.).

–Shallow Water Tint(s)

A blue tint (Blue Tint No. 1) is shown on the chart to emphasize shallow water areas considered dangerous to navigation. *The depth contour selected as the boundary for the tinted area is not a constant for all charts, but rather determined by the chart scale, prevailing depths available, and the draft of the vessels expected to navigate within the charted area.* The limit value for the tint for any chart can be determined by noting the soundings on either side of the tinted area (see Kals). Having said this, the limit of the blue-tinted area is typically the 6-foot curve on harbor charts, and the 12-, 18-, or 30-foot curves on coastal charts (Dutton, Chapman).

For some charts two separate tints are used, Blue Tint No. 1 and a lighter Blue Tint No. 2. The use of two tints enables two depth zones to be delineated; the second depth zone (deeper and tinted in a lighter blue) expands the usefulness of the blue-tinted danger area to another group of chart users.

Figure 4–4 provides an excerpt from NOS Chart No. 13218 (Martha's Vineyard to Block Island) which illustrates many of the chart conventions discussed above. In this case, the limit of the blue tinted area is the 30-foot curve. Depth curves are shown at 30, 60, 90, 120, and 150 feet. Note that the soundings density is greatest in shoal areas and where necessary to characterize the shape of the depth curves.

–Improved (Artificial) Channels

Unlike natural channels, improved (artificial) channels are those which are dredged to establish and maintain project depths. The side limits of improved channels are shown on charts by dashed lines (I 22 of Chart No. 1). Depth curves are not shown for improved channels. Channel depth information is either tabulated or shown within or adjacent to the channel.

Controlling depths are charted in feet on non-metric charts (including those with soundings in fathoms) and meters and decimeters on metric charts.

Channels for which graphic surveys are received by NOAA and which are 400 feet or more in width (Type 1) for their major portion provide depth information tabulated by quarters; channels 100 feet to 400 feet (Type 2) are tabulated by outside quarters and middle half; and channels less than 100 feet (Type 3) are tabulated by full width. On charts where dredged channel legends and tabulations are adequately covered by larger scale charts, the legend and tabulation are omitted, a "(see note)" placed in the channel, and a note (preferably on a land area of the chart) is added, as illustrated by the following example:

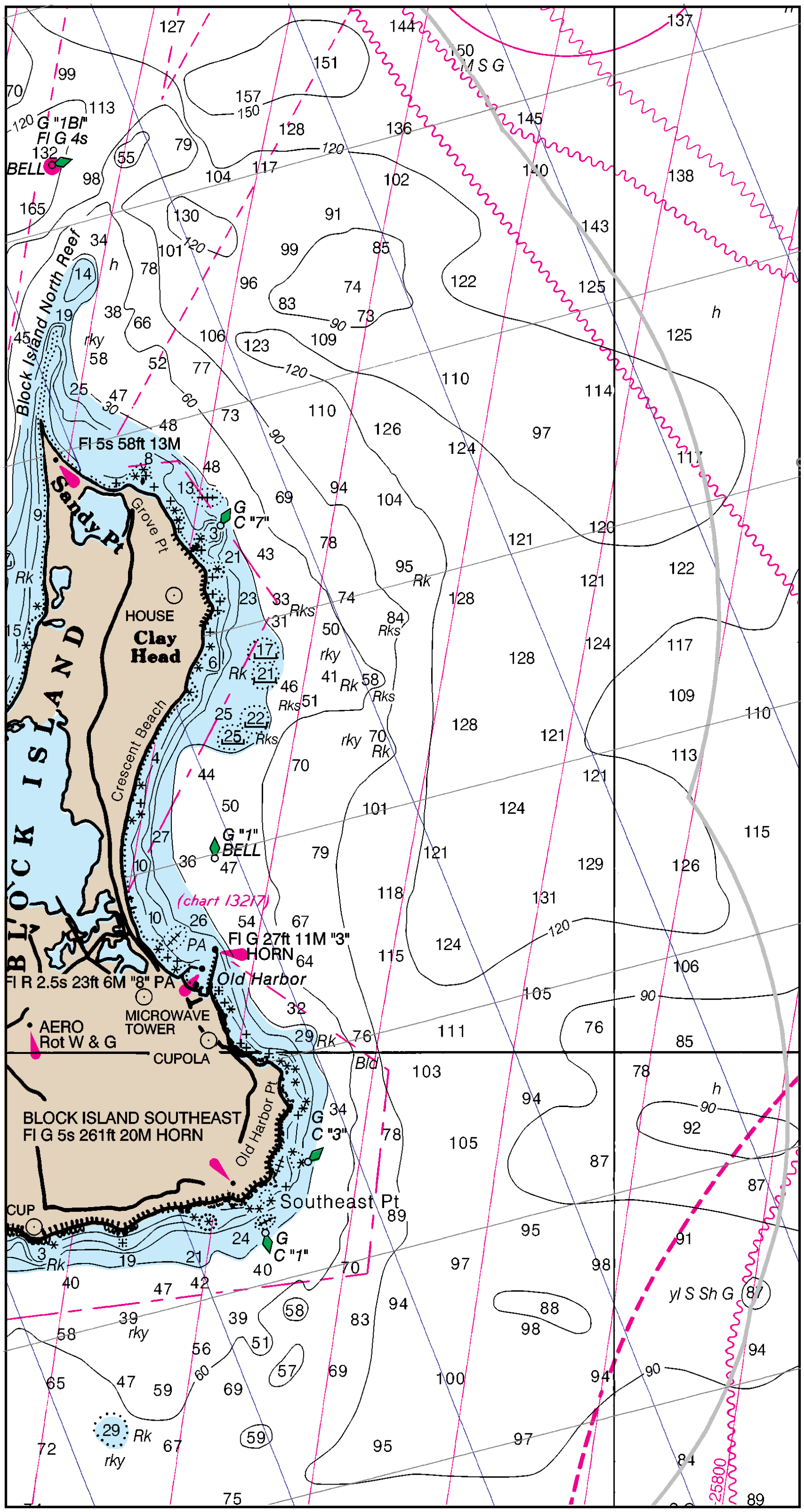


Fig. 4-4. Excerpt from NOS Chart No. 13218 (Martha's Vineyard to Block Island). The 30-foot curve is the limit of the blue tint. Depth curves are shown at 30, 60, 90, 120, and 150 feet. Note that the soundings density is greatest in shoal areas or where necessary to characterize the shape of the bottom. The characteristic of the bottom is principally rocky, and there are numerous sunken rocks in the area. Two dangerous sunken wrecks can be seen, with unknown depths.

BEAUFORT INLET

The project depth is 30 feet to Morehead City. For controlling depths, use chart 11547.

If the reported depth is less than the charted depth, an additional notation such as *"Reported shoaling in channel 1986"* is added.

–Symbols

Dashed lines are used to show channel limits for improved channels. The line thickness, length of dash, and space vary with the type of channel. Blue tint is charted inside the limits of improved channels when the project depth or controlling depth is equal to or less than the value of the charted blue tint curve or when the seaward end of an improved channel terminates in a blue tint area, regardless of channel depth.

Figure 4–5 presents an excerpt from NOS Chart No. 12314 (Delaware River, Philadelphia to Trenton), which shows how improved channels are depicted on the nautical chart. A table of channel depths is included elsewhere on this chart. Controlling depths in this area are between 16 and 18 feet according to surveys of 1-91. There is actually a powerplant located near the two stacks to the right of the Duck Island Range. Barges laden with coal are unloaded at the overhead conveyor. Note that barges coming from seaward (the south) cannot travel directly to the conveyor from the main channel. Rather, they must be pushed north to the Perriwig Channel to avoid shoals and rocks. Here is indisputable evidence of the benefits of a chart!

Bottom Characteristics

The character of the bottom is identified on all nautical charts, particularly in harbors, designated anchorages, and all other areas where vessels may anchor. Bottom characteristics determine the suitability of the area for anchoring, and the type of anchor best suited to the area (see Hinz, or the introduction to appendix A).

Bottom characteristics are of interest for other reasons. According to the *Nautical Chart Manual,* bottom characteristics are charted to provide the following information;

"1. They assist fishermen in selecting areas where fish may be found and in avoiding places where nets and equipment may be damaged.

"2. In tidal areas, they show where vessels may safely take the ground at low water.

"3. In shoal areas, they help navigators to assess the stability of shoals and to distinguish rocky areas from areas of unconsolidated materials."

Descriptors used for bottom characteristics are shown in Section J of Chart No. 1. The most commonly used bottom characteristics on nautical charts are provided in table 4–4. Definitions of these terms are given in appendix A. Nouns and their abbreviations begin with a capital letter; adjectives or qualifying words and their abbreviations are composed of lowercase letters only. Bottom characteristics are charted in black italic type.

Figure 4–4 also shows the use of bottom descriptors. In the area around Block Island, the bottom is described in various places as *"hrd"* (hard), *"rky"* (rocky), *"Blds"* (boulders), *"yl S Sh G"* (yellow sand, shells, and gravel), and *"M S G"* (mud, sand, and gravel).

Specific Hazards to Navigation

The balance of this chapter addresses specific hazards to navigation, including danger curves, rocks, shoals, ledges and reefs, foul areas, wrecks, obstructions, marine structures, unexploded ordnance, and dangerous water conditions. Many of these objects/areas have special symbols described in Chart No. 1. Specific references to section of Chart No. 1 are shown in parentheses. Thus, for example, the symbol used to represent the danger curve or danger line is shown in Section K, item 1, of Chart No. 1. It is noted in what follows as "danger curve (K 1)." Although pertinent excerpts of Chart No. 1 are included in this and other chapters, space constraints do not permit inclusion of the entire chart in this manual. Users should read this

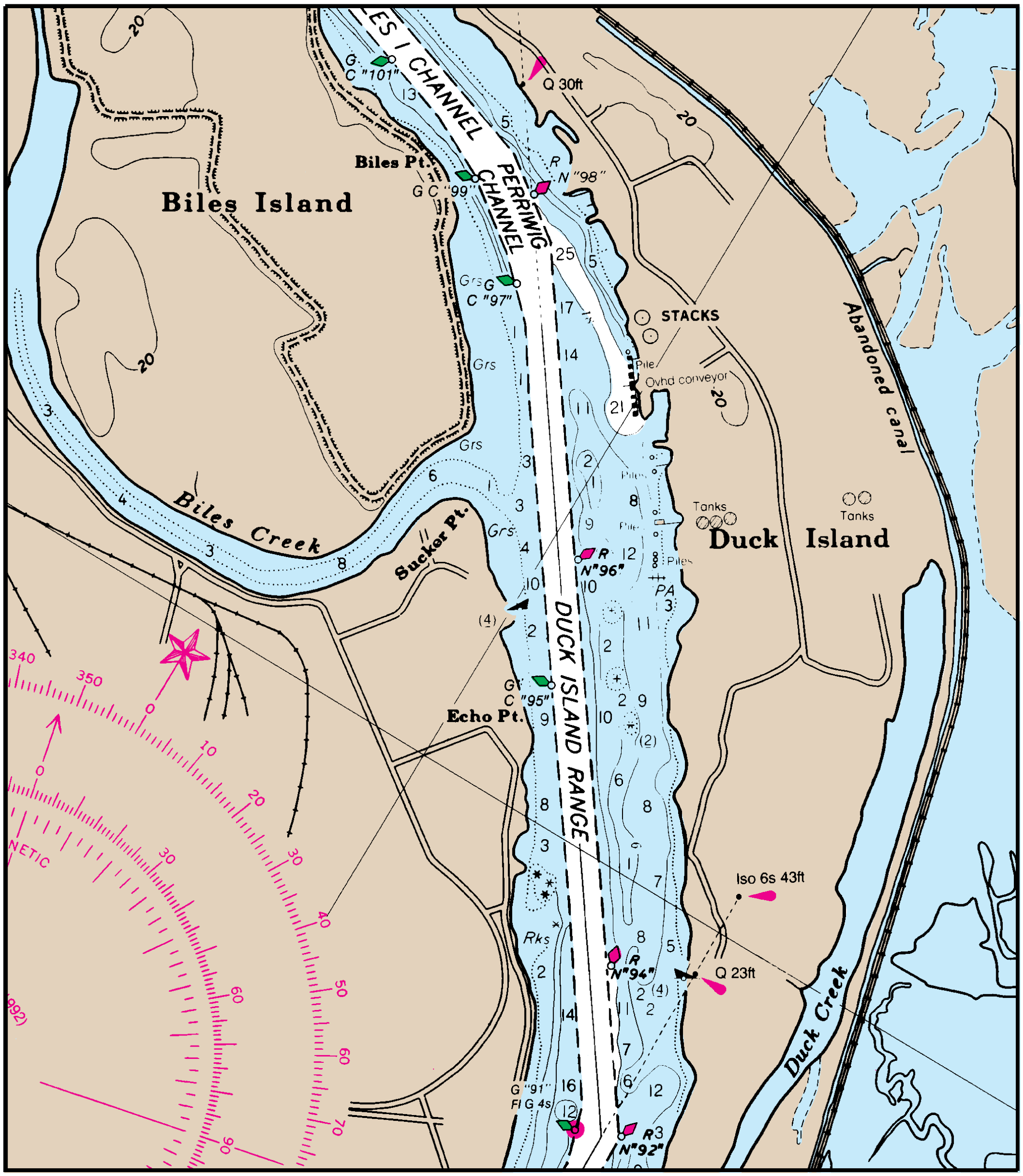


Fig. 4-5. Excerpt from NOS Chart No. 12314 (Delaware River, Philadelphia to Trenton). This excerpt illustrates the chart conventions for depicting improved channels. A table of controlling depths for each channel segment is shown elsewhere on the chart.

manual with a copy of Chart No. 1 at hand for ready reference.

As a point of general interest, it is useful to note the type convention used to depict these objects/features. Vertical type is used for names of topographic features and fixed objects, which extend above high water—i.e., "bare" features are shown in conventional type. *Slant (italic) type is used for names of hydrographic features, including names of water areas, underwater features, and floating ATONs (see Chapter 5).* Because this convention is common to all charted items discussed below, a discussion on type styles is not repeated in each of the subsections, except where necessary for clarity.

The various specific dangers to navigation are charted principally to alert the mariner to submerged artificial and natural hazards. However, it should be noted that certain types of vessels may congregate in these areas, and present an additional collision hazard. Thus, for example, private and charter fishing vessels

TABLE 4-4
Bottom Characteristics and Abbreviations

Nouns	Noun	Source Abbreviation	Chart Abbreviation
	Boulders	Blds	Blds
	Clay	Cl	Cy
	Coral	Co	Co
	Coralhead	ClHd	ClHd
	Gravel	G	G
	Grass	Grs	Grs
	Mud	M	M
	Ooze	Oz	Oz
	Pebbles	P	P
	Sand	S	S
	Shells	Sh	Sh
	Shingle	Sn	Sn
	Silt	Silt	Si
	Stones	St	St
	Seaweed	Wd	Wd

Adjectives	Adjective	Source Abbreviation	Chart Abbreviation
	Broken	brk	bk
	Coarse	crs	c
	Dark	dk	dk
	Fine	fne	f
	Gritty	gty	gty
	Hard	hrd	h
	Large	lrg	lrg
	Light	lt	lt
	Rocky	rky	rky
	Small	sml	sml
	Soft	sft	so
	Speckled	spk	spk
	Sticky	stk	sy

Colors	Color	Abbreviation
	Black	bl
	Blue	bu
	Brown	br
	Gray	gy
	Green	gn
	Orange	or
	Red	rd
	White	wh
	Violet	vi
	Yellow	yl

SOURCE: *Nautical Chart Manual*

may be found in the vicinity of fish havens and wrecks, dive boats may be found in the area of charted wrecks, and service vessels of various types may be found in the area of artificial platforms. Rule 5 of the Navigation Rules specifies:

> "Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision."

Particular vigilance is appropriate in areas of greatest vessel density.

Figure 4–6 provides an excerpt of Section K from Chart No. 1, which illustrates many of the symbols referenced in what follows.

Danger Curve (K 1)

According to the *Desk Reference Guide,* a *danger curve...*

> "...is a dotted curve used to draw the navigator's attention to a danger which would not stand out clearly enough if it were represented on the chart solely by other specific symbols. This dotted curve is also used to delimit areas containing numerous dangers, through which it is useful to navigate."

Danger curves are used to outline areas or emphasize discrete features (e.g., rocks, shoals, submerged structures) that are known or potential hazards to navigation. As with depth curves generally, the limiting line is always charted on the side of safety—that is, the danger curve is either drawn to scale or slightly larger, to help ensure that any errors are conservative.

Submerged structures covered by 66 feet, or 11 fathoms (20 meters) or less are indicated by a dotted danger curve enclosing the symbol for the particular danger. If the structure is covered by depths greater than 11 fathoms (20 meters), the danger curve is charted only if the structure is considered hazardous to navigation.

–Charting Practices

The danger curve is charted with a black dotted line. Insofar as possible, the danger curve is charted in its exact geographic position. This curve is an integral part of other symbols used to depict hazards. If chart space presents a problem for inclusion of a specific symbol within a danger curve, the symbol may be omitted and only the depth included. Areas enclosed by a danger curve that are less than 2.5 mm in diameter at chart scale are charted with the minimum size circle 2.5 mm in diameter. Adjacent features individually enclosed with a danger curve may be enclosed with a common generalized curve on small-scale charts. *A blue tint is used within a danger curve to mark depths of 66 feet or 11 fathoms or less. The blue tint can be used in areas of greater depths if the object is considered a hazard to navigation.*

–Labels and Notes

Appropriate labels are included to describe the danger being enclosed with the danger curve.

Rocks (K 10-17, a, b, f)

According to the *Desk Reference Guide,* a *rock...*

> "...is an isolated large mass of stone, usually one constituting a danger to navigation. Rock is a collective term for masses of hard material generally not smaller than 256 mm.
>
> Rocks are classified as bare, awash, rocks awash at the sounding datum only, or sunken. Bare rocks are those extending above the plane of *mean high water* [MHW see figure 4–1]; rocks awash are those exposed at some stage of the tide; ...sunken rocks are those covered at the chart datum. A sunken rock is potentially the most dangerous natural hazard to navigation. When selecting rocks for [charting], 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 are factors to be considered. Special care shall be used in

General					
1			Danger line, in general		
2	21 Rk 21 Obstr 3_2 3_2 5		Swept by wire drag or diver		

Rocks					
Plane of Reference for Heights → H				Plane of Reference for Depths → H	
10	25 (21)		Rock (islet) which does not cover, height above height datum	4_1 (3,1) (1,7)	(4 m)
11	(2) (2) 4	Uncov 2 ft Uncov 2 ft (2) (2)	Rock which covers and uncovers, height above chart datum	3_7 (2_7) (1_6) (1_6)	
12		(0) (0)	Rock awash at the level of chart datum		
13	+		Dangerous underwater rock of uncertain depth	+	
14			Dangerous underwater rock of known depth	+(4_8) 10 +(12_1) 20	
14.1		12 Rk	in the corresponding depth area		
14.2		5 Rk	outside the corresponding depth area	5 (4_8) 10 20 (12_1)	3_2

Fig. 4-6. Excerpt from Section K of Chart No. 1

Continued on next page

15	+ 35 Rk	35 Rk	*Non-dangerous rock, depth known*	21 R	35R. 35R +(35)
16	Co 3₁ Reef Line		*Coral reef which covers*	Co Co	
17	Breakers	Br	*Breakers*	19 5₈ Br 18	

Wrecks					
Plane of Reference for Depths → H					
20	Hk	Hk	*Wreck, hull always dry, on large-scale charts*	Wk	
21		Hk	*Wreck, covers and uncovers, on large-scale charts*	Wk	Wk Wk Wk Wk
22			*Submerged wreck, depth known, on large-scale charts*	5₂ Wk	9 Wk
23		Hk	*Submerged wreck, depth unknown, on large-scale charts*	Wk	Wk Wk
24	PA		*Wreck showing any portion of hull or superstructure at level of chart datum*		Wk Wk
25	Masts	Mast (10 ft) Funnel	*Wreck showing mast or masts above chart datum only*	Mast	
26	5₁ Wk		*Wreck, least depth known by sounding only*	4₆ Wk 25 Wk	(9)
27	2₁ Wk 5 Wk	2₁ Wk 5₁ Wk 5 Wk	*Wreck, least depth known, swept by wire drag or diver*	4₆ Wk 25 Wk	2₁ Rk
28			*Dangerous wreck, depth unknown*		
29			*Sunken wreck, not dangerous to surface navigation*		
30	8 Wk		*Wreck, least depth unknown, but considered to have a safe clearance to the depth shown*	25 Wk	15

Fig. 4-6. Excerpt from Section K of Chart No. 1

Continued on next page

31	Foul Wks #	Foul Wks Wreckage	*Remains of a wreck or other foul area, dangerous to navigation should be avoided by vessels anchoring, trawling etc.*	# Foul	#

Obstructions					
Plane of Reference for Depths → H					*Kelp, Sea-Weed* → J
40	Obstn	Obstn	*Obstruction, depth unknown*	Obstn Obstn	#
41	5½ Obstn	5½ Obstn	*Obstruction, least depth known*	4_6 Obstn 16_8 Obstn	
42	21 Obstn 5 Obstn	21 Obstn 5 Obstn	*Obstruction, least depth known, swept by wire drag or diver*	4_6 Obstn 16_8 Obstn	
43.1	Subm piles Stakes, Perches	Subm piles Subm piling	*Stumps of posts or piles, all or part of the time submerged*	Obstn	T Subm piles
43.2	Snags Stumps		*Submerged pile, stake, snag, well or stump (with exact position)*		T T T
44.1	Fsh stks		*Fishing stakes*		
44.2			*Fish trap, fish weirs, tunny nets*		
45			*Fish trap area, tunny nets area*	Fish traps Tunny nets	
46.1	Obstruction (fish haven) (actual shape)	Obstruction (fish haven)	*Fish haven (artificial fishing reef)*		
46.2	Obstn Fish haven (Auth min 42 ft)		*Fish haven with minimum depth*	(2_4) 2_4	
47	Oys		*Shellfish cultivation (stakes visible)*	Shellfish	

Fig. 4-6. Excerpt from Section K of Chart No. 1

Continued on next page

Supplementary National Symbols					
a	*		*Rock awash (height unknown)*		
b	*5 Rk* *5 Rks*		*Shoal sounding on isolated rock or rocks*		9 R 2 r 2 P (8)
c			*Sunken wreck covered 20 to 30 meters*		
d	*Sub vol*		*Submarine volcano*		
e	*Discol water*		*Discolored water*		
f	21 *Rk* 3₂ 3₂		*Sunken danger with depth cleared (swept) by wire drag*		*Obstn* 21 5
g	*Reef*		*Reef of unknown extent*		
h	*Co*	*Coral* *Co* *Co* *Co*	*Coral reef, detached (uncovers at sounding datum)*		
i	*Subm Crib*		*Submerged Crib*		
j	Crib *(above water)*		Crib *(above water)*		
k			*Submerged Crib with depth*		(2)
l			*Crib with drying height*		(2)

Continued

Fig. 4-6. Excerpt from Section K of Chart No. 1

charting dangerous rocks. Isolated and dangerous rocks, whether bare, awash, or sunken, shall be emphasized by a danger curve encircling the symbol." [Material in brackets has been inserted for clarity.]

Rocks are particular hazards to navigation. Running into a rock not only grounds the vessel—problem enough—but also may severely damage the hull of the vessel. Attempts to free the vessel may only make matters worse if the hull was damaged by the grounding (Cahill, Minnoch).

Bare rocks, however, can serve as useful landmarks for fixing a vessel's position. A sufficiently prominent bare rock at or near a sunken rock or other danger may be an excellent natural marker for the sunken hazard—a natural wreck marker. In cases where the bare rock is in the general vicinity of invisible hazards to navigation, this rock can be used by the mariner to establish a danger bearing or danger circle (see Bowditch, Dutton).

–Charting Practices

Charting conventions consist of a *symbol,* and various *labels or notes,* which could include the height of the rock, depth of water over the rock, and the name of the rock. Names and labels or rocks covered or periodically covered at certain tide levels or that refer to the sounding datum are charted in black italic type. Corresponding labels for bare rocks are shown in vertical type. Symbols and labels are discussed below.

–Rocks Symbols and Labels

The classification of rocks shown on NOAA charts varies according to the geographic location of the charted area—Atlantic and gulf coasts, Pacific coast, and Great Lakes. For this reason, separate remarks are included for each region.

–Bare Rock (K 10)

A bare rock (islet) is defined as one with an elevation at least 2 feet above MHW for the Atlantic and gulf coasts, at least 3 feet above MHW for the Pacific coast, and at least 5 feet or more above low-water datum for charts of the Great Lakes. An islet is charted in its exact geographic location. Islets are drawn to scale (if possible at the chart scale). If not, the bare rock symbol (K 10) is used. On small-scale charts, the minimum size (0.5 mm by 0.65 mm) symbol may exaggerate the size of the rock. If known, the elevation (in feet or meters above the chart datum) is shown in vertical type enclosed in parentheses.

In some cases, fixed ATONs are located on a rock. The light or daybeacon symbol (see Chapter 5) takes precedence over the rock symbol. (Cartographers take particular care to restore the rock symbol if the light or daybeacon is moved.)

–Rocks Which Cover and Uncover (K 11)

A rock which covers and uncovers (rock awash) is defined as a rock with an elevation 1 foot above MLLW to less than 1 foot above MHW for the Atlantic and gulf coasts, 2 feet above MLLW to less than 2 feet above MHW for the Pacific coast, and 2 feet above low-water datum to 4 feet above low-water datum for the Great Lakes. A rock awash is charted in its exact geographic location and shown to scale if possible. If not, the symbol (K 11) for this type of rock is used. If known, the elevation (in feet or meters above the chart datum) is given in vertical type. For these rocks, the elevation is charted in vertical type enclosed in parentheses and underlined.

–Rocks Awash at the Level of Chart Datum (K 12)

A rock awash at the level of chart datum is defined as a rock with an elevation 1 foot below MLLW to less than 1 foot above MLLW for the Atlantic and gulf coasts, 2 feet above MLLW to less than 2 feet above MLLW for the Pacific coast, and 2 feet below low-water datum to less than 2 feet above low-water datum for the Great Lakes. This rock is charted in its exact geographic location and shown to scale if possible. If not, the symbol (K 12) for this type of rock is used.

–Sunken Rocks (K 2, 13)

A sunken or submerged rock is defined as a rock covered more than 1 foot at MLLW for the Atlantic and gulf coasts, more than 2 feet at MLLW for the Pacific coast, and covered more *than 2 feet at low-water datum for the Great Lakes.* If the depth is unknown, a special symbol (K 13) is charted. If the depth is known, it is given (in feet or meters relative to chart datum).

A depth determined by a wire-drag survey is denoted by a special symbol (K 2). The maximum wire-drag cleared depth over a rock is charted.

Critical dangers to navigation, including rocks, located under bridges are charted in their position on the largest scale chart coverage. The bridge symbol is broken when such dangers are charted beneath the bridge structure—a policy that reflects the potential importance of the hazard.

Figure 4–7 provides illustrations of chart conventions for numerous hazards to navigation.

–Doubtful Danger Labels

In some cases information regarding rocks or other specific hazards is uncertain or incomplete. A series of labels (and associated definitions) has been developed and may be appended to the symbol. According to the *Desk Reference Guide,* these *labels* include:

> "SD" (Sounding Doubtful). Of uncertain depth. This shall be used when a depth shown on a chart over a rock is strongly suspected of being less than that stated. The position is not in doubt.

> "Rep" (Reported). The "Rep" label shall be attached to a charted rock because it is considered dangerous to navigation, but which has not been confirmed by an authoritative field observation party. The year the feature is reported shall be included as part of the label (e.g., Rep (1985)) and shall be enclosed with parentheses. "Rep" may be combined with the other labels in these groups.

> "ED" (Existence Doubtful). Of uncertain existence. The expression shall be charted to indicate the possible existence of a rock, the actual existence of which has not been established.

> "PA" (Position Approximate). Of inexact position. The expression shall be charted to state that the position of a rock has not been accurately determined. The plotting of an object from preliminary data is not of the desired accuracy [10 feet, see Chapter 6] . . ., but it is acceptable for interim charting until an accurate position is available.

> "PD" (Position Doubtful). Of uncertain position. This expression shall be charted to indicate that a submerged rock has been reported in various positions but no one position has been definitely verified. The existence of the feature is not in question, only its correct position.

Similar labels are used to depict other hazards, so these labels are not repeated in each of the following sections. As a practical matter, mariners would do well to resolve the cartographers' uncertainty by assuming that the feature exists. Where adequate safe water exists adjacent to the feature, mariners should simply avoid the potentially hazardous area.

Shoals (K b, O 25)

According to the *Desk Reference Guide,* a *shoal...*

> "is an offshore hazard to navigation on which there is a depth of 16 fathoms (30 meters) or less, and is composed of any material except rock or coral."

Although not all shoals are hazards to navigation for all vessels—note that shoals can have charted depths as great as 30 meters—shoals certainly represent a hazard for deep-draft vessels. Moreover, water over a shoal may be disturbed and present other hazards to recreational vessels even if there is sufficient depth over the shoal. Finally, the prudent mariner should remember that shoals can shift location—particularly after storms or in areas of strong currents. Where these conditions are known, these are noted as "changeable areas" and hydrography is not reported. However, care is always required when navigating shoal areas (e.g., *Professional Mariner,* Issue No. 1).

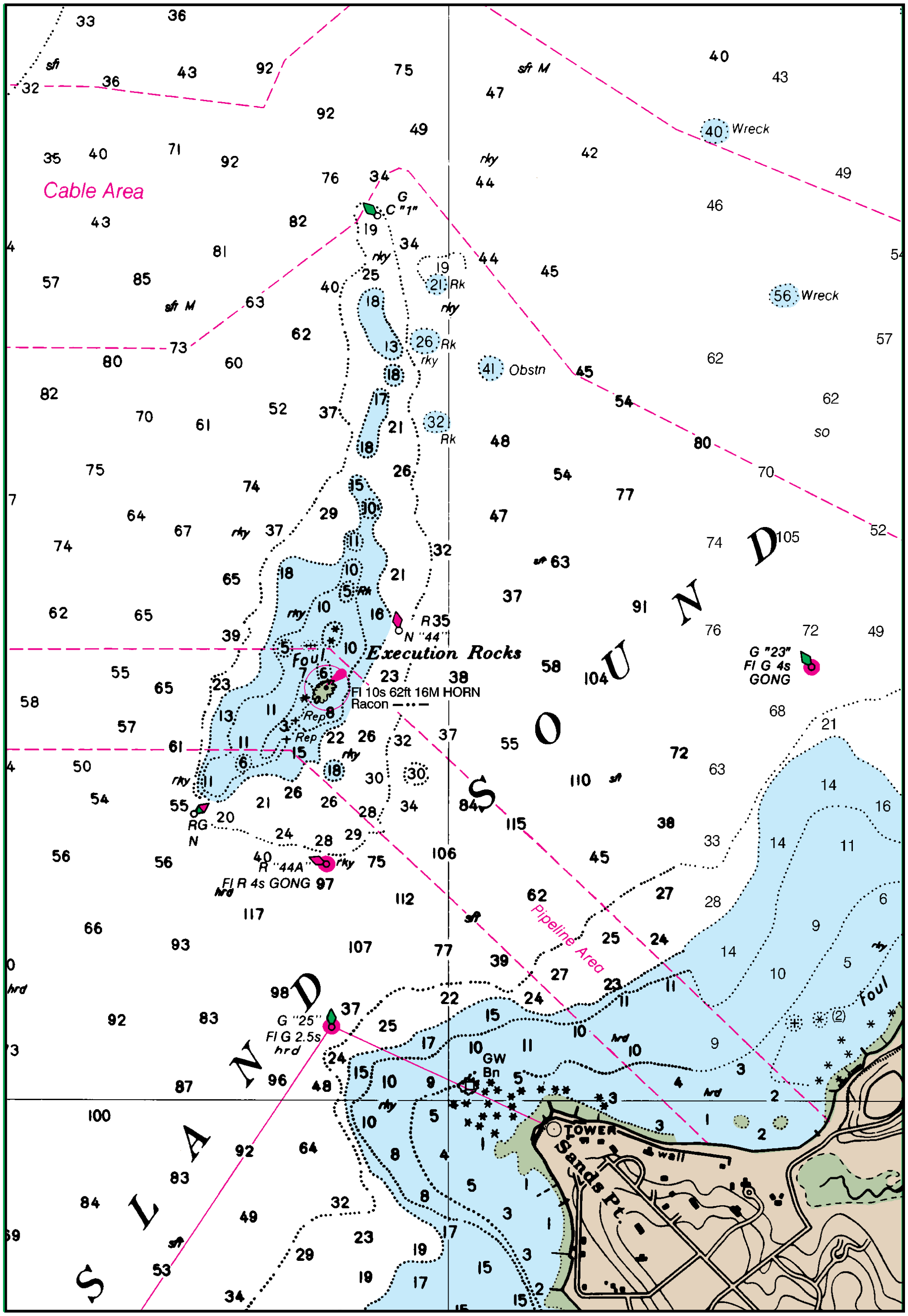


Fig. 4-7. Excerpt from NOS Chart No. 12366 (Long Island Sound and East River). This excerpt shows a number of hazards, including danger curves, foul areas, sunken rocks, wrecks, obstructions, and pipeline and cable areas.

–Charting Practices

Shoals are depicted by *soundings, danger curves*, and *blue tint* as appropriate (see above). Shoals are charted in their exact geographic positions. Shoals carry the primary label *"Shoal"* (or abbreviation *"Shl"* where space is limited) in black italic type. The label may include the name of the shoal (e.g., *"Nebraska Shoal"*). If the danger is doubtful or its position approximate, the appropriate qualifiers (i.e., "SD," "PD," "ED," or "PA") are included.

Ledges and Reefs (Various)

According to the *Desk Reference Guide, ledges and reefs* are defined as follows:

> "A ledge is a rock formation connecting and fringing the shore of an island or large land mass; it is generally characterized by a steep sheer in the submarine topography.
>
> "A reef is a rocky or coral formation dangerous to surface navigation which may or may not uncover at the sounding datum. A rocky reef is always detached from shore; a coral reef may or may not be connected with the shore."

Reefs and ledges are further subdivided into *uncovering ledges and reefs* (J 21, J 22, K h), *submerged ledges and reefs* (K 16, K g), and *oyster reefs* (K 1, K 47). Obviously, reefs and ledges represent a major hazard to navigation. Running aground on ledges and reefs, as with rocks, entails the ever present danger of structural damage. Moreover, these are (at least at some part of the tidal cycle) invisible dangers to navigation. Their depiction on the nautical chart is, therefore, particularly important.

–Charting Practices

Charting conventions consist of a *symbol* and various explanatory *labels and notes.*

For uncovering ledges and reefs standard symbols (J 21, J 22, and K h) are charted. A label is added when scale permits to identify the feature, e.g., *"Rock"* or *"Coral."* Names may be incorporated into the label.

Submerged ledges and reefs are shown by a danger curve (black dotted line), and blue tint to delineate the limits of the feature. A label is added to further identify submerged ledges and reefs, e.g., *"Subm ledge" or Subm reef."* Depths over rocks and coral heads within submerged ledge or reef limits are charted using soundings and labels, e.g., *"5 Rk"* or *"5 Co Hd."* If the depth over these features is unknown, the submerged rock symbol (K 13) is used with the appropriate label.

On small-scale charts where space constraints limit the amount of detail that can be included, the most shallow depth over the submerged ledge or reef is included in the label. As with other underwater features, labels are shown in italic type, e.g., *"Subm ledge (cov 5 feet at MLLW)."*

Oyster reefs are charted using the same charting conventions. If oyster reefs bare at the chart sounding datum, green tint is added to the dotted danger curve. A label is added to identify oyster reefs, e.g., *"Oyster Bar,"* or *"Oyster Reef"* in italic type. Oyster reefs and bars are charted if these present a hazard to navigation or upon request or recommendation of state or local agencies for informational purposes.

Foul Area (K 31)

According to the *Desk Reference Guide,* a *foul area...*

> "is an area of numerous uncharted dangers to navigation. The area charted serves as a warning to the mariner that all dangers are not charted individually and that navigation through the area may be hazardous."

A foul area is an area where the bottom is known to be strewn with rocks, reefs, boulders, coral, obstructions, heavy concentrations of kelp, or other debris that could impede navigation. Foul grounds should be avoided by vessels intending to anchor or engage in activities, such as trawling, which could be adversely affected by the presence of hazards in the foul area (e.g., nets could snag). The term foul does not apply to areas where the bottom is soft (e.g., mud or sand) or composed of other bottom materials not likely to cause damage to a vessel or otherwise restrict activities.

–Charting Practices

A foul area is charted with a *limiting danger curve* (see above) and *label(s).* A *blue tint* and *soundings data* may also be included.

–Symbol (K 31)

The symbol for a foul area (K 31) may be shown in isolation, but may also be combined with other symbols, e.g., those for rocks, to provide a more complete description to the mariner.

Important visible objects located in foul areas, which are useful as landmarks (see Chapter 6 for chart conventions for landmarks), are also charted. These landmarks can alert the mariner to the presence of the foul area and be used for danger bearings, etc. (see Bowditch, Dutton).

Foul areas are charted in their exact geographic positions as provided in the source material available to cartographers. Where possible, foul areas are charted to scale to show the actual size and shape of the actual foul area. Foul areas less than 2.5 mm in diameter at chart scale are charted with the minimum size (2.5 mm) symbol. A blue tint is added to foul areas dangerous to navigation, generally those having depths of 66 feet or 11 fathoms (20 meters) or less, when enclosed with a danger curve and not supported by depth contours and soundings.

–Label(s) and Notes

Descriptive labels, including *"Foul," "Foul Area," "Boulders," "Blds," "Kelp," "Danger line," "Reef line,"* are included to indicate the type of danger present. Labels are printed in black italic type.

Wrecks and Hulks (K 20-31)

According to the *Desk Reference Guide,*

> "A WRECK is the ruined remains of a vessel which has been rendered useless, usually by violent action, such as the action of the sea and weather. In hydrography the term is limited to a wrecked vessel, either submerged or visible, which is attached to or foul of the bottom or cast upon the shore.
>
> "A HULK is generally defined as the remnants of an abandoned wrecked/stranded vessel, the actual shape of which is shown on large-scale charts. May also be used to define stored or permanently berthed vessels where actual shape is shown on large-scale charts."

Wrecks depicted on nautical charts are classified as either *stranded* or *sunken (Nautical Chart Manual).* A stranded (visible) wreck is defined as one which has any portion of the *hull* or *superstructure* above the sounding datum. Submerged wrecks are located below the sounding datum or have only the masts visible.

Wrecks are continually subject to the effects of current and weather. As a result, wrecks can change in physical form and in location. Particularly if not visible and at depths at or near the draft of the vessel, wrecks present a hazard to navigation. Important information received on "new" wrecks or changes in the status of existing wrecks are published in the NM and LNM.

Wreck locations are not only of interest to mariners seeking to avoid potential dangers, but also to divers and charter captains. Fishing vessels using nets generally avoid areas with wrecks because of the potential for wrecks to snag or damage nets.

–Charting Practices

All stranded and sunken wrecks are charted on the largest scale chart nautical chart of the area. Wrecks not classified as dangerous (see below) are omitted on charts smaller than 1:150,000 scale in areas covered by larger scale charts. Charting conventions for wrecks/hulks consist of a *symbol, labels and notes,* and *blue or yellow tint.* Additionally, doubtful or questionable wrecks are so noted by appropriate label (e.g., *"PA," "PD," "ED,"* etc).

–Symbols, Labels, and Tints

Stranded wrecks are charted with a standard black symbol (K 24) which may face either left or right. The baseline of the symbol is shown parallel to the bottom of the chart, and the small "circle" at the base of the symbol (look closely at the symbol) marks the published position of the wreck. If the scale of the chart is sufficiently large, the true outline of a stranded wreck is shown with a solid line, land (gold) tint, and labeled. If a significant portion of the wreck is determined to be bare at the SPOR, it is considered a topographic feature and labeled with vertical, rather than italic, type.

Sunken wrecks are considered dangerous to navigation if any part of the wreck lies at 66 feet or 11 fathoms (20 meters) or less below the sounding datum. Wrecks deeper than 66 feet or 11 fathoms may also be considered dangerous in areas expected to be traveled by deeper draft vessels. Wrecks in areas where water depths and submerged features have been removed (changeable areas) are not charted as this information could be misleading. Dangerous sunken wrecks are denoted by one of several symbols (K 25-28) as noted below:

> Dangerous wrecks lacking precise depth information and those where the depth over the wreck is unknown are charted with the center cross lines of the dangerous wreck symbol (K 28) marking the published position of the wreck. The symbol is rotated so that it is coincident with the known alignment of the wreck. If the alignment of the wreck is unknown, the symbol is aligned with the baseline of the chart. A blue tint is added for emphasis within the enclosing danger curve.
>
> Sunken wrecks with only their masts visible at the sounding datum are charted using symbol (K 25) with the added label *"Masts."*
>
> A dangerous wreck over which a precise least depth has been determined is charted with a sounding surrounded by a dotted danger curve, blue tint, and a label (K 26).
>
> A cleared depth obtained by a wire-drag survey over a dangerous wreck is shown with a sounding surrounded by a dotted danger curve, blue tint, a wire-drag symbol outside the danger curve below the sounding, and the label *"Wk"* (K 27).
>
> The label *"Wreckage"* and a dotted danger curve (K 31) is used to identify areas where numerous dangerous wrecks are located or where the wreckage is scattered. Blue tint is added within the danger curve.
>
> Sunken wrecks that are not deemed to be dangerous to surface vessels expected to frequent the area are charted with a sunken wreck symbol only (K 29).

–Wrecks Marked by Buoys

Buoys used to mark dangerous wrecks are charted in their exact position if possible (see Chapter 5). However, if the chart scale does not permit showing both symbols in their exact locations, the wreck is charted in its exact location, and the buoy is moved slightly.

Obstructions (K 40-42)

According to the *Desk Reference Guide,* an *obstruction...*

> "is anything that might hinder marine navigation. An obstruction on a nautical chart is usually considered to be a hard, unyielding isolated object, such as a sunken rock or manmade article commonly located in deeper depths, that would endanger or prevent the safe passage of vessels. The term 'obstruction' is often used as a preliminary label for reported dangers until they can be identified and properly labeled, and includes such objects as submerged piles, sunken wrecks, uncharted rocks, etc."

From the mariner's perspective, obstructions have the same significance as rocks or wrecks—obstructions are objects that may present a hazard to navigation. The majority of items charted as obstructions are reported to NOAA through the NM and LNM and from USCGAUX and USPS reports.

–Charting Practices

The guidelines for classifying an obstruction as dangerous to surface navigation are the same as those used for sunken wrecks and rocks—e.g., those covered by 66 feet or 11 fathoms (20 meters) or less of water, unless in an area frequented by deeper draft vessels. An unidentified submerged object that is not considered to be the remains of a submerged wreck and is not considered a danger to surface navigation is termed a *"Snag"* rather than an obstruction.

Obstructions are charted with *symbols, labels,* and a *blue tint.* Appropriate qualifiers (e.g., *"ED,"*), discussed above, are included if the obstruction is questionable or uncertain.

–Symbols and Labels

Three symbols are used to depict obstructions (K 40-42), depending upon the available depth information. These objects are charted to scale in the exact position of the obstruction and enclosed with a danger curve filled with blue tint. If the chart scale does not permit a rendition to scale, the minimum size (2.5 mm) circle is used. All obstructions carry the label abbreviation *"Obstn"* in black italic type.

Snags are charted with a 1 mm circle and labeled *"Snag."*

The depth over the obstruction is charted if known. In cases where a cleared depth over the charted position has been obtained from a wire-drag survey, the label *"cleared __ ft 19__"* is added.

Natural Dangers (K 43.2)

Natural dangers include deadheads, logs, snags, and stumps. Running into any of these dangers can cause structural problems and/or damage propellers. (It is generally agreed by most mariners that propellers are not the depth sounding apparatus of choice!) Definitions and charting practices for these natural dangers are described briefly below.

A deadhead is a grounded log or tree trunk often floating free at one end or below the surface of the water. A deadhead is usually charted with a 1 mm circle and labeled *"Snag."*

Logs that are grounded with some parts visible above the surface of the water are charted in some cases. These logs are charted with a 1 mm circle and labeled *"Snag."*

A tree or branch embedded in a river or lake bottom and not visible on the surface is charted as a snag.

Stumps are the stationary remains of trees, often submerged. These are labeled *"Stumps."*

Fish Havens Regulated by State and Federal Permits (K 46.1, K 46.2)

Fish havens are artificial shelters constructed of rocks, concrete, car bodies, and other debris and put on the seafloor to attract fish. Fish havens are often found in the vicinity of fishing ports or major coastal inlets and are usually considered hazards to navigation (and certainly to anchoring). Some fish havens are periodically altered, which increases the potential hazard.

–Charting Practices

Fish havens are denoted with a *symbol* (K 46.1, K 46.2), *labels/notes, soundings,* and *blue tint* (if considered a danger to navigation). Fish havens are charted in their exact position and to scale—subject to a minimum dimension of 2 mm to ensure that the chart feature is readily recognizable. Fish havens with authorized minimum depths of 66 feet or 11 fathoms (20 meters) or less are charted with a dotted limiting danger curve and blue tint. Those greater than 66 feet or 11 fathoms are charted with a dashed limiting danger curve and no tint, unless the fish haven is considered to be a danger to navigation, in which case the blue tint is used. The label *"Fish Haven"* is appended.

Fish havens are often marked with privately maintained buoys. These are charted if published in the LNM but omitted otherwise.

Miscellaneous Hazards

Other hazards that are charted when considered dangerous to navigation include marine structures (e.g., platforms and cribs, fishing and hunting structures, drilling platforms), fishing structures (e.g., fish/crab pens, fish stakes, and fish traps, weirs, tunny nets), floating structures (e.g., floats, floating breakwaters, and floating piers), logging structures (log booms), mineral development structures (e.g., wells, wellheads, platforms, and artificial islands). Charting practices are similar to those identified above. Space constraints do not permit an exhaustive discussion of each of these hazards in this manual. A brief sampling of the chart symbols used to depict these hazards includes:

> Platforms and Cribs; charted as topographic features if at or above the shoreline plane of reference, charted as hydrographic features if below the shoreline plane of reference.
>
> Fish Stakes (K 44.1)
>
> Fish Traps, Weirs, Tunny Nets (K 44.2, K 45)
>
> Floating Breakwaters (F 4.1)
>
> Log Booms (N 61)
>
> Wells (L 20)
>
> Wellheads (L 21.1-21.3, L 13)
>
> Artificial Islands (L 15)
>
> Dolphins (F 20), Piles (F 22, K 43.1, K 43.2)

Unexploded Ordnance

According to the *Desk Reference Guide,* the term *unexploded ordnance...*

> "...refers to any undetonated explosive material which is reported to be outside the charted limits of established regulated explosives dumping areas. (Unexploded bombs, depth charges, torpedoes, ammunition, pyrotechnics, etc.)"

Unexploded ordnance generally does not pose a hazard for transiting vessels, but anchoring in these areas could be risky. Other activities, such as diving, or use of fishing nets would also be imprudent. (Disentangling a torpedo or depth charge from a fouled net would present an unwelcome challenge!) Unexploded ordnance is charted when reported in LNM or by reliable sources. Sunken wrecks containing unexploded ordnance are considered dangerous wrecks and so charted.

–Charting Practices

Charting conventions for unexploded ordnance consist of a *symbol* and *explanatory labels.*

–Symbols

Unexploded ordnance areas are outlined with a dashed line. The ordnance is charted in its exact geographic positions. The dashed limit lines are charted to scale. If the area is less than 2.5 mm in diameter at chart scale, the minimum size 2.5 mm symbol is used. The size of the unexploded ordnance area includes an allowance for the uncertainty of the reported position.

Sunken wrecks containing unexploded ordnance are charted with the dangerous sunken wreck symbol (see above).

–Labels and Notes

Unexploded ordnance areas are labeled (in black italic type) *"Unexploded Ordnance,"* followed by the year the hazard was reported, *"(Reported 19__),"* in parentheses beneath the area label. Sunken wrecks carrying unexploded ordnance are labeled *"Wk (Unexploded Ordnance)."* The type of ordnance (e.g., bombs, depth charges, etc.) may be charted if known.

Unsurveyed Area (I 25)

According to the *Desk Reference Guide,* an *unsurveyed area...*

> "...is an area on a nautical chart where hydrographic surveys are unavailable or limited. These areas are usually labeled 'Unsurveyed.' "

Unsurveyed areas are charted to alert the mariner to areas where depth information is unknown. In general, hydrographic detail is not charted in areas of continual and rapid change. If a recent survey reveals conditions so different that a satisfactory match (junction) cannot be made with the hydrography of former surveys, a blank band is charted beyond the limits of the more recent survey.

–Charting Practices

Unsurveyed area limit lines are charted with a dashed line (I 25). A blank space approximately 5.0 mm wide is charted between the limits of hydrographic surveys that fail to match satisfactorily.

The label *"Unsurveyed Area"* is charted in black italic type. In constantly changing areas, an appropriate note explaining the lack of hydrography is charted in black. Where surveys do not junction satisfactorily, a note (e.g., *"Hydrography to (eastward) from surveys of 1934"*) is charted in black italic type.

Dangerous Water Conditions (Various)

According to the *Desk Reference Guide, dangerous water conditions...*

> "...are physical characteristics of water including visible movement, coloring, and the presence of marine vegetation that constitute a hazard to navigation or indicate the presence of submerged obstructions or shoal areas."

Illustrative dangerous water conditions include rapids/waterfalls (C 22), breakers (C d, K 17), overfalls/tide rips/races (H 44), eddies (H 45), kelp (J 13.2), discolored water (K e), and currents (H 40, 41, H m, t). Their relevance to safe navigation is so obvious as not to require further explanation.

–Charting Practices

Extensive dangerous water conditions are *outlined* and *labeled* to identify the condition. Small areas are charted with symbols or labels only. On conventional and small-craft nautical charts or areas where significant tidal currents exist, tidal current arrows (H 40, 41, H m, t) are charted at locations selected from the "Current Differences" listed in the latest edition of the *Tidal Current Tables.*

–Symbols

As noted, limits to dangerous water areas are charted in their exact geographic positions with a dashed line or (for small areas) with various symbols.

–Labels and Notes

A label describing the nature of the conditions is charted to provide further information. Labels are charted with capital and lower case letters in black italic type; e.g., *"Tide Rips."* Discolored water—often an indication of shoals—is abbreviated *"Discol Water,"* or *"Discol"* if space is at a premium.

Where particularly strong currents exist, a label and a note may be charted in addition to a current arrow and velocity label. The following note provides an illustrative example;

> **"CURRENTS AT SERGIUS NARROWS**
>
> At times the velocity reaches 8 knots. On an average, the current turns from North to South about 2 hours before the time of high water at Sitka and from South to North about 1-3/4 hours before the time of low water at Sitka.
>
> For more precise information consult the Pacific Coast Current Tables of the National Ocean Service which includes predictions of the times of slack and times and velocities of strength for every day of the year."

Additional information on currents may be provided in the form of a current diagram (H t) or limits to major currents, such as the Gulf Stream.

Although not necessarily considered a dangerous water condition, tidal information is relevant to the mariner, and presented in summary form on the nautical chart. Information on the height of the water is presented in two forms, tide notes for areas with appreciable tidal range, and hydrographs (diagrams showing seasonal variability in water levels) for charts of the Great Lakes. In either case, these data are averages of water levels only, and not specific predictions. The notes alert the mariner to the presence of large variations in water level, and the need to consult other references for tidal predictions.

Submarine Pipelines and Cables (L 30.1—44)

Submarine pipelines and cables can be damaged as a result of vessel groundings. Anchors can also damage these objects, and anchoring restrictions are in effect in these areas. Moreover, submarine pipelines may present significant hazards to navigation, similar to a submerged wreck, rock, or other hazards discussed above.

Submarine cables include those used for power transmission and those used for communications. Damage to either can have significant adverse consequences (e.g., loss of power, disruption of communications) as well as causing damage to the vessel and/or its propellers.

–Submarine Pipelines (L 40.1, 40.2, 41.1, 41.2, 43, 44)

Submarine pipelines are partitioned into four classes; those used for *nonvolatile material transport, potable water intakes, volatile material transport,* and *abandoned* (or unused) pipelines.

> Nonvolatile material transport pipelines are conduits for the intake of nonpotable water (e.g., for cooling or irrigation purposes) and for discharge of wastes (e.g., cooling water).
>
> Potable water intakes are structures designed for the intake of drinking water. These are usually elevated above the bottom and supported and protected by a debris-screening structure (a crib), which is separately charted. These are charted in the Great Lakes and other freshwater inland lakes.
>
> Volatile material transport pipelines are used to convey liquids and gases, usually petroleum or other mineral products of a hazardous nature. Collisions with, or dragging an anchor on, these pipelines also entail the risk of pollution incidents, explosions, and fires.
>
> Abandoned (unused) pipelines are no longer in service, but still present a hazard to navigation.

Chart symbols and conventions differ among these pipeline classes. All pipelines may be charted either as an *individual pipeline,* or included in a *pipeline area.*

–Individual Pipelines

Individual pipelines are charted using several *symbols, labels,* and *notes.*

> Intake and discharge pipes (nonvolatile material transport) are charted in black using a unique symbol (L 41.1). This symbol is directional—the ball part of the symbol being placed at the end furthest from the assumed source of flow. No label is added. Conduits for discharging effluents; e.g., industrial, chemical, sanitary, and storm water discharge, are charted with the same black symbol (L 41.1) and labeled *"Sewer"* in italic type on the largest scale chart and on smaller scales as space permits.
>
> Potable water intakes are charted using one of two black symbols (L 41.1, L 43), and labeled *"PWI"* in italic type.

Abandoned pipelines are charted in black using a unique symbol (L 44) without any label.

Pipelines used for liquids and gasses are depicted by a unique magenta symbol (L 40.1) without any label.

In addition, the following caution note (in magenta vertical type) is added to all charts containing submarine oil and gas pipelines and submarine cable areas:

"CAUTION
SUBMARINE PIPELINES AND CABLES

Charted submarine pipelines and submarine cables and submarine pipeline and cable areas are shown as:

Symbols (L 40.2, L 30.2)

Additional uncharted submarine pipelines and submarine cables may exist within the area of this chart. Not all submarine pipelines and submarine cables are required to be buried, and those that were originally buried may have become exposed. Mariners should use extreme caution when operating vessels in depths of water comparable to their draft in areas where pipelines and cables may exist, and when anchoring, dragging, or trawling.

Covered wells may be marked by lighted or unlighted buoys."

–Pipeline Areas

As noted above, pipelines can be charted individually or in areas. Pipeline areas are shown in magenta by dashed area limits (L 41.2) and labeled *"Pipeline Area."* According to the *Nautical Chart Manual:*

"The extent of the limits of the area will be governed by local conditions (e.g., the number of pipelines or cables) but shall in all cases include the immediate area which overlies the pipeline or cables. The limiting lines shall be spaced 1,000 feet apart or 500 feet on each side of the pipeline or cable position or from the outer ones of a group, or a minimum of 5.0 mm at charting scale for small-scale charts. Cable and pipeline areas shall be labeled in Newton Light Italic type, capital and lowercase letters, with type size appropriate to the size of the feature or scale of the chart."

–Submarine Cables (L 30.1, 30.2, L 31.1, L 32)

According to the *Nautical Chart Manual:*

"Cables are classified as power cables and communication cables. Power cables are used to transmit electricity across a large expanse of water where overhead transmission is not feasible, or in areas of heavy commercial shipping where greater danger would exist by use of overhead transmission. Communication cables are used to transmit messages. Submarine cables shall be charted within protected waters such as harbors, rivers, bays, estuaries, or other inland navigable waterways to warn the mariner of possible interference with navigation and to help prevent damage to cables from anchors. Cable and pipeline areas should not be charted in large areas void of hydrography, except to show the terminus of a line."

As with pipelines, cables can be charted individually or in areas.

–Individual Cables

Power cables are depicted by one of two magenta symbols (L 30.1 "generic cable," or L 31.1). Abandoned or unused cables are depicted by a unique magenta symbol (L 32). Communications cables are depicted by a magenta symbol (L 30.1). The continuity of the wavy-line symbol (L 30.1) is not broken for soundings or other chart details except where legibility of the overprinted feature would be impaired. No labels are included.

–Cable Areas

Cable areas are charted in the same manner as pipeline areas, except that a unique symbol is used (L 30.2).

Other Relevant Sources of Information

In addition to the nautical chart and Chart No. 1, several other sources provide information on hydrography and specific hazards to navigation. These include the *U.S. Coast Pilot, Local Notices to Mariners,* and the *Tide Tables and Tidal Current Tables.*

U.S. Coast Pilot

The *U.S. Coast Pilot* contains valuable material on hydrography and hazards to navigation that supplements the nautical chart. In particular (see the *Coast Pilot Manual),* this publication provides textual information on aquacultural sites, bars, basins, channels, currents, dangers depths, fish havens, fishtraps, heights, submarine features, tides, and wrecks. In general, the *U. S. Coast Pilot* provides narrative material that goes beyond that provided by the symbols, notes, and legends used on the nautical chart. For example, the guidance offered in the *Coast Pilot Manual* for a description of bars, dangers, submarine features, and wrecks is:

> "Bars. Where a bar is dangerous, state under what conditions it is dangerous and describe the most favorable conditions for crossing. State whether the bar breaks in ordinary weather or only in heavy weather and how far out the breakers extend. Give the least depth at the best place for crossing the bar (where there is no dredged channel)....

> "Dangers. Give kind and extent of natural dangers; least depths over them; if they break, at what stage of the tide; and how much, if any, is bare at the chart datum. Do not list each individual danger in a group; a description of the most prominent, or the one nearest the channel, or the one farthest from shore is usually sufficient.

> "Submarine features. Describe the character of the bottom slope, especially when approaching the shore. State whether soundings can be depended upon to warn of the approach to danger. Note any special submarine features, such as valleys and escarpments, that may be useful in depth curve navigation.

> "Wrecks. Describe dangerous wrecks in or near channels not maintained (dredged) by the Corps of Engineers and along established routes or likely passage. . . . Do not discuss wrecks lying well offshore unless they present a hazard in a normal coastal route or in the approach to port (e.g., within a safety fairway). A wreck lying amid other described dangers should not be mentioned, nor should those lying in shallows or other areas out of the way of normal navigation."

The *U.S. Coast Pilot* reads as though an experienced mariner, with local knowledge, were briefing the navigator. For example, here are three brief excerpts from the *U.S. Coast Pilot, Volume 3, Atlantic Coast: Sandy Hook to Cape Henry* (1993) applicable to waters off Cape May, NJ.

> "The approaches to Delaware Bay have few off-lying dangers. The 100-fathom curve is 50 to 75 miles off Delaware Bay, and the 20-fathom curve is about 25 miles off. Depths inside the 20-fathom curve are irregular, and in thick weather a deep-draft vessel should not approach the coast closer than depths of 12 fathoms until sure of its position; the safest approach or passing courses would be outside Five Fathom Lighted Buoy F and Delaware Lighted Horn Buoy D.

> "The shoals off Cape May are mixed clay and sand and have the consistency of

hardpan; the ridges run in approximately the same directions as the currents. Cape May Channel, 1-mile southwest of the cape, is an unmarked passage between shoals, with depths from 2 to 6 feet on either side. The channel is seldom used, and then only by fishing vessels and pleasure craft; local knowledge is required for safe passage.

"The channels have strong currents, and many tide rips form near Prissy Wicks Shoal, which has depths as little as 2 feet about 2 miles south of Cape May Light. In Cape May Channel, the current velocity is 1.5 knots on the flood and 2.3 knots on the ebb."

Tide Tables and Tidal Current Tables

These publications, described in Chapter 1, provide information necessary to estimate the set and drift of the current, and the height of the tide at any time for numerous locations. Tide and current information provided on the nautical chart is very general, and use of the *Tide Tables and Tidal Current Tables* is recommended.

Notice to Mariners (NM)

The NM is a bulletin in pamphlet form issued weekly by the *National Imagery and Mapping Agency (NIMA)*. NM contains all corrections, additions, and deletions to all NIMA and NOAA charts.

Local Notice to Mariners (LNM)

The USCG *Local Notice to Mariners* (LNM) contains important information on changes to hydrographic features and dangers to navigation. Charts should be corrected with the LNM before being used.

With respect to hydrographic features, the LNM provides information on changes to charts for individual features; e.g., a revised depth over a charted hazard, and more general information. In some cases, the revised information can be described fully by a simple narrative statement; e.g., "Add, dangerous wreck at location." In other cases, a chartlet is provided in the LNM showing the updated information. The chartlet is published in the exact scale of the chart being updated, so that all that is necessary is to cut out the chartlet and paste it over the corresponding area of the nautical chart. Figures 4–8 and 4–9, for example, provide an illustration from NOS Chart No. 12366 and the revised chartlet published on December 6, 1993. This chartlet was included to amend the published soundings and depth curve data in the East River, near the Throgs Neck Bridge, NY. As can be seen in this example, the changes are substantial, and chart correction is particularly easy.

Concluding Remarks

No attempt is made to summarize this extensive chapter. Rather, it is fitting to conclude with some general remarks on chart accuracy and tips for using the hydrographic information provided on charts. Some of the suggestions are identical to those furnished in other chapters. These points are also made here for emphasis.

The *Admiralty Manual of Navigation* offers the following comments on the reliability of nautical charts:

"... no chart is infallible; every chart is liable to be incomplete in some way or another. Charts based on lead-line surveys are particularly fallible; a single lead-line sounding, which surveyed at best a few centimeters on the sea bed, may be reflected by a figure occupying several hectares of ground depending on the scale of the chart. Any such chart being used for pilotage would have to be treated with the greatest suspicion.

" The degree of reliance to be placed on a chart must depend upon the character and completeness of the original survey material and on the completeness of reports and subsequent changes. Apart from any suspicious inconsistencies ...matters which must be taken into account are the scale of the chart, its soundings in relation to the dates of the surveys or authorities from which it has

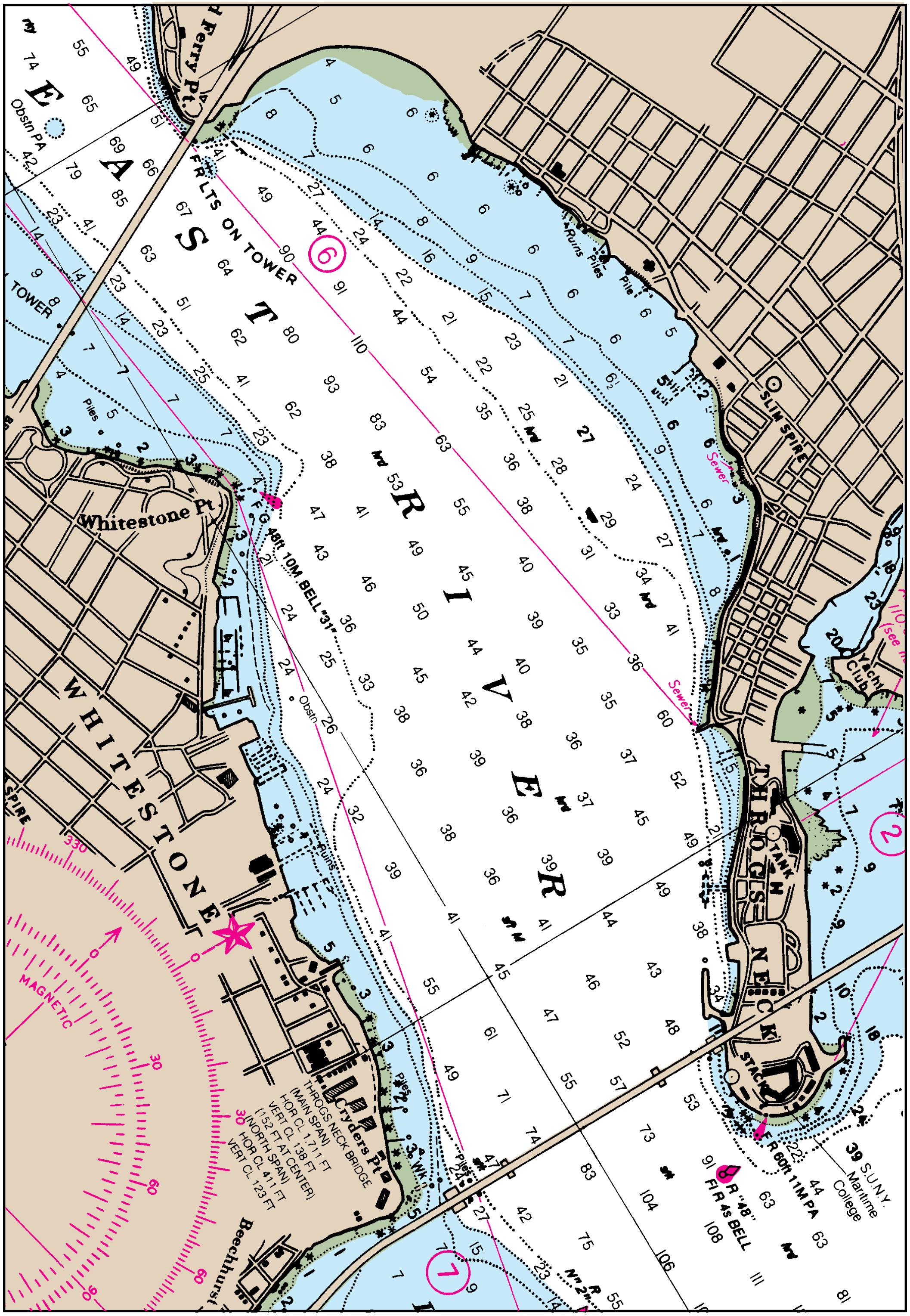


Fig. 4-8. Excerpt from NOS Chart No. 12366 (Long Island Sound and East River). The area shown was subject to a correction in the LNM.

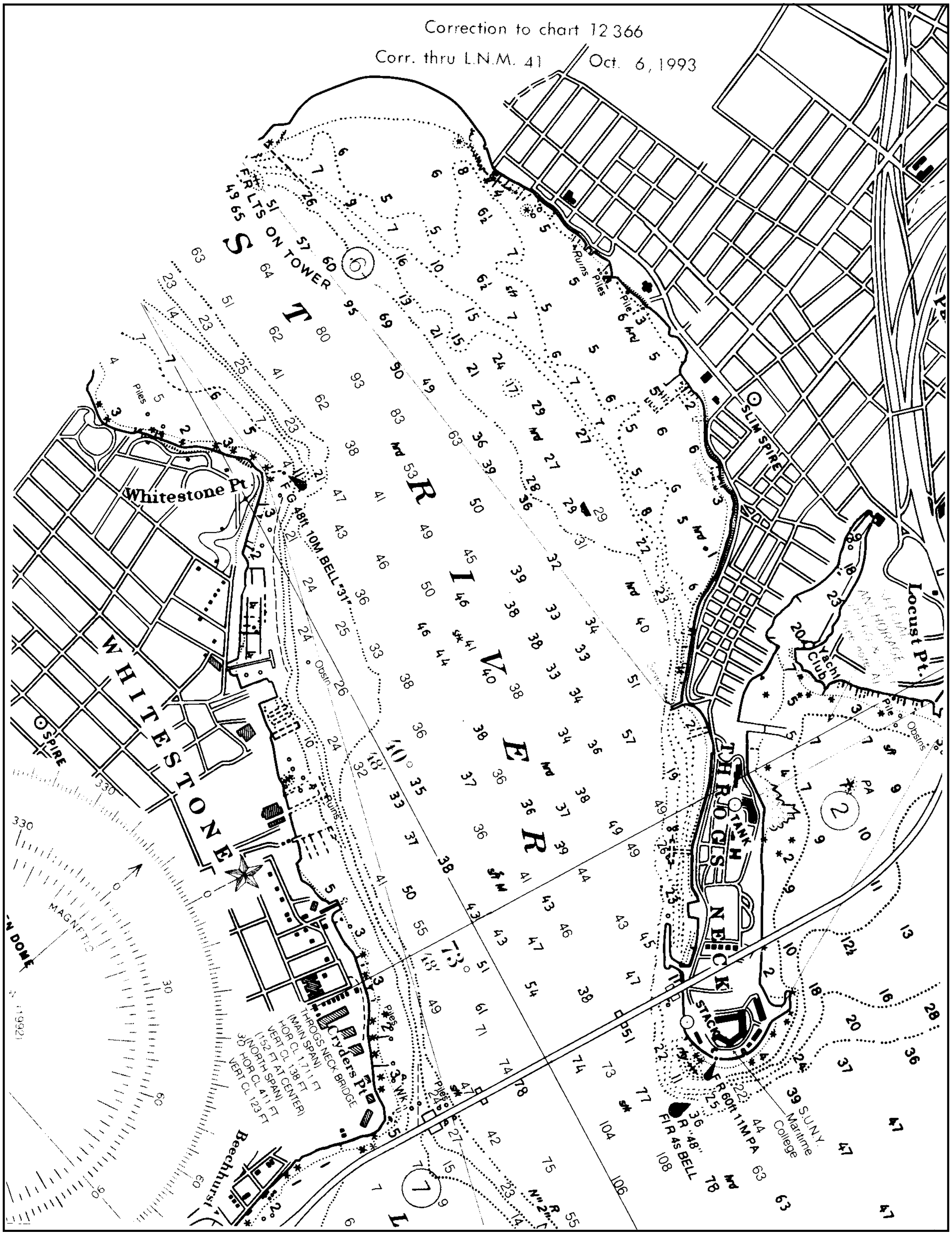


Fig. 4-9. Chartlet LNM issued to correct exhibit shown in Figure 4-8.

> been compiled and examination of the chart itself. Even these considerations can only suggest the degree of reliance to be placed on the chart. The chart must never be taken for granted."

Although NOAA produces some of the finest nautical charts in the world, even these charts have some limitations. Depth information on nautical charts is based on soundings from the latest available hydrographic survey which, in many cases, may be quite old. The age of hydrographic surveys supporting nautical charts varies. Approximately 60 percent of inshore hydrography was acquired by **leadline** (pre-1940) sounding technology. The mariner should consult the source diagram to identify areas recently surveyed. Where possible, courses should be selected that pass through recently surveyed areas.

Always use the largest scale chart of the area to be navigated.[4] Large-scale charts provide the greatest amount of hydrographic detail for a small area as well as showing more ATONs and landmarks. Ensure also that the chart has been corrected with information provided in the NM and LNM. These points are especially important if using electronic charts. It is very tempting to "zoom out" on the chart scale in an attempt to "fit in" the entire track in setting waypoints. However, this may obscure important information on hazards to navigation. Remember also that most electronic charts are obsolete shortly after production. There is no presently available substitute for a corrected large-scale paper chart, although this may change in the future.

Remember that the general appearance of the sea bottom is likely to resemble the adjacent land features, even if the chart soundings do not show this pattern. For example, if the adjacent land mass has steep hills, is strewn with boulders and rocks, and rocky islands are found offshore, the sea bottom is likely to have a similar appearance. Look carefully at the charted depths and bottom contours. Adjacent depths that differ greatly from one another (shown on the chart or observed on the depth finder) indicate boulders, pinnacles, or other natural hazards that project upwards from the sea bottom. These areas are most likely to have uncharted natural hazards. Leave an extra margin—an ample safety margin—of depth under the keel in such areas. Also, where possible, travel in well-established channels in preference to other areas.

Safety margins are important in the *horizontal,* as well as the *vertical* plane. Unless the vessel's mission is to voyage to a charted hazard, any hazard should be given a wide berth. (In figuring a horizontal safety margin, it is important to consider the probable error in the vessel's position—i.e., different margins are appropriate depending upon the navigation systems in use.)

Be particularly careful when voyaging in areas, such as changeable areas, for which hydrographic information is not charted. Natural channels in certain inlets or other areas where there are strong currents change fre-

[4]Amazingly, operators of even commercial craft—such as the skipper of the tug *Mauvilla* (which ran into a railroad bridge precipitating an AMTRAK rail wreck in September 1993)—sometimes venture forth without *charts,* let alone corrected large-scale charts (see Anon, *Professional Mariner,* 1994).

In another incident (Anon, *Professional Mariner,* Issue No. 1) the *Little Gull,* an offshore clamboat skippered by a hired delivery captain, ran aground off Brigantine, NJ. The vessel was found to have no fixed compass and no charts of the area of the grounding. The captain was quoted as saying that he never plots anything on a chart and rarely refers to them. "I don't have to plot; I just know it all by heart. My brain is so impregnated with loran bearings (sic) that I can figure out where to go without charts."

quently, and should be used only by mariners with local knowledge.

Fix the vessel's position at frequent intervals. This reduces the likelihood of straying from the intended track into more hazardous areas. If the vessel's position is appreciably off course, plot a revised track to ensure that it is safe to return to the original course.

The *U.S. Coast Pilot* and other sources, such as commercial cruising guides, should be consulted for additional information. Other mariners with local knowledge are also useful sources. (However, do not blindly follow other vessels in the belief that they know where they are going, unless their draft is considerably greater than yours!)

Finally, mariners should make it a point to report chart discrepancies/update. In order-of-magnitude terms, there are approximately 2,000 employees involved in one aspect or another of chart production—including hydrographic survey crews—but nearly 16 million recreational boats owned. Even if only a small fraction of these boaters were to send chart updates to NOAA, the quality of nautical charts would improve significantly.

"The sound navigator never trusts entirely to the obvious. The price of good navigation is constant vigilance. The unusual is always to be guarded against and when the expected has not eventualized, a doubtful situation always arises which must be guarded against by every precaution known to navigators... It is always the captain who is sure in his own mind, without the tangible evidence of safety in his possession, who loses his ship."

Excerpt from Report of Court Inquiry investigating the Point Honda disaster in 1923.

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———: *Dangerous Curve.*
———: *Dangerous Water Conditions.*
———: *Depth Curve.*
———: *Feature.*
———: *Fish Haven.*
———: *Foul Area.*
———: *Ledge and Reef.*
———: *Low Water Line.*
———: *Natural Resources.*
———: *Obstruction.*
———: *Platform.*
———: *Rock.*
———: *Ruins.*
———: *Shallow.*
———: *Shoal.*
———: *Tides.*
———: *Unexplained Ordnance.*
———: *Unexploded Ordnance.*
———: *Unsurveyed Area.*
———: *Wire Drag and Swept Area.*
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CHAPTER 5

"An incorrectly identified mark is a hazard, not an aid, to navigation."

Alton B. Moody

Aids to Navigation

Introduction and Overview

According to accepted NOAA *Nautical Chart Manual* nomenclature, an *Aid to Navigation* (ATON)...

> "...is a man-made structure/device external to a craft designed to assist in determining the craft's position or a safe course or to warn of dangers or obstructions. When the information is transmitted by light waves, the device is a visual aid to navigation; if by sound waves, an audible aid to navigation; if by radio waves, a radio aid to navigation. Any aid to navigation using electronic equipment, whether or not radio waves are involved, may be considered an electronic aid to navigation. The term "aid to navigation" should not be confused with the more general term "navigational aid" which covers any instrument, device, chart, method, etc., intended to assist in the navigation of a craft."

A more complete list of ATONs and associated information normally found on nautical charts is provided later in this chapter. Briefly, however, ATONs include such objects as buoys, lights, fog signals, daybeacons, range markers, radiobeacons and LORAN-C and Omega lattices. Although the GPS certainly satisfies the definition of an ATON, this system is not discussed in this chapter, because GPS information is not provided on nautical charts. Omega is also not discussed in this manual even though Omega information is provided on certain nautical charts because small craft are not generally equipped with these receivers. Finally, charted LORAN-C information is not included in this manual because this is covered at length in the *USCG LORAN-C User Handbook,* to which the reader is referred.

ATONs may be fixed (land-based or fixed structures in the water) or floating (e.g., buoys). Landmarks are the functional equivalent of ATONs but, because these have not been especially constructed for this purpose, are not formally classified as ATONs. Landmarks are treated in a separate chapter (Chapter 6. Landmarks) of this manual.

This chapter provides information on the type and utility of ATONs and how these are depicted on nautical charts. (Because ATONs are so important to safe navigation and, therefore, charted in great detail, this chapter is long and detailed.) The chapter also identifies the sources of additional information (e.g., the Chart No. 1, *U.S. Coast Pilot* and the *Light List*) which supplement that provided on the nautical chart. As appropriate, practical comments are made throughout the chapter on the correct use of ATONs for marine navigation. (See also

Chapter 6 for additional perspectives applicable to ATONs as well as landmarks.) Numerous references are given at the end of this chapter for those interested in additional detail. Names enclosed in parentheses (e.g., Bowditch) denote particularly pertinent references. The Glossary in appendix A provides definitions of key terms related to ATONs.

Brief Historical Asides

As might be expected, what are now called ATONs have a long history (see, e.g., Bowditch, Naish). As the later history of ATONs may be familiar to readers of this manual, it is interesting to provide some brief asides on the early periods. Towers (used originally as landmarks, and later as lighthouses) were reportedly constructed to aid passage along the Mediterranean coast as early as 660 B.C. Between 283 and 277 B.C., Sostratus of Cnidus built a large (500 ft) structure on the island of Pharos which marked the harbor of Alexandria from the north. The Romans established a network of fire towers along the Mediterranean.

By medieval times, beacons and range markers were in use to facilitate entrance to the ports of Genoa and Pisa. In the so-called Dark Ages in Europe, hermits and monks located on remote islands and promontories displayed light signals in chapels and participated in salvage operations for wrecked vessels. (Today this might be viewed as a conflict of interest!)

The organization of the Hanseatic League not only provided for economic cooperation but also advanced the use of ATONs (and mechanisms for collecting what would now be termed “user fees”) for navigation. A surviving chart of the approaches to Bruge dating from about 1500 A.D. shows *buoys* as well as towers. (A seaman’s manual of 1295 A.D. refers to buoys marking the river channels to Seville.) In England, Trinity House was established in the early 1500s as a pilotage authority charged with (among other things) the responsibility of constructing and maintaining marks on the land.

By the 1700s ATONs had become relatively sophisticated and widespread. The first recorded range marks in America were two light towers placed in line on Plumb Island to mark the channel to Newburyport, MA, on the Merrimack River.

Importance of ATONs in Coastal Navigation

As with landmarks, ATONs are charted objects used for determining *LOP* (e.g., with a hand-bearing compass or radar or by direct plotting in the case of range markers) and *curves of position* (e.g., circles of position with an optical range finder for ATONs with charted height information, such as certain lights or hyperbolas of position with LORAN-C) so as to determine a fix or estimated position for the vessel. ATONs also mark hazards to navigation, identify the limits to safe channels, designate special-use areas (quarantine and anchorages), and provide other relevant information. Table 5–1 provides both general and specific illustrations of how information derived from ATONs can be used for marine navigation. ATONs can be used to fix the vessel’s position, to serve as homing or tracking aids, to ensure that the vessel remains clear of dangerous waters (e.g., by using danger bearings, danger circles, or passing on the “safe side” of buoys) to identify turn points, and for a variety of specialized purposes such as compass calibration or (less frequently with ATONs) to determine whether or not the vessel’s anchor is dragging.

Importance of Positive Identification and Related Matters

Before discussing the various types of ATONs, charting practices, and related matters, it is appropriate to emphasize several key points noted throughout this manual.

> The mariner should be *fully familiar with the charting conventions* employed to depict ATONs. And important textual material (e.g., Chart No. 1, and the appropriate *USCG Light List*) should be readily available for reference.
>
> Any observed ATON (or landmark) should be *positively identified* by the mariner prior to its use for navigation. Published texts (e.g., Cahill,

Table 5-1
Utility of ATONs Shown on Nautical Chart

GENERAL:

- Used for determining range or bearing by visual means (or radar) in coastal waters so as to determine a fix or estimated position;

SPECIFIC ILLUSTRATIONS:

- Used for determination of fix, running fix, estimated position, set and drift of current;
- Used for plotting danger bearings, danger circles, horizontal danger angles;
- Used (in conjunction with danger bearing or circle) for evaluation of vessel's position with respect to unobservable hazards to navigation;
- Used to determine a safe course which avoids unobservable hazards to navigation;
- Used for establishing vessel turning bearings;
- Used for homing or tracking purposes;
- Used for compass calibration; and
- (Less frequently) Used for determining whether or not an anchor is dragging.

Milligan, Maxim) and USCG accident files are replete with examples of mishaps or accidents which resulted from the incorrect identification of an ATON. Bowditch (see references) lists "failure to identify aids to navigation" as the second of 16 common errors in navigation. The mere observation of an ATON (or landmark) at approximately the right position and at approximately the right time—although relevant—is not sufficient proof that the aid observed is the same as that shown on the chart. ATONs are equipped with numerous characteristics (e.g., the flash characteristics and color of a light, the Morse code identifier of a radiobeacon, the number and color of an unlighted buoy or daybeacon) to facilitate positive identification.

Closely related to the above point, it is important that charts (and such publications as the *Light List* and *U.S. Coast Pilot*) be amended as described in the *latest published corrections.* ATONs are moved, renumbered, removed, and/or characteristics changed periodically. This can have significant consequences (see Cahill) for the uninformed mariner. Bowditch also lists "failure to correct charts" among the common errors in navigation.

Whenever observations are taken on any fixed ATON or landmark, this *information should be plotted* on the nautical chart by the mariner. Even a single LOP can be useful, and frequent fixes are typically necessary in coastal waters where ATONs are placed. Differences between the vessel's dead reckoning position and the plotted fix enable currents to be estimated and/or should alert the mariner to the possibility of other errors.

Finally, *all available means* (e.g., maintenance of a dead reckoning plot, use of GPS, LORAN-C, depth sounder or other means) *should be* *used for navigation.* Reliance on only one method is unprofessional and unwise.

ATONs and Related Chart Information (General)

This chapter includes the following ATONs: lights, buoys, fog signals, daybeacons, ranges, and radiobeacons. These are discussed in order in the following sections. Brief comments on "trial courses" are also included in this chapter. The symbols used in charting these aids are illustrated in Sections P, Q, R, and S of *Chart No. 1, Nautical Chart Symbols, Abbreviations, and Terms* (Ninth Ed.) to which the reader is referred. (Pertinent excerpts from Chart No. 1 are included in this chapter for ready reference.)

ATONs are placed in appropriate locations in harbors and inland waterways to facilitate navigation. The placement of these ATONs follow a particular pattern or convention termed *the lateral system,* in which the colors, shapes, and numbering of lights, buoys, and daybeacons are determined by their position in relation to "safe water." (In virtually all U.S. waters the *International Association of Lighthouse Authorities* (IALA) System B is followed. Therefore, the IALA-B system is discussed in this manual.) These designations are applied to navigable channels proceeding from seaward toward the head (limit) of navigation. The colors and numbers of buoys and lights along the coasts and along traffic routes not leading distinctly from seaward or toward headwaters follow the same system, but applied so that even-numbered aids mark the starboard side when proceeding in 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. Table 5–2 provides a capsule summary of the characteristics of lateral aid in most U.S. waters. Additional information on buoyage systems can be found in the *Light List* and other references (e.g., *Coast Guard Aids to Navigation,* Chapman).

Most ATONs used by mariners on a day-to-day basis for navigation purposes are maintained by the USCG. In 1993, there were approximately 50,500 federal ATONs in U.S. waters (Ihnat)! These aids include lights, buoys (lighted and unlighted), daybeacons, and approximately 200 marine radiobeacons. As shown in figure 5–1, the majority (51 percent) of these ATONs are buoys—lights (25 percent) and daybeacons (24 percent) account for about equal portions of the remainder. (Fog signals are not included in this tabulation, as these are typically collocated with a buoy or light.) In addition to federally maintained ATONs, there are approximately the same number of privately maintained ATONs. Some privately maintained aids are useful for navigation and are tabulated in the *Light List* and shown on nautical charts. Charting federal aids (let alone some fraction of the private aids) and keeping charts up to date, is obviously a large undertaking.

An ATON is charted if it is in the *Light List* or is assigned a *Light List* number when published in the LNM. Thus, any ATON found

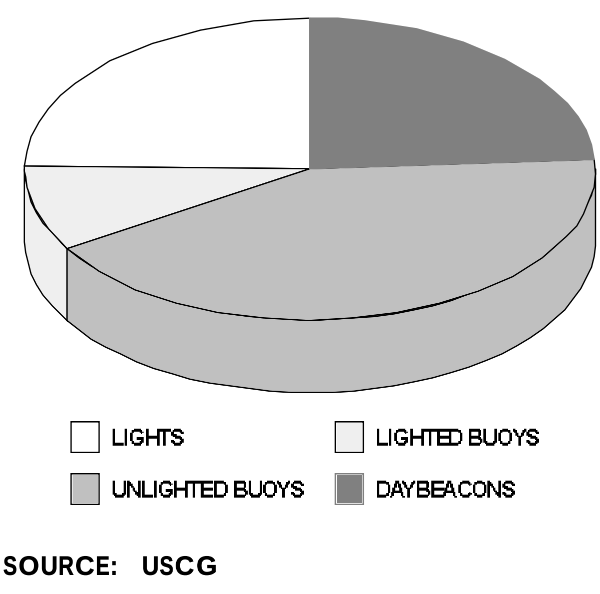


Fig. 5-1. Distribution of the more than 50,500 Federal ATONs in U.S. waters in 1993; buoys are most numerous.

Table 5-2
Characteristics of IALA-B Lateral System

Characteristic	Port Hand Marks	Starboard Hand Marks
Color	Green	Red
Shape (buoys)	Cylindrical (can) or pillar	Conical (nun) or pillar
Daymark	Green square	Red triangle
Light color (when fitted)	Green	Red
Reflector color	Green	Red
Numbers (if numbered)	Odd	Even

At a point where a channel divides, when proceeding in the "conventional direction of buoyage," a preferred channel in Region B may be indicated by a modified port or starboard lateral mark as follows:

Characteristic	Preferred Channel to Starboard	Preferred Channel to Port
Color	Green with one broad red horizontal band	Red with one broad green horizontal band
Shape (buoys)	Cylindrical (can) or pillar	Conical (nun) or pillar
Daymark	Green square, lower half red	Red triangle, lower half green
Color	Green	Red
Rhythm	Composite group flashing (2+1)	Composite group flashing (2+1)
Reflector color	Green	Red

CAUTION: When proceeding toward sea, it may not always be possible to pass on either side of preferred channel aids to navigation. The appropriate nautical chart should always be consulted.

in the *Light List* will also be found on the chart.[1] Additionally, some ATONs are charted which are not in the *Light List,* such as those established by neighboring foreign countries, aids having "reliable" maintenance authorities (such as those established by the military), and environmental buoys which are not included in the *Light List.* As well, radar reflectors, lights, and sound signals are charted for those features (e.g., floats, targets, platforms, dredging range markers, and data collection buoys) not specifically intended for use in navigation, whether the feature is listed in the *Light List* or not.

[1]This assumes that the chart has been *corrected* based upon data in the LNM.

ATON information provided on nautical charts includes a *symbol* unique to each class of aid and a set of *characteristics* such as number, height, color, and nominal range. These characteristics are provided in *labels.* Symbols and characteristics are placed so as to be readily identified by the chart user (not obscured by less important information) and to avoid overlap with any charted channels. These standard symbols are reserved for ATONs which appear in the *Light List.* Charted lights and beacons not intended as guides for normal surface navigation are shown with a *landmark symbol* (see Nautical Chart Manual, Chapter 6. Landmarks) and identifying label. Any identifying navigational light or beacon that is not established by the USCG or equivalent authority is identified on the charts either by the label "Priv" (for privately maintained aids) or by naming the agency that is responsible for its maintenance.

Temporary aids are seldom charted unless given a *Light List* number. ATONs established (and/or aid characteristics that are changed) for the winter navigation season are considered temporary aids and these (changes) are not charted. However, specific details for important aids, such as seasonal fog signals at major aids, are charted in all areas. A seasonal aid note is found on all Great Lakes charts and on east coast charts from Cape Henry, VA, northward. This note reads as follows:

SEASONAL AIDS

> "During some winter months or when endangered by ice, certain aids to navigation are replaced by other types or removed. For details see the U.S. Coast Guard *Light List.*"

Lights

According to official charting definitions in the *Desk Reference Guide,* a *light...*

> "is a luminous signal emitted by a *fixed structure*[2] to aid navigation that marks channels, warns of dangers or obstructions to navigation, and assists the mariner in determining his position. Lights are identified by their characteristics at night and by the shape and color of their daymarks. Light characteristics include flash sequence, length of light and dark periods, color, and range of visibility. Lights are categorized by function (e.g., junction light, directional light, range light, leading light, sector light, passing light, and aeronautical light)." [Emphasis added.]

There were approximately 12,200 federally maintained lights in U.S. waters in 1993.

Most lighted ATONs (including lights and lighted buoys) are equipped with controls that automatically cause the light to operate during darkness and to be extinguished during daylight. These devices are not of equal sensitivity and, in consequence, all lights do not come on or go off at the same time. The lighting apparatus is serviced at periodic intervals, but there is always the possibility that the light is extinguished or operating improperly.

Lights can be used for navigation during the hours of daylight or darkness. During daylight, the fixed structures associated with these lights serve as *landmarks* for bearing or range determination. During daylight hours, the identification of the light is based upon the position of the light and its physical appearance. (The physical appearance of a

[2]Lighted buoys are classified by NOAA as *buoys,* rather than lights, and are discussed later in the main text.

light structure is *not* found on the chart, however, as noted below.) At night, the light is used in much the same manner except that the identification of the light is based primarily upon the *characteristics* of the light, such as the *color, flash sequence,* and *position.*

–Charting Practices

This section provides information on charting practices for lights and related information. Charting conventions consist of a light *symbol,* associated *labels and notes,* and (for sectored lights or where lights have obscured sectors) *information on the sector(s).*

–Symbol (P)

Major lights, minor lights, and lighthouses are charted as shown in Section P of Chart No. 1. In particular, the position of the light is shown by a black 0.75 mm dot (or open black circle 1.0 mm in diameter in the case of an articulated light), with a magenta "flare" (3.4 mm in length with a rounded end of 0.6 mm radius) drawn about 1 mm from the light dot. This light *symbol* has the visual appearance of an exclamation mark (!) in print. The flare is generally oriented toward the label and is drawn to avoid obscuring other relevant chart detail. Where possible, the flare orientation is aligned with those of neighboring buoy symbols (see below). Leading lights (i.e., those arranged, similar to range lights—except that only a single light is used—to indicate a path to be followed) may be charted with the flare oriented seaward along the line.

–Labels and Notes

The label and note(s) provide information on the *name* of the light and the light's *characteristics,* including the light number (if any). This information is very useful for identifying the light and for determining whether it can be seen from the vessel's approximate position.

Miah Maull shoal light in Delaware Bay
Official U.S. Coast Guard photograph

If the name of the light appears in the *Light List* and space permits, the name of the light is shown in black conventional (vertical) type above the light characteristics.[3] The name may be omitted if it is the same as the name of the geographic feature in the immediate vicinity and space is at a premium. Thus, for example, if the geographic name "Pt Judith" were shown in the chart, the name "Pt Judith Lt" would not be given.

The characteristics of the light include its *flash characteristic, color, period, height, visibility (nominal range),* and *number.*

Flash characteristics include the sequence and timing of the flashes and include fixed, occulting (single occulting, group occulting, and composite group occulting) isophase,

[3]These are shown in conventional, rather than italic type because italic type refers, among other things, to floating structures. See also Chapter 4.

flashing (including single flashing, group flashing, composite group flashing, quick, very quick, and ultra quick), Morse code (e.g., Morse "A"), fixed and flashing, and alternating. Illustrative flash characteristics and associated chart labels are shown in Section P (10.1 to 10.11) of Chart No. 1, which is reproduced in figure 5–2. Although not particularly complex, this diagram requires some study. Study of this illustration should be supplemented with on-the-water practice in identifying the characteristics of lights. Mariners are also cautioned that if a vessel has considerable vertical motion due to pitching in heavy seas, a light sighted on or near the horizon may alternately appear and disappear with the possible result that its true characteristic will not be apparent. In consequence, the light could be misidentified. Under these conditions, the true characteristic may not be apparent until the vessel is closer to the light. The watch stander should be placed at the highest convenient station for such observation.

The *color* of lights is shown using standard abbreviation (e.g., R for red, G for green, W for white, etc., as shown in Sections P 11.2 through 11.8 of Chart No. 1) following the flash characteristics of the light. Generally, white lights are not so labeled (and if no color is shown, on the chart, white can be assumed) except where a light exhibits more than one color, in which case W is shown. Amber lights are charted as yellow and abbreviated "Y." Although the color of a light is important to its identification, mariners should be aware that the apparent color of the light may change with distance, because the various colored lights may have different nominal ranges (see below). Additionally, ice or snow may cover the panes of unattended lights, greatly reducing the visibility of lights (see below) and may cause colored lights to appear white.

The *period* of a light is defined as the time (in seconds) required to exhibit a full pattern together with the interval between patterns. Periods are shown on the nautical chart, to the nearest tenth of a second expressed as a decimal, after the flash characteristic. Mariners should "time" a light using a stopwatch. To increase the precision of measurement for lights with short periods, the aggregate time required to complete several cycles should be measured. Thus, for example, if 60 seconds were required for 10 cycles, the period would be 6 seconds.

Taken together, the flash characteristic, color, and period provide key information necessary to *identify* the light when it is in operation. According to both the *Admiralty Manual of Navigation* and Bowditch, *the characteristics of a light must always be checked on sighting.* As noted by Moody, "An incorrectly identified mark is a *hazard,* not an aid, to navigation."

The *height* of the light is the vertical distance between the light source (not the top of the light!) and the shoreline reference datum. Height is shown in feet using the abbreviation "ft" except on metric charts, where height is shown in meters using the abbreviation "m." Height information is important for distance-off calculations (see Bowditch) in daytime or for estimating the distance at which a light can be seen at night (see below). Normally, the mariner should search for the highest lights first when approaching a coast—as these are likely to be seen most easily. However, the mariner should bear in mind that lights placed at high elevations are more frequently obscured by clouds, mist, or fog than those lights located at or near sea level.

The *visibility* of the light is expressed as the "nominal range," and is charted except in the case of range lights or privately maintained lights.[4] The *nominal range* is the maximum distance (in nautical miles on most charts, in statute miles on most Great Lakes charts) a light may be seen *at night* in clear

[4]The nominal range is not given in the *USCG Light List* either, because these are very short-range ATONs.

Light Characters

Light Characters on Light Buoys → Q

	Abbreviation International	Abbreviation National	*Class of light*	*Illustration* *Period shown*	
10.1	**F**	F	*Fixed*		F
10.2	*Occulting (total duration of light longer than total duration of darkness)*				
	Oc	Oc; Occ	*Single-occulting*		Oc; Occ
	Oc(2) Example	Oc (2); Gp Occ	*Group-occulting*		Oc (2); Gp Occ
	Oc(2+3) Example	Oc(2+3)	*Composite group-occulting*		Oc(2+3)
10.3	*Isophase (duration of light and darkness equal)*				
	Iso	Iso; E Int	*Isophase*		Iso; E Int
10.4	*Flashing (total duration of light shorter than total duration of darkness)*				
	Fl	Fl	*Single-flashing*		Fl
	Fl(3) Example	Fl (2); Gp Fl	*Group-flashing*		Fl (2); Gp Fl
	Fl(2+1) Example	Fl (2+1)	*Composite group-flashing*		Fl (2+1)
10.5	**LFl**	L Fl	*Long-flashing (flash 2 s or longer)*		L Fl
10.6	*Quick (repetition rate of 50 to 79 – usually either 50 or 60 – flashes per minute)*				
	Q	Q; Qk Fl	*Continuous quick*		Q; Qk Fl
	Q(3) Example	Q(3)	*Group quick*		
	IQ	IQ; Int Qk Fl; I Qk Fl	*Interrupted quick*		IQ; Int Qk Fl; I Qk Fl

Source: Chart No. 1.

Fig. 5-2. Illustrative Flash Characteristics

Continued on next page

	Abbreviation		*Class of light*	*Illustration* *Period shown*	
	International	National			
10.7	*Very quick (repetition rate of 80 to 159 – usually either 100 or 120 – flashes per min)*				
	VQ	VQ; V Qk Fl	*Continuous very quick*		VQ; V Qk Fl
	VQ(3) Example	VQ (3)	*Group very quick*		
	IVQ	IVQ	*Interrupted very quick*		
10.8	*Ultra quick (repetition rate of 160 or more – usually 240 to 300 – flashes per min)*				
	UQ	UQ	*Continuous ultra quick*		
	IUQ	IUQ	*Interrupted ultra quick*		
10.9	Mo (A) Example	Mo (A)	*Morse Code*		
10.10	**FFl**	F Fl	*Fixed and flashing*		F Fl
10.11	**Al.WR**	Al; Alt	*Alternating*	R W R W R W	Al; Alt

Source: Chart No. 1.

Continued

Fig. 5-2. Illustrative Flash Characteristics

weather (meteorological visibility of 10 nautical miles) without regard for the height of the light or the observer. For those lights with two or more colors (see below) either both nominal ranges are shown (e.g., 15/10M) or *the lesser of the two* ranges will be given.

Calculation procedures for estimating the *actual distance from which a light can be seen at night,* considering the height of the light and observer, nominal range, and prevailing visibility, are detailed in the *Light List* and other references (e.g., Bowditch, Dutton, Maxim). Common practice for the navigator is to draw circles around these lights on the chart with radius equal to the distance at which the light is likely to be visible (see Schlereth) and to estimate the corresponding time when these should first be seen. These calculations are only approximate (Burch). Nonetheless, if lights are not sighted within a reasonable time after that predicted, a dangerous situation may exist and the mariner should be appropriately cautious.

Finally, the assigned *number or letter(s)* of the light structure (if any) are shown following the visibility, and enclosed in quotation marks. The number or letter can be observed (e.g., with binoculars) during daylight hours.

On large-scale charts, the characteristics of lights are shown in the following order: flash characteristic, color, period, height, visibility, and number. For example, an 85 foot red light (number "2") of nominal range 10 miles which exhibits a group of three flashes within a period of 10 seconds would include the light symbol, light name (if appropriate) and the label: Fl (3) R 10s 85ft 10M "2."

Small-scale charts show complete information regarding characteristics for major seacoast lights expected to be used for coastal navigation, but may omit certain information in cases where congestion is a problem. In this event, characteristics are omitted in the following order: height, period, number of flashes in groups, the number or letter on the structure, and the nominal visibility.

–Sectors, and Related Matters

In some cases, terrain masking (e.g., a mountain or island) may limit the area over which a light may be seen. Knowledge of these "blind" areas is obviously useful to mariners. (There is, after all, no point in looking for something that cannot be seen. Moreover, a prudent mariner might well alter the intended track so as to avoid an obscured sector of a major light.) An *obscured* sector (sometimes termed "dark sector") is a portion of the light sector of a navigational light in which the light is not visible. Where a LNM reports its establishment, the obscured sector (see Section P 43 of Chart No. 1) is charted with dashed "rays" marking the limits of the obscured sector. Additionally a dashed arc in the sector centered on the light indicates the obscured sector. Directional arrows are used to mark the points where the dashed arc intersects the dashed ray line. A label, "LT OBSC" or "DARK SECTOR," is added for clarity. See figure 5–3 for an illustration of a light with an observed sector taken from NOS Chart No. 13218.

In other cases, sectors are deliberately created by placing colored glass in the lanterns of lights to provide additional information to the mariner. Sector lights (see Sections P 40 and 42 of Chart No. 1 for symbology) are used primarily to warn mariners of dangerous shoals or other hazards to surface navigation. The danger sectors are usually red and are charted (in degrees true) from the perspective of the mariner looking *toward* the light. Mariners are cautioned not to alter course based solely on the observed sectors, but rather to note the correct compass bearing. This is because it is difficult to determine the sector boundaries with accuracy because the edges of a colored sector cannot be sharply demarcated.

Figure 5–4 presents an excerpt from NOS Chart No. 12304 which shows a red sector on the Brandywine Shoals Light warning of shoals in this area.

–Directional Lights

Several types of *directional lights* are in use (see Section P 30 of Chart No. 1 for chart conventions). These lights have a very narrow sector designed to mark a direction to be followed. The narrow sector may be flanked by an obscured or intensified light, or by lights of a different color or characteristic. A direc-

Fourteen Ft. Bank Light in Delaware Bay. Note differences in appearance with Miah Maull shown earlier. Official U.S. Coast Guard Photograph.

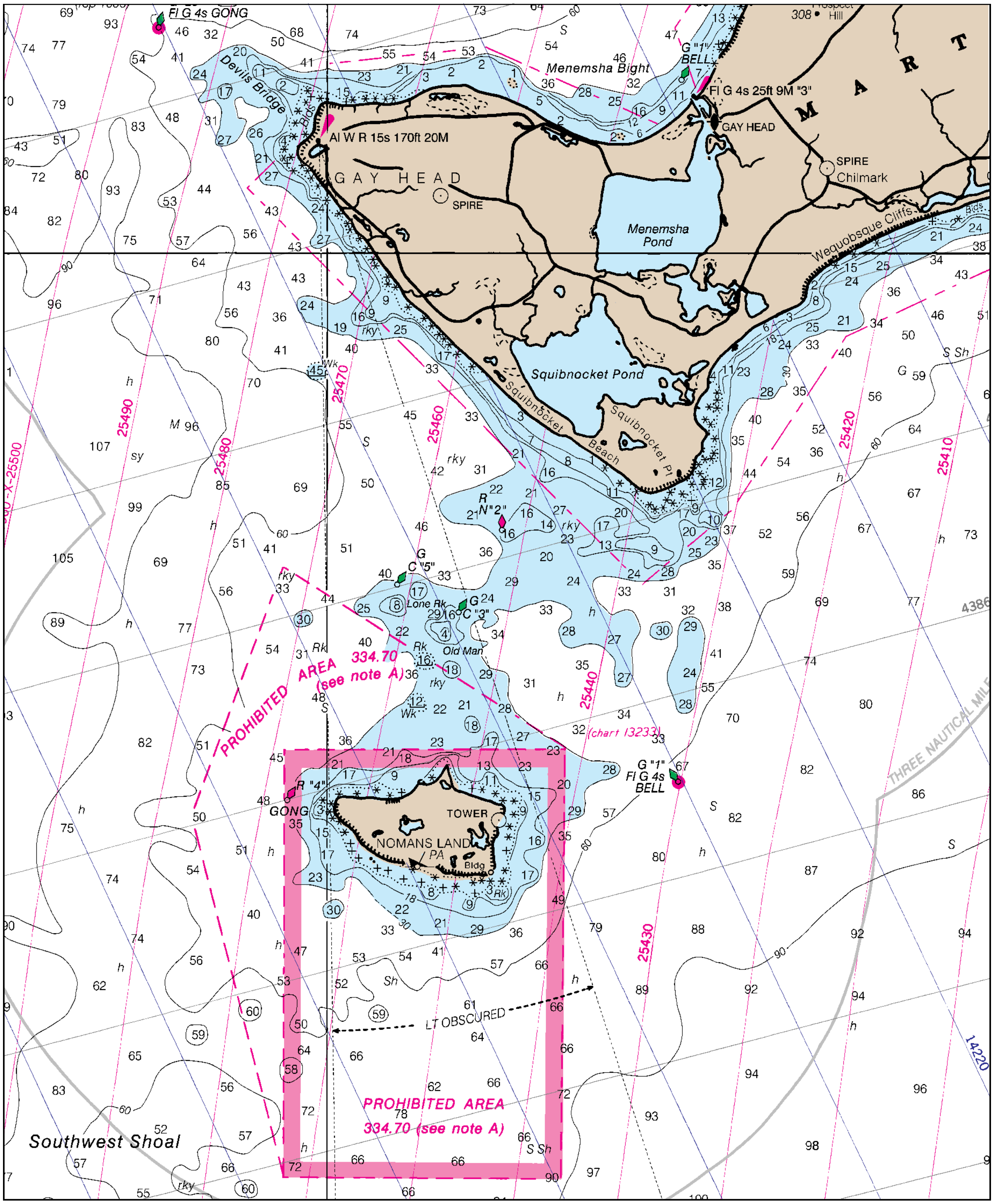


Fig. 5-3. Excerpt from NOS Chart No. 13218 (Martha's Vineyard to Block Island). Note the obscured sector of the Gay Head Light south of Nomans Land. The light at Gay Head is an alternating red and white with a period of 15 seconds and a nominal range of 20 nautical miles. The height of this light is 170 ft.

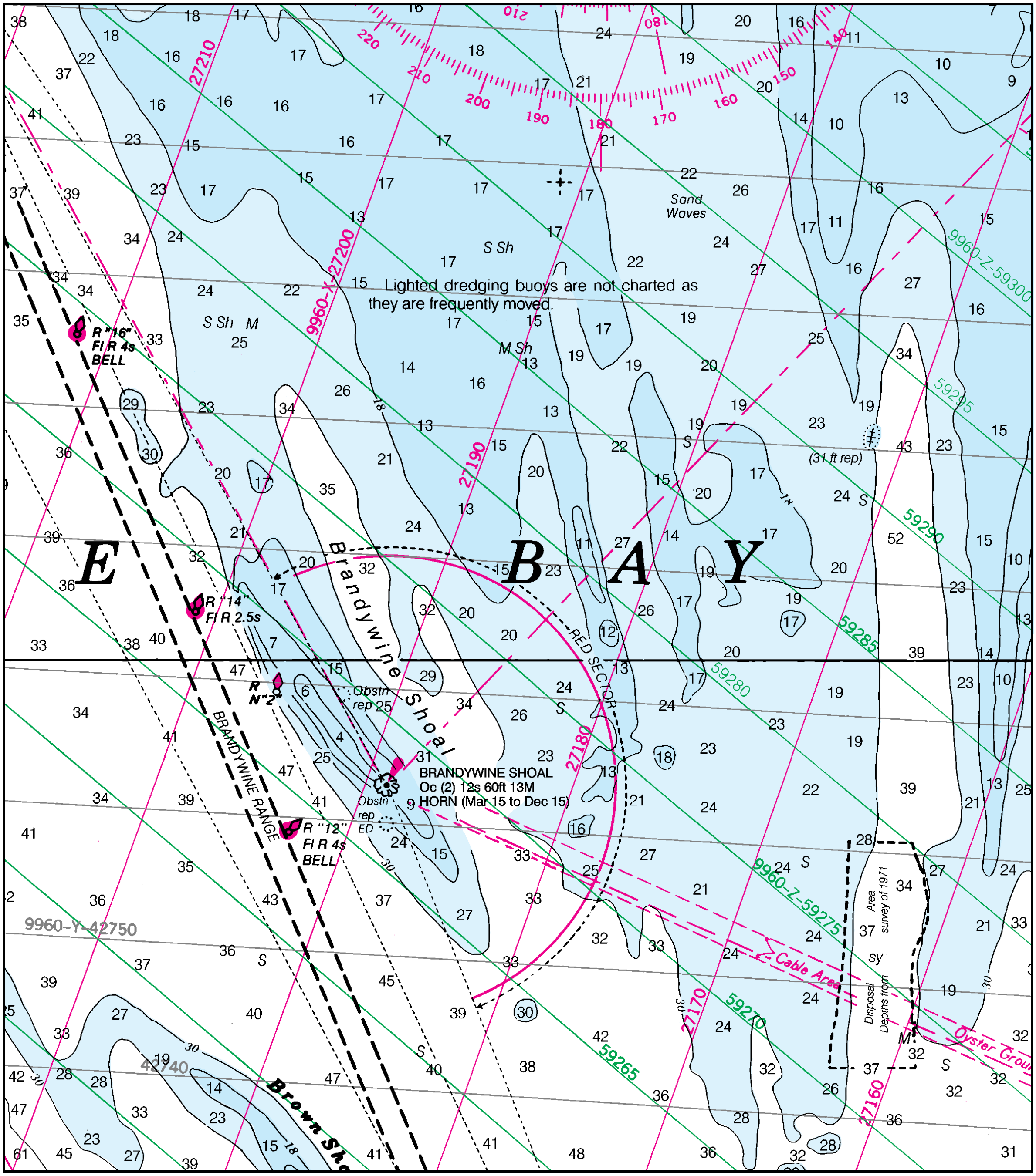


Fig. 5-4. Excerpt from NOS Chart No. 12304 (Delaware Bay). Note the red sector of the Brandywine Shoal Light. The 60 ft. light has a nominal range of 13 nautical miles. Reference to the *Light List* indicates that this is the lesser of the 17-mile range of the white light and the 13-mile range of the red sector. The horn, according to the *Light List*, emits a 2-second blast every 15 seconds. The light is a group occulting with a 12-second period. Note also the riprap symbol at the base of the light.

tional light normally shows three adjoining sectors of red, white, and green, with the center white beam oriented to mark the channel.

–Leading Light

A *leading light* (see Section P 20 of Chart No. 1 for chart conventions) is similar to a range light or marker (see below) except that it marks a channel with a single light (with ray lines) rather than with two separate lights. It is usually a high intensity beam marking the safe channel which diminishes to much lower intensities around the remainder of the horizon. It differs from a directional light (see above) in that it shows only one color of light instead of the three-color sectors of the directional light.

–Aeronautical Lights

Aeronautical lights (see Section P 60 of Chart No. 1 for chart conventions) are white and green navigation lights associated with airports and often found atop the control tower. Because these are generally attended during their hours of operation, the lights are highly dependable. Moreover, these are often the most conspicuous of the nonstrobe lights and their nominal range may be greater than those established for marine navigation. The aeronautical light is charted by a standard light dot with magenta flare. The light symbol is accompanied by its characteristics and the label "AERO."

–Articulated Lights

An *articulated light* is a floating light, also called a *buoyant beacon.* It is basically a vertical pipe structure that oscillates around a universal coupling connected to a sinker. The light structure (which is typically 10 feet to 15 feet above the water surface at high tide) is kept upright by the buoyancy of a submerged floatation chamber. Unlike other buoys (see below) it has no "scope" of chain and the light is directly over the sinker, i.e., this structure has no "watch circle." It is designed primarily to mark narrow channels with greater precision than conventional buoys in situations where the depth of water, up to 60 feet, is too great for a normal pile or dolphin light structure (see Dutton).

When first introduced, this type of ATON, which is neither a true buoy nor exactly a fixed light, required a new symbol for charting (see Section P 5 of Chart No. 1). This symbol is a black open circle 1.0 mm in diameter (the "approximate position" symbol for a landmark explained in Chapter 6) centered on the published position with a magenta flare. The open circle is chosen in lieu of a dot (used for other fixed lights) because the structure may be displaced more than 10 feet of its "true" position. The articulated light is labeled *"Art"* in Newton Medium italic type.[5]

–Strobe Lights

Many charted features are marked with very quick-flashing high-intensity lights, called strobe lights. The light is usually a xenon gas condenser-discharge flash lamp or flash tube. Strobe lights are used on certain USCG-maintained ATONs and on aeronautical hazards, such as stacks, towers, and buildings. ATONs published in the NM and *Light List* as well as landmarks with a strobe light include the label "Strobe" as well as other label elements (see above). The flash period of a strobe light is usually (but not always) omitted because of its extremely short duration (much less than 1 second).

[5]The reason italics are used (in lieu of the vertical lettering found on other lights) is that articulated lights—though classified as fixed structures—are floating lights. Buoys are also labeled in italic type.

–Riprap

Riprap are mounds of broken rock, cobbles, boulders, or fragments that are often placed around light structures as protection against ice damage and scouring by fast-moving currents. Desirable as the use of riprap may be from the point of view of protecting the structure—and helping to ensure the reliability of the light—riprap also presents a *hazard to navigation* for vessels that pass too close aboard. Riprap is denoted on nautical charts by a special symbol (see Section P a of Chart No. 1).

Supplemental Information Regarding Lights and Other ATONs

In addition to the nautical chart, the *Light List*, the *U.S. Coast Pilot*, and commercial cruising guides offer relevant information on ATONs. Additional information provided in these sources is briefly discussed below.

–The *Light List*

The *Light List* is the authoritative source of information on ATONs. It is published annually by the USCG in several volumes, covering various geographic areas. The *Light List* is a valuable complement to the nautical chart and provides specific information on ATONs. Contrary to the implication of its title, the *Light List* offers information on *unlighted as well as lighted* ATONs. In addition to general information regarding ATONs the *Light List* includes specific information on each ATON such as its LLNR, the *name and location* of the ATON, the *geographic coordinates* (latitude and longitude), *characteristics, height, nominal range* (for a wider variety of ATONs than found on the nautical chart), an *identification of the structure,* and *pertinent remarks.*

The organization of the *Light List* is actually quite logical, but requires some study to be used effectively. When all else fails, the index at the back of each volume is helpful.

Much of the information on ATONs shown in the *Light List* is identical to that provided on nautical charts. However, the *Light List* does contain information not found on charts and, additionally, is revised more frequently than most nautical charts and, therefore, is more likely to contain up-to-date information. (However, a properly corrected chart is also up to date.)

Perhaps the most useful information contained in the *Light List* that does not appear in the nautical chart is a brief description of the structure and the accompanying remarks. The description of the structure is particularly useful for identifying lights during daylight conditions. For example, the route from seaward up the Delaware Bay is marked by several lighthouses, including the Brandywine Shoal Light (see figure 5–4), Fourteen Foot Bank Light, Miah Maull Shoal Light, Elbow of Cross Ledge Light, and Ship John Shoal Light. (Photographs in this chapter show two of these lights.) Mariners with local knowledge can readily identify these lights by their distinctive physical appearance.[6] However, those without local knowledge would certainly benefit from the following descriptions taken from the *Light List, Volume II, Atlantic Coast, Toms River, New Jersey to Little River, South Carolina (1993):*

> "Brandywine Shoal Light-Cylindrical concrete structure, adjacent to old screwpile with red sector from 151 degrees to 338 degrees covering shoal area southwest of Cape May. As with several other lights in the area, this light is equipped with an emergency light of lower intensity with same characteristic as main light when main light is extinguished.

[6]In SAR cases on the Delaware Bay in which the distressed mariner reports a position near one of these lights, rescue authorities often ask the mariner to describe the light. This procedure can save fruitless search hours in cases where the distressed vessel does not have an accurate position fix and misidentifies the light.

"Fourteen Foot Bank Light-White tower and dwelling on black cylindrical pile.

"Miah Maull Shoal Light-Red conical tower, on gray conical pier; red cylindrical watch room and black lantern.

"Elbow of Cross Ledge Light-Red skeleton tower with small white house on international orange cylindrical base.

"Ship John Shoal Light-Brown octagonal dwelling with pyramidal roof; on cylindrical pier. Light has red sector from 138 degrees to 321.5 degrees covers shoals on east channel. High intensity beam down Miah Maul Range."

Additionally, the *Light List* provides specific information on ATONs which are seasonal—information not shown on the nautical chart. For example, this same volume of the *Light List* notes that the Deadman Shoal Lighted Buoy IDS which is normally equipped with a flashing green light with a 4-second period is replaced by an unlighted winter marker from December 15 to April 1 of each year.

–The U.S. Coast Pilot

The *U.S. Coast Pilot* also provides information on lights and other ATONs. The scope of the material provided in the *U.S. Coast Pilot* is quite broad (see other chapters of this manual) and, as a result, coverage of ATONs is less complete than can be found in the *Light List.* Nonetheless, the *U. S. Coast Pilot* does contain useful information on selected ATONs. In particular, the *U. S. Coast Pilot* often provides descriptions of lights that are useful for identifying the light structure during daylight hours. For example, here are a few descriptions of lights taken from the *U.S. Coast Pilot Volume 3 (1993), Atlantic Coast: Sandy Hook to Cape Henry:*

"The entrance to South River is between Saunders Point and Thomas Point, 1.8 miles northeastward. Thomas Point Shoal Light (38° 53.9' N, 76° 26.2' W), 43 feet above the water, is shown from a white hexagonal tower on piles, in depths of 5 feet near the outer end of the shoal 1.2 miles east-southeastward of the point; a fog signal is at the light. The light is 1.5 miles due west of a point on the bay ship channel 124.2 miles above the Capes." (p. 176)

"Solomons Lump Light (38° 02.9' N, 76° 00.9' W), 47 feet above the water, is shown from a white octagonal dwelling, with a square tower, on a brown cylindrical base, in depths of 7 feet on the Smith Island side of Kedges Straits." (p. 190)

"Sharps Island Light (38° 38.3' N, 76° 22.5' W), 54 feet above the water, is shown from a leaning, brown tower on a cylindrical pier, in 10 feet at the north end of a shoal that bares at the east end...." (p. 194) [This description is particularly valuable to those without local knowledge. The structure actually leans a great deal, and it is difficult to believe that this is an ATON when approaching from certain angles in daylight!]

–Published Guides and Other Books

Published cruising guides and other books often have descriptions and photographs which are useful to the mariner. Books on lighthouses (e.g., Caldwell, de Gast, Holland), in particular, often contain photographs which facilitate daylight identification. These books are not designed for navigational purposes, however, and the appearance of the light may have changed since the photograph was taken.[7]

Buoys

According to the somewhat lengthy official definition in the *Desk Reference Guide,* a *buoy...*

> "is a floating object, other than a lightship, moored or anchored to the bottom as an aid to navigation. Buoys may be classified according to shape, as spar, cylindrical or can, conical, nun, spherical, barrel, or pillar buoy. They may also be classified according to the color scheme, as a red, green, or checkered buoy. A buoy fitted with a characteristic shape at the top to aid in its identification is called a topmark buoy. A sound buoy is one equipped with a characteristic sound signal, and may be further classified according to the manner in which the sound is produced, as a bell, gong, horn, trumpet, or whistle buoy. A lighted buoy is one with a light having definite characteristics for detection and identification during darkness. If the light is produced by gas it may be called a gas buoy. A buoy equipped with a marker radiobeacon is called a radiobeacon buoy. A buoy with equipment for automatically transmitting a radio signal when triggered by an underwater sound signal is called a sonobuoy. A combination buoy has more than one means of conveying intelligence; it may be called a lighted sound buoy if it is a lighted buoy provided with a sound signal. Buoys may be classified according to location, as channel, mid-channel, middle ground, turning, fairway, bifurcation, junction or sea buoy. A bar buoy marks the location of a bar. A buoy marking a hazard to navigation may be classified according to the nature of the hazard, as obstruction, wreck, telegraph, cable, fish net, dredging, or spoilground buoy. Buoys used for particular purposes may be classified according to their use, as anchor, anchorage, quarantine, mooring, warping, swinging, marker, station, watch, or position buoy. A light-weight buoy especially designed to withstand strong currents is called a river buoy. An ice buoy is a sturdy one used to replace a more easily damaged buoy during a period when heavy ice is anticipated."

The above definition also identifies some of the many navigational uses of buoys. Perhaps the most significant use of a buoy is to enable the mariner to stay in safe water and avoid unseen hazards to navigation.

As noted, buoys are the most common ATON. Approximately 25,500 federal buoys marked U.S. waters in 1993. Buoys may be lighted and/or have fog signals (see below), but most (82 percent) are unlighted can or nun buoys.

Physically, buoys are floating ATONs that are moored to the seabed by concrete sinkers attached to the body of the buoy with chain or synthetic rope of various lengths. Buoy moorings vary in length, being sufficiently long to accommodate the water depth where the buoy is located, plus an allowance for variations in water depth. The mooring lengths define a "watch circle," and buoys move within this circle depending upon wind, current, and tidal height. The size of the watch circle is not reflected in the chart.

---

[7]As an example of this point, an attractively illustrated book (see de Gast) reprinted in 1993, contains a dramatic photograph of the Sharps Island Light referred to above. This light (correctly described in the *USCG Light List*) is leaning as a result of ice damage in 1977. The photograph of this light, unchanged since the original 1973 edition of this book, does not reflect this damage. No doubt the light looks better in its undamaged state, and the author did not intend to write a navigation text.

More than 80 percent of buoys in U.S. waters are unlighted. Unlighted nun buoy.
Official U.S. Coast Guard photograph.

Buoys vary substantially in size and physical appearance. The reader is directed to any of several references at the end of this chapter for illustrations and photographs of various types of buoys.

–A Brief Digression: Position Fixing with Buoys

It is noted above that ATONs can be used for fixing the vessel's position. Although it may be common practice to use both fixed and floating ATONs for this purpose, *the prudent mariner should try to avoid fixing the vessel's position using floating aids.*[8] As noted in the introductory material published in each *Light List:*

> "Buoy positions represented on nautical charts are approximate positions only, due to the practical limitations of positioning and maintaining buoys and their sinkers in precise geographical locations. Buoy positions are normally verified during periodic maintenance visits. Between visits, atmospheric and sea conditions, seabed slope and composition, and collisions or other accidents may cause buoys to shift from their charted locations, or cause buoys to be sunk or capsized....
>
> *...Prudent mariners will use bearings or angles from fixed aids to navigation and shore objects, soundings, and various methods of electronic navigation to positively fix their position."* [Emphasis added.]

Guidance on the use of buoys for position fixing offered in COMDTPUB P16502.8, *U. S. Coast Guard Aids to Navigation* (p. 39) is even more explicit:

> "In order for mariners to derive maximum use from aids to navigation, the different aids to navigation are shown on nautical charts. Thus, mariners are aware of the aids to navigation which they may expect to pass, and may plot any bearings which they take for the purpose of determining their position. DO NOT USE BUOYS TO PLOT A FIX." [Emphasis in original.]

[8]An articulated light (see main text) is a buoyant structure tethered directly to the seabed in such a manner that it has no "watch circle." Although similar to a buoy in some respects, it is regarded as a fixed ATON *for charting purposes.* However, these should be treated as *floating aids* in terms of position fixing.

Buoys could be off-station at any time, but are more likely to be off-station after storms, and in icy conditions. During the severe flooding of the Midwest in the summer of 1993, for example, it was estimated (*Professional Mariner,* Issue No. 3) that as many as 70 percent of the thousands of ATONs in the area needed to be replaced. Severe ice and snow storms in the Northeast in the following year also required numerous buoys to be reset in the Delaware Bay and New York harbor.

It is recognized that there are circumstances where fixed ATONs may not be available for position fixing yet numerous buoys might be present in the area. Any position based solely on buoys should be regarded with a healthy skepticism and verified using fixed ATONs at the first opportunity.

Buoys can be damaged and moved off station by ice, one of the reasons that position-fixing with buoys is not recommended. Here crew from the USCG Red Oak work on an ice-damaged buoy.
Official U.S. Coast Guard photograph.

–Charting Practices

As with other ATONs, buoys are charted with a symbol and one or more labels providing capsule information about the buoy. As noted, generally only buoys listed in the *Light List* are charted. In most cases this presents no difficulty for the mariner. However, there are numerous buoys that are not charted. In particular, buoys marking channels along the Atlantic coast and gulf coast that shift frequently are generally omitted. (Charting these would require excessively frequent revisions.) Where these buoys are not charted, a note is added explaining that these buoys are omitted. In this case a standard note is added to the chart:

Entrance to Inlets

> The entrance channels at the inlets not protected by jetties are subject to frequent changes. The buoys are not charted because they are frequently shifted in position. Buoys are removed if shoaling makes inlets unnavigable.

Entries for such buoys in the *Light List* do not contain latitude and longitude coordinates.

Note also that a given chart may omit buoys (and other information) which are shown on a larger scale chart of the area.

–Symbols (Q)

There are numerous charting symbols used to depict buoys of various types. Figure 5–5, taken from Chart No. 1, provides a sample for review. Chart No. 1 should be studied in some detail to ensure familiarity with the various buoy symbols. Refer to table 5–2 for guidance on the significance of lateral aids. Definitions of various types of buoys can be found in the Glossary in appendix A of this manual and the *Light List*. Additionally, the *Light List* provides an explanation of the significance of each buoy to the mariner.

The position of a buoy is shown with a small circle, the “approximate position” symbol (see Chapter 6) because of the practical limitations in positioning and maintaining buoys and their sinkers in accurate geographic locations. Buoys are charted, insofar as possible, in their published position on large-scale charts. In cases where a buoy position coincides with the symbol for another critical feature, such as a rock awash, the buoy may be charted slightly off position for clarity, but always on the same azimuth as the feature that it marks. If buoys are on opposite sides of a dredged channel and plot less than 0.5 mm apart, the aids may be separated to 0.5 mm.

Channel buoy symbols (e.g., the diamond shape) are generally shown at a 65° angle from the channel lines, with the symbol pointing toward the top of the chart. Buoy symbols marking the limits of fish trap areas are oriented so as to fall inside the area. For other buoys the orientation of the buoy symbols is approximately 25° from the vertical with the symbol inclined toward the label.

Lighted buoys, except superbuoys, are charted with a magenta disk 2.5 mm in diameter, centered on the circle located at the base of the buoy symbol. The few buoys equipped with a RACON[9] are charted with a 7.1 mm diameter magenta circle centered on the circle located at the base of the buoy.

Superbuoys, including single point mooring buoys, *oceanographic data acquisition systems buoys* (ODAS), and *large automated navigation buoys* (LNB or LANBY), share a unique symbol (Sections P 8 and Q 26 of Chart No. 1). See figure 5–6 for an illustration.

[9]The word RACON is derived from RAdar beaCON. A RACON produces a coded response (Morse) when triggered by a radar signal.

Buoys and Beacons			
IALA Maritime Buoyage System, which includes Beacons → Q 130			
1		*Position of buoy*	
Colors of Buoys and Beacon Topmarks			
Abbreviations for Colors → P			
2	G	*Green and black*	G B G G G
3	R "2"	*Single colors other than green and black*	R R Y Y R
4	RG	*Multiple colors in horizontal bands, the color sequence is from top to bottom*	BY GRG BRB
5		*Multiple colors in vertical or diagonal stripes, the darker color is given first*	RW RW RW
6		*Retroreflecting material*	
Note: Retroreflecting material may be fitted to some unlit marks. Charts do not usually show it. Under IALA Recommendations, black bands will appear blue under a spotlight.			
Lighted Marks			
Marks with Fog Signals → R			
7		*Lighted marks on standard charts*	Fl.G G Fl.R R
8		*Lighted marks on multicolored charts*	Fl.R R Iso RW Fl.G G
Topmarks and Radar Reflectors			
For Application of Topmarks within the IALA-System → Q 130		*Topmarks on Special Purpose Buoys and Beacons* → Q	
9		*IALA System buoy topmarks (beacon topmarks shown upright)*	
10		*Beacon with topmark, color, radar reflector and designation*	No 2 Name R
11		*Buoy with topmark, color, radar reflector and designation*	No 3 G
Note: Radar reflectors on floating marks are usually not charted.			

Fig. 5-5. An Excerpt From Chart No. 1: Buoys

Continued on next page

Buoys

Features Common to Buoys and Beacons → Q 1–11

Shapes of Buoys

20	N	*Conical buoy, nun buoy*		
21	C	*Can or cylindrical buoy*		
22	SP	*Spherical buoy*		
23	P	*Pillar buoy*		
24	S	*Spar buoy, spindle buoy*		
25		*Barrel buoy*		
26		*Super buoy*		

Light Floats

30		*Light float as part of IALA System*	Fl.G.3s No 3 Name G	
31		*Light float (unmanned light-vessel) not part of IALA System*	Fl.10s12m26M	

Mooring Buoys

Oil or Gas Installation Buoy → L   *Small Craft Mooring* → U

40		*Mooring buoys*		
41		*Lighted mooring buoy (Example)*	Fl.Y.2,5s No 1	
42		*Trot, mooring buoys with ground tackle and berth numbers*	1 2	
43	See Supplementary national symbols s, t	*Mooring buoy with telegraphic or telephonic communication*		
44		*Numerous moorings (example)*	Small Craft Moorings	

Continued

Fig. 5-5. An Excerpt From Chart No. 1: Buoys

LANBY silhouetted against rising sun.
Official U.S. Coast Guard photograph.

As a point of interest the present LANBYs—built originally to replace lightships—are now nearing the end of their service life and are being replaced by smaller, solar-powered *exposed location buoys* (ELBs). The newer ELBs are cheaper to buy and maintain than the older diesel-powered LNBs (Walsh).

–Charted Characteristics

The characteristics of buoys include color and shape, and, if so equipped, the color and period of their light. Characteristics are abbreviated as shown in Chart No. 1 (Sections Q 2 through Q 71, and a through U) and the *Light List.* These characteristics are important to the mariner for identification purposes. Indeed, as with lights, all mariners are cautioned to establish positive identification of each buoy in the vicinity of the vessel's track. Noticeably absent from this list of characteristics are the height of the buoy and the nominal range (if lighted). (Nominal ranges for selected buoys can be found in the *Light List,* and typically varies from about 4- to 6-nautical miles for most lighted buoys.)

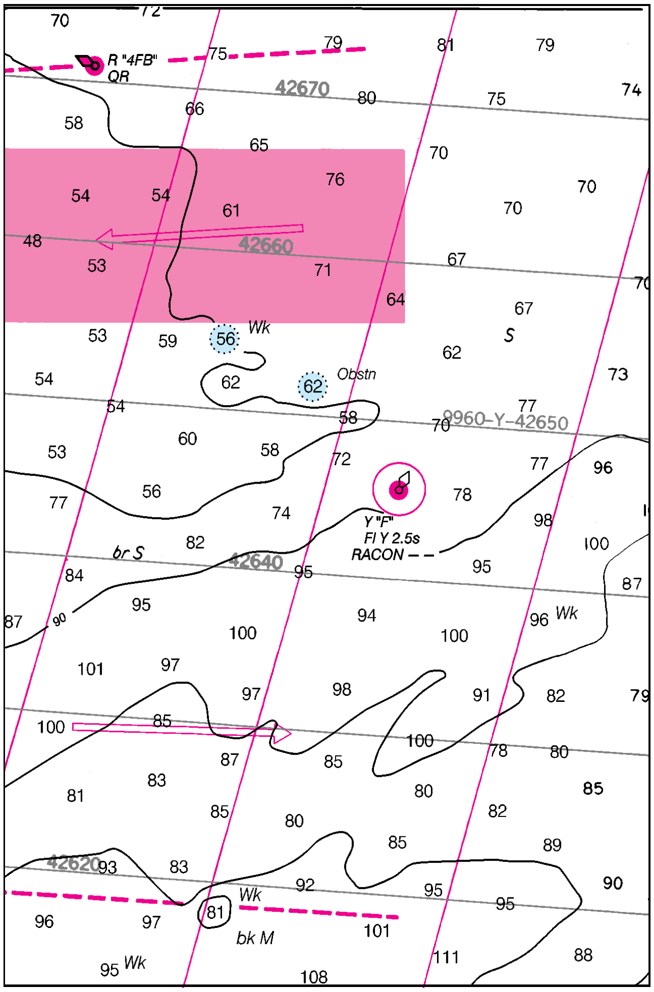


Fig. 5-6. Excerpt from NOS Chart No. 12214 (Cape May to Fenwick Island). Note the LANBY in this illustration. This buoy has a RACON with the identifier (— —) as well as a light and a horn.

Buoy characteristics are shown in italic type.[10] These labels are placed so as not to overlap with wreck symbols, shoals, least depths, and other critical features. Buoys are identified on charts by their shape (can, nun, spherical buoy, spar buoy, or pillar buoy) and by any audible signal they emit (bell, whistle, gong). Buoys (with the exception of mooring buoys) are labeled as to their color using specified abbreviations given in Chart No. 1.[11] For example, red buoys are shown with magenta fill, labeled "R," and green buoys with green fill and labeled "G."

The identifying number (or letter(s)) painted on the buoy (not the LLNR) is shown in quotation marks, e.g., "22."

Light characteristics and period are also presented in the label in much the same manner as noted above for lights.

Private buoys listed in the *Light List* are identified with the label "Priv" in italic print. The service name is charted on military ATONs, e.g., "Navy." Privately maintained buoys not listed in the *Light List* are not generally charted.

A radar-enhancing structure or reflective material has been installed on nearly all major buoys and many minor buoys. Therefore, reference to this feature is not charted as part of the buoy's characteristics. Instead, the following note is included on the chart:

> "Radar reflectors have been placed on many floating aids to navigation. Individual radar reflector identification on these aids has been omitted from this chart."

On large-scale charts, the characteristics of buoys are shown in the following standardized order; color (omit if black) shape, (if unlighted), number (or letter(s)), flash character (if lighted), light color (if lighted), light period (if lighted), and fog signal (if so equipped). For example, the complete legend would be charted as follows:

[10]This is consistent with the convention that floating objects are shown in italics.

[11]Black buoys are not discussed in this manual as these are being phased out.

Lighted Buoy	Unlighted Buoy
R "22"	R
Fl R 4s BELL	N "22"

In congested areas and on smaller scale charts, some of these characteristics are sometimes omitted. Characteristics of lighted buoys are omitted in the following order: period, color, number, light color, and flash characteristics. For unlighted buoys, the corresponding order is: color then number.

Space constraints do not permit an exhaustive discussion of the many types of buoys found in U.S. waters. However, three of the most common types of buoys are briefly reviewed.

–Channel Buoys

These buoys mark the edges of navigable channels. In the IALA-B system, red buoys mark the starboard side of the channel, and green the port side of the channel when proceeding from seaward. Unlighted red buoys have a conical shape, called a nun, and bear even numbers, increasing from seaward. These would be charted using the first symbol shown in Section Q 3 (Q 20) of Chart No. 1 and carry the label R (for red), N (for nun), and the number of the buoy (e.g., "6") in quotation marks. If lighted, this buoy would have a somewhat different physical appearance (e.g., a larger buoy rather than the simple nun), a red light atop the buoy, and would be charted by adding the magenta disc and the characteristics of the light would be noted as discussed above.

Unlighted green buoys have a cylindrical shape, called a can, and bear odd numbers, increasing from seaward. These would be charted using the first of the symbols shown in Section Q 2 (Q 21) of Chart No. 1, and carry the label G (for green), C (for can), and the number of the buoy (e.g., "7") in quotation marks. If lighted, this buoy would have a somewhat different physical appearance (e.g., a larger buoy rather than the simple can), a green light atop the buoy, and would be charted by adding the magenta disc and the characteristics of the light would be noted as discussed above.

Incidentally, mariners are sometimes confused by the exact meaning of the phrase "returning from seaward" in certain instances. The nautical chart should always be consulted to verify the safe side for passing any buoy with lateral significance. Additionally it is worth noting that no buoy should be passed very close aboard; buoys can move throughout the watch circle (endangering the vessel). Moreover, buoys may be located outside of the channel (generally noted in the *Light List)* in cases where the channel is deep. A vessel that ventures too close to the buoy may no longer be in the channel.

A Standard Lighted Radar Reflective Buoy (no sound).
Official U.S. Coast Guard Photograph.

–Junction Buoys

Junction buoys typically mark a junction of two channels and can be passed safely on either side. As with other buoys, these can be lighted or unlighted.

> If unlighted, the buoy would resemble a green can (if the preferred channel were to the right when approaching from seaward) or a red nun (if the preferred channel were to the left when approaching from seaward). The nun would have horizontal red and green bands with the topmost band red. It would be charted by the symbol shown in Section Q 4 of Chart No. 1. The diamond shape would have two fills—red and green (topmost red)—and the letters RG along with the letter(s) on the buoy shown in quotation marks.
>
> If lighted, these would be larger buoys, but retain the same physical color and lettering scheme. The color of the light matches the color of the topmost band. These would be charted using the same symbols as given above, except that the magenta disc would be added, along with the light characteristics as noted above.

–Midchannel Buoys

Midchannel buoys (also called fairway buoys) mark safe water at or near the center of the channel and can be passed on either side. Physically these can be lighted (with a white light blinking the Morse "A") or unlighted, with either the characteristic shape of the lighted buoy or a spherical shape. These are vertically striped red and white. These are charted by the first of the symbols shown in Section Q 5 of Chart No. 1, with or without the magenta disc depending upon whether the buoy is lighted or not. The label would contain the color code *RW* (for red and white), and the identifying letter on the buoy, together with the light characteristic *Mo (A)* if appropriate.

Fog Signals (R)

According to official charting definitions in the *Nautical Chart Manual, fog signals*...

> "are audible aids used to warn of danger and to provide the mariner with a means of determining a craft's position when visibility is obscured by fog, snow, rain, smoke, or thick weather. Among the devices in common use as fog signals are the following:
>
> > "Diaphones produce sound by means of a slotted reciprocating piston actuated by compressed air. 'Two-tone' blasts consist of two tones of different pitch, beginning with a high-pitched blast and ending on a low pitch.
> >
> > "Diaphragm horns produce sound by means of a disc diaphragm vibrated by compressed air or electricity. Duplex or triplex horn units of differing pitch produce a chime signal.
> >
> > "Sirens produce sound by means of either a disk or a cup-shaped rotor actuated by compressed air or electricity.
> >
> > "Whistles produce sound by compressed air emitted through a circumferential slot into a cylindrical bell chamber.
> >
> > "Bells produce a distinctive sound by the vibration of a hollow, cup-shaped metallic vessel which gives forth a ringing sound when struck.
> >
> > "Gongs produce a sound by the vibration of a resonant disc."

There were approximately 1,620 fog signals on federally maintained ATONs in 1993, the majority (75 percent) of which were installed on buoys.

These fog signals are used by the mariner in much the same manner as lights or buoys. And, indeed, these signals are often collocated with fixed or floating aids to navigation. Each fog signal has specific characteristics by which it can be distinguished. The signal characteristic is the phase relationship of the recurring sound emissions. Here are a few pointers to keep in mind relative to fog signals and operation in fog:

> Fog signals on fixed stations and large navigational buoys produce a specific number of blasts and silent periods each minute, when operating, to facilitate positive identification.
>
> Fog signals on buoys are generally activated by the motion of the sea: therefore, they do not emit regular signal characteristics and, when the sea is calm, may emit no sound signals.
>
> Fog signals can be activated by several means (including manually, remotely, or with a "fog detector"). In cases where a fog detector is employed, there may be a delay in the automatic activation of the signal. Additionally, fog detectors may not be capable of detecting patchy fog conditions.
>
> The sound from a fog signal may not be sufficiently loud to be heard over the noise of an engine. Therefore, it may be useful to periodically reduce the engine to idle power—or turn it off completely—to listen for these signals.
>
> Remember to sound the appropriate signals when operating in fog. If visibility is so impaired to necessitate reliance on fog signals, it is sufficiently poor to require appropriate sound signals from all vessels. Note also that speed should also be adjusted to the prevailing circumstances.
>
> Particular attention should be paid to positive identification of buoys in sequence. When a buoy in sequence is missed, consider running a search pattern to find the buoy. Moreover, use all available means of navigation, including electronic position-finding aids, radar, and depth-sounder information.
>
> Finally, as noted in the *Light List,* "mariners should not rely on sound signals to determine their position. Distance cannot be accurately determined by sound intensity. Occasionally, sound signals may not be heard in areas close to their location. Signals may not sound in cases where fog exists close to, but not at, the location of the sound signal."

These important caveats aside, fog signals can be very useful aids to navigation in circumstances of restricted visibility.

–Charting Practices

Fog signals are depicted by a *symbol* and appropriate *labels and notes.* In most cases, fog signals are located on fixed or floating aids to navigation. Therefore, the fog signal is charted using the appropriate symbol for the light or buoy. Information on the fog signal is included in the labels associated with the ATON. In some cases, fog signals are included on structures not normally used for navigation. In this case the *landmark* symbol (see Chapter 6) is used, and the appropriate label appended.

–Labels and Notes

Fog signals are labeled as "DIAPHONE," "HORN," "SIREN," "WHISTLE," "BELL," or "GONG." The appropriate designation (see Section R of Chart No. 1) is used as part of the characteristic of the aid. Refer to the *Light List* for a detailed presentation of the sound sequence and period.

U. S. Coast Guard ATON personnel servicing daymark and light, Miami, Florida.
Official U.S. Coast Guard Photograph

Daybeacons (Q)

According to official charting definitions in the *Desk Reference Guide,* a *daybeacon*...

> "...is an *unlighted fixed aid,* specifically designated for navigation, placed on shore or on marine sites. They are established and maintained by the U.S. Coast Guard. They are identified by their color and the shape of the daymark. Reflective borders are placed on certain daybeacons to assist the navigator using a searchlight to more readily locate them at night. The color of the reflectors has the same significance as the color of the aid." [Emphasis added.]

Key words in the above definition are "beacon" and "fixed." Contrary to the popular sense of the word "beacon," daybeacons are unlighted aids.[12] Moreover, these are fixed structures and, therefore, admonitions against

[12]According to Naish (see references), the word beacon comes from the German word *bake.* The meaning of this word in Frisia and North Germany is a signal pole or construction placed in or near the water. The plural form, *baken,* is the source of the English word *beacon.*

using floating structures (noted in the above section on buoys) for position fixing do not apply. Daybeacons are used by mariners in the same manner as lights and landmarks—e.g., to identify channels and to fix the vessel's position. The lack of lighting limits the utility of these aids for night navigation but, despite this limitation, daybeacons appear surprisingly bright in the reflected glare of the vessel's searchlight. Daybeacons include lateral daybeacons (in red or green), preferred channel daybeacons, safe water daybeacons (in red-and-white), and special-purpose daybeacons (yellow quarantine area daybeacons, regulatory warning daybeacons).

There were approximately 11,900 federally maintained daybeacons in U.S. waters in 1993, less than one-half the number of buoys. Daybeacons are often used in shallow inland waters, because these are less expensive to install and maintain than buoys. Additionally, these have the advantage of being fixed, rather than floating structures. Physically, these consist of one or more piles driven into the bottom, surmounted by signboards called daymarks.

–Charting Practices

This section provides information on charting practices for daybeacons and related information. Charting conventions consist of a *symbol* and associated *labels* to describe the characteristics of the daybeacon.

–Daybeacon Symbols

The daybeacon symbols are shown in Section Q (80 through 83) of Chart No. 1. The center of the daybeacon symbol is located at its geographic position. Daybeacons along dredged channels are also charted in their true positions, unless they are on opposite sides of a channel and plot less than 0.5 mm apart. In this case, to add clarity, the aids may be separated to 0.5 mm. However, daybeacons are not moved off ranges (see below) nor natural objects.

There are two principal standard symbols used to depict daybeacons; a *triangle* and a *square.* Triangular daybeacons (starboard hand red marks with even numbers in the IALA-B system) are typically represented by an equilateral triangle 2.0 mm on each side. (To avoid chart clutter in congested areas, a 1.5 mm triangle may be substituted.) Red triangular daybeacons are shown with a magenta fill, those with other colors (e.g., preferred channel daybeacons) are unfilled and the colors and identifying numbers or letters are included in the label.

Square daybeacons (port hand marks with odd numbers in the IALA-B system) are typically represented by a square 1.65 mm on each side (or a smaller 1.3 mm square). The square symbol is also used to represent rectangular, round, octagonal or diamond-shaped daybeacons). Green daybeacons are shown with a green fill, those with other colors (e.g., preferred channel, safe water, or special purpose daybeacons) are left unfilled, and the colors and identifying numbers or letters are included in the label.

Figure 5–7 shows daybeacons in the vicinity of Hereford Inlet, New Jersey.

–Daybeacon Labels

Labels include the color(s) of the daybeacon and the identifying numbers and letter(s), charted in black vertical type.[13] Color choices include red (starboard hand markers), designated with an "R," red and green (junction beacons with preferred channel to port), designated with an "RG," red and white (fairway beacons), designated with an "RW," green (port hand markers), designated with a "G,"

[13]Note that these are depicted in upright letters, rather than italics, because these are fixed structures.

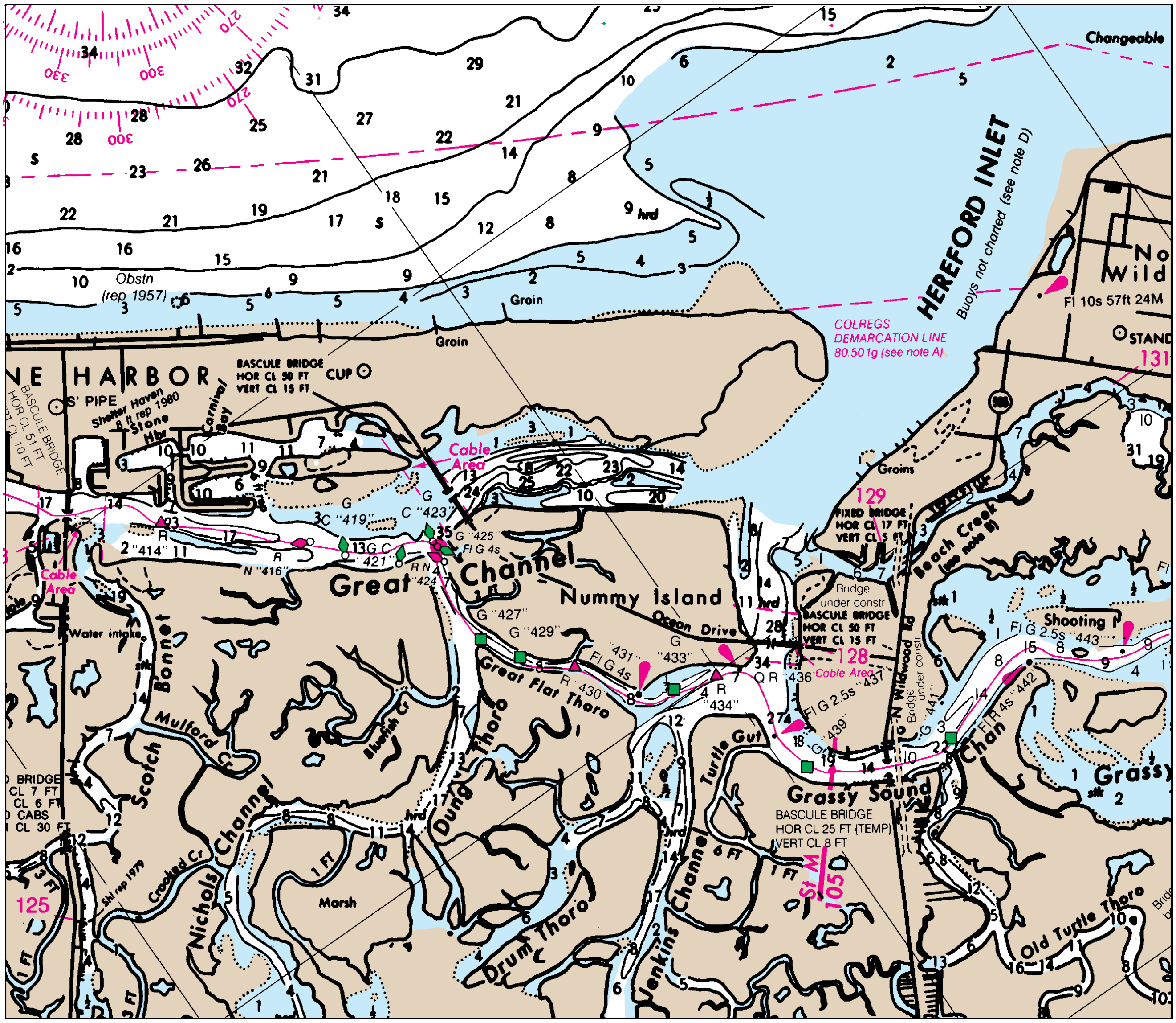


Fig. 5-7. Excerpt from NOS Chart No. 12316 (Little Egg Harbor to Cape May, New Jersey). Note that the buoys in Hereford Inlet are not charted. Note also the daymark symbols marking the Great Flat Thoro. Cupolas and a standpipe can be seen as landmarks. Lights, lighted, and unlighted buoys are also shown.

green and red (junction beacons with preferred channel to starboard), designated with a "GR," yellow (quarantine area, practice area), designated with a "Y," and white (regulatory warning, state boundary), designated with a "W."

Numbers and letters are charted as appropriate. The abbreviation "Bn" is used to depict daybeacons which do not have identifying numbers or letters.

Daybeacons that have information written on the dayboards may have that information (e.g., "Rock") charted as an optional part of the aid characteristic. Private daybeacons are labeled "Priv."

Ranges (M)

According to the *Light List, ranges...*

> "are non-lateral aids to navigation systems employing dual beacons which, when the structures appear to be in line, assist the mariner in maintaining a safe course. The appropriate nautical chart must be consulted when using ranges to determine whether the range marks the centerline of the navigation channel and also what section of the range may be safely traversed. Ranges display rectangular dayboards of various colors and are generally, but not always lighted. When lighted, ranges may display lights of any color."

As constructed, a range consists of two beacons, one is called the front range marker and is lower in height than the other, called the rear range marker. The rear marker is usually located some distance from the front marker. (Often the front range marker is on a fixed structure in the water, and the rear range marker is on land.) When these two markers appear directly in line (one behind the other, but both visible because the rear marker is higher) they are said to be "in range," or "in transit" in British usage. The line defined by the range is called a "range line" or "leading line." Daybeacons and other charted objects forming a range are often called "leading marks." Likewise range lights are sometimes termed "leading lights."

Approaching the front range marker, if the two marks are exactly in range, the vessel's position is exactly along the range line. If the lower marker is to the left (right), the vessel must alter course to the left (right) to rejoin the range. Because of geometric considerations, the horizontal angle between the range markers seen by a vessel a fixed distance away from the channel centerline *increases* with decreasing distance (Brogden). Thus, the sensitivity of the angle to side-to-side excursions increases as the vessel draws closer to the markers. The range markers provide an accurate and easily obtained line of position. Artificial ranges (lighted or unlighted) have been installed in line with channels in many ports. In cases, such as the Delaware River, where the river has many bends, separate ranges mark each of the straight sections, and navigation amounts to following a sequence of ranges throughout the voyage. Most ranges are aligned with the center of the channel, but in some areas more than one range is used to define the inbound and outbound ranges of the channel.

Range lights may be of any standard light color or period, the principal requirement being that these stand out from their surroundings. Thus, for example, green rather than red or white lights might be used to mark a range that would be aligned with the setting sun. Most range lights show a high intensity beam within only a very narrow arc of visibility marking the channel centerline and are obscured around the remainder of the horizon. These lights appear to lose brilliance rapidly as the vessel strays from the range line. Range lights are often visible at distances considerably greater than the actual usable range, to ensure that they can be seen in adverse weather conditions.

After extensive research and testing, the USCG is preparing to install "light pipes" on many channel ranges around the country (*Professional Mariner,* 1994). These light pipes are fiberglass tubes, approximately 15 feet long and 6 inches in diameter with a special film on the inside and a light source at one end. The light pipe is placed directly in front of the boards of the range markers. The light pipes are highly conspicuous at ranges up to several miles, and—compared to conventional lights—it is much easier to detect the alignment (or misalignment) of two vertical lines of light. Light pipes will be supplied with various colors and characteristics in the same manner as conventional range lights.

–Charting Practices

Only ranges published in the *Light List* are charted. As with other ATONs charting conventions consist of a *symbol* and associated *labels.*

Range lights are separately charted as noted above in the section on lights. If the scale is too small to chart a pair of range lights individually, these are shown with one light dot and labeled, for example, "2F." A *passing light,* if installed, is generally placed on the front light of a range structure located in the water. The passing light serves as an extra precaution to alert mariners to the existence of the range light structure when approaching the light from its dark side at night. (Not all ranges are equipped with passing lights, however.) Because the passing light is of secondary importance to the range light, its characteristic is charted on a separate line below the range light label—in the same order as shown in the *Light List.* If the visibility of the passing light is included in the *Light List,* it is also included in the chart label.

–Symbol (M 1)

The range symbol is shown in Section M 1 of Chart No. 1. The usable portion of ranges is shown by a solid line to the point where the vessel should leave the range. (Defining the limits of the range is obviously of key importance for curving channels.)

From the point where the range should be left, the range is continued with a short-dashed line to the rear navigational aid.

In the event of extreme shoaling or shoaling over a large area in an improved channel, range lines may be dashed, or even omitted, through a shoaling area that is depicted by hydrography.

Figure 5–8 shows ranges used to mark a section of the upper Delaware River, as shown on NOS Chart 12314 (Delaware River, Philadelphia, PA, to Trenton, NJ).

–Range Labels

The range label shows the name of the range and the bearing of the range (in degrees true along the range in the direction of the front marker) if these are published in the *Light List* and considered useful to the mariner.

–Dredging Ranges

The USACE has established ranges in some areas to control channel maintenance dredging. These ranges (often unlighted) are not intended for navigation and are charted only as a "DREDGING RANGE." Structures comprising this range are charted as landmarks (see Chapter 6). If the dredging structure is listed in the *Light List,* the structure label provides light and fog signal information.

–Natural Ranges

Spires, cupolas, towers, tanks, and other artificial or natural features may form "natural ranges" which chart users sometimes recommend for charting. These natural ranges are not charted unless recommended by the USCG and published in the LNM.

Radiobeacons and Related Aids (S)

A brief introduction to radiobeacons provided in the *Light List* states,

> "As the first electronic navigation system of navigation, radiobeacons provided offshore coverage and also became the first all-weather electronic aid to navigation. The Coast Guard operates about 200 radiobeacons located on the Atlantic, Gulf, and Pacific coasts, and on the Great Lakes. These radiobeacons are located at lighthouses, on large buoys and along the coasts. All positions are charted.
>
> "In order to use this system, the mariner needs a radio direction finder, which is a specifically designed radio receiver with a directional antenna. This antenna is used to determine the direction of the signal being emitted by the shore station, relative to the vessel.
>
> "The basic value of the radiobeacon system lies in its simplicity of operation and its relatively low user costs, even though the results obtained may be somewhat limited. The general problems and practices of navigation when using

radiobeacons are very similar to those encountered when using visual bearings of lighthouses or other charted objects.

"A radiobeacon is basically a short range navigational aid, with ranges from 10 to 175 nautical miles. Although bearings can be obtained at greater ranges, they will be of doubtful accuracy and should be used with caution. When the distance to a radiobeacon is greater than 50 miles, a correction is usually applied to the bearing before plotting on a Mercator chart. These corrections, as well as information on accuracy of bearings, plotting, and other matters are contained in...Radio *Navigation Aids*...[or the *U.S. Coast Pilot*]."

An individual radiobeacon can be used to determine a single LOP and for tracking or homing purposes. If the vessel makes a 90° "dog leg" of known length, the approximate

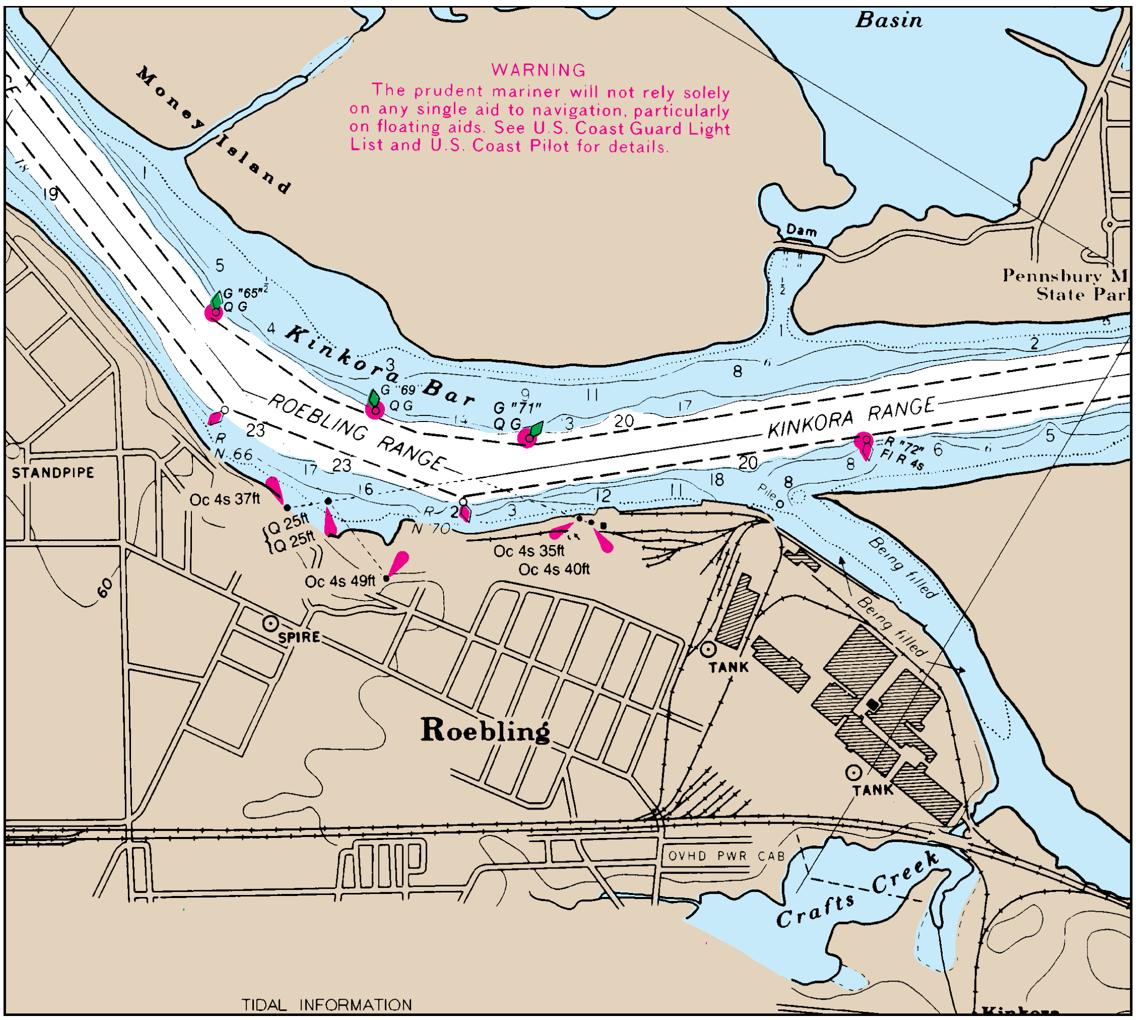


Fig. 5-8. Excerpt from NOS Chart No. 12314 (Delaware River, Philadelphia, PA, to Trenton, NJ). Three ranges are shown on this inset. The rear range marker for the Kinkora Range is an occulting white light with a 4-second period. The front range marker for this same range is a quick-flashing white. The boundary between the Roebling Range and the Kinkora Range is close to the unlighted red nun "70." Green buoy "71" is a lighted quick-flashing buoy. The reason that the quick characteristic is used is that two course changes are necessary over a short distance. Landmarks shown include tanks and a spire.

distance off (Maxim) a single radiobeacon can be calculated from the length of the dog leg and the degrees of bearing change. Radiobeacons are typically located at or near-harbor entrances to maximize the utility of the homing or tracking capability of the system. The LOP from a radiobeacon can be crossed with another LOP (e.g., from a nearby radiobeacon or visual aid) to determine a fix. Mariners using radiobeacons for tracking or homing purposes are cautioned to keep track of the vessel's position so as to avoid running aground or into hazardous waters. Historical examples (see Maxim) of homing without distance checks abound. Additional material on radiobeacons can be found in the references listed at the end of this chapter (e.g., Bowditch, Dutton, Hobbs).

For many years, this system, also called *radio direction finder* (RDF), had the largest number of users of any radionavigation system. In recent years, LORAN-C and GPS have become systems of choice for marine navigation. However, many radiobeacons are being modified to broadcast differential GPS corrections, so radiobeacons will continue in service for some time to come.

Marine radiobeacons operate in the 200 to 400 kilohertz region, just beneath the AM broadcast band. These radiobeacons transmit a Morse code identifier for 50 seconds, followed by a 10-second continuous tone at the end of each operating minute:

> The function of the Morse code sequence is to provide positive identification of the radiobeacon. Positive identification of radiobeacons is as important as positive identification of any ATON. Morse code identifiers are often (but not always) an abbreviation of the facility name. Thus, for example, the two letter Morse code identifier for Cape May is "CM," and that for Barnegat Inlet is "BI." However, there are exceptions (Cape Henry, for example, carries the identifier "CB"), so it is necessary to consult the *Light List* for authoritative information. The *Light List* provides the Morse symbols (e.g., Cape May is –.–. – –) so it is not necessary to know Morse code to use the system.
>
> The function of the continuous tone is to provide the best signal for determining an "aural null" in rotating the antenna to determine the bearing to the station.

–Charting Practices

All marine radiobeacons transmitting signals in areas where hydrography and other navigational information is provided are charted. The useful range of the radiobeacon, along with other pertinent information for radiobeacons in U.S. waters is provided in the *Light List.* On charts of scale 1:500,000 and smaller, radiobeacons are not shown if the chart does not permit navigation within their range. (Low power radiobeacons with a useful range of 10 miles or less are normally omitted from small-scale charts where larger scale charts are available.)

This section provides information on charting practices for radiobeacons and related information. Charting conventions consist of a radiobeacon *symbol* and *associated label(s).*

–Symbol (S 1)

Most radiobeacons are collocated with another visual aid to navigation. If so, the chart symbol will include that for the co-located aid, together with a radiobeacon symbol (see Section S 1 of Chart No. 1) consisting of a 7.1 mm diameter magenta circle centered on the position of the aid. For stand-alone radiobeacons, the black "position accurate" landmark symbol (see Chapter 6) is placed at the center of the magenta circle.

–Labels

In addition to providing information about the "host aid" (e.g., buoy, light, etc.), if one exists, the label provides information about the radiobeacon. The label is given in black vertical type if the antenna is attached to a fixed aid, and italic type if the antenna is attached to a floating aid.

The label includes the abbreviation "R Bn," the frequency (in kilohertz), and the Morse code characteristics, regardless of the chart scale.

–Aeronautical Radiobeacons

Aeronautical radiobeacons (which operate on similar frequencies to marine radiobeacons and can be received by the same equipment) are sometimes useful for marine navigation, particularly if located in close proximity to the coastline or if there is no rough terrain between the beacons and the coastline that might distort signal propagation.

If charted, the aeronautical radiobeacon is depicted with a black "position accurate" landmark symbol and a 7.1 mm diameter magenta circle centered on the landmark symbol. A label in conventional black type is placed adjacent to the symbol and clear of the magenta circle. The label includes the abbreviation "AERO R Bn" and the frequency and characteristics of the radiobeacon.

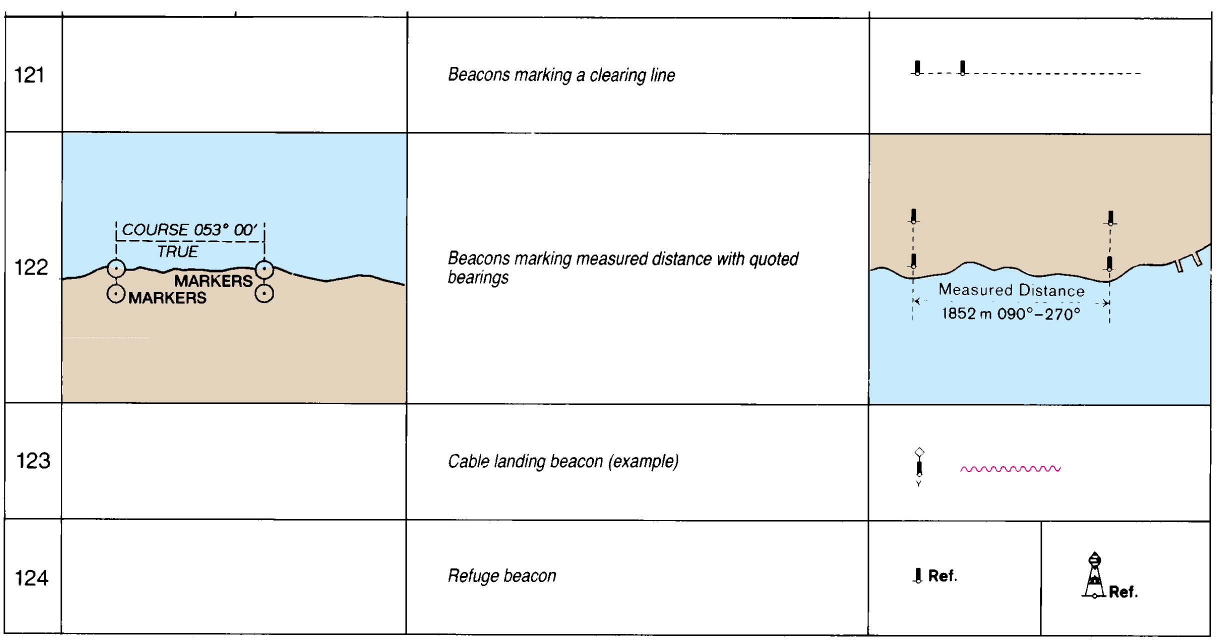
Miscellaneous Related Information

Nautical charts also include information on courses, recommended and alternate courses, routing systems, traffic schemes, and areas and limits. These are discussed in Chapter 7. Trial courses, however are included in this chapter.

–Measured Course (Q 122)

A *trial course* is a course at sea, the ends of which are marked by ranges ashore and the length of which has been accurately measured. Trial courses are used by vessels to calibrate logs and other instruments that measure speed, as well as to prepare graphs or tables of engine *revolutions per minute* (RPM) versus speed through the water. (See Maxim or other references for details.)

A standard symbol (see the excerpt noted in Section Q 122 from Chart No. 1 and reproduced here in figure 5–9) is used to mark the range or measured course ashore. The course and length of the trial course are indicated by a label.



121		*Beacons marking a clearing line*	
122	COURSE 053° 00′ TRUE MARKERS MARKERS	*Beacons marking measured distance with quoted bearings*	Measured Distance 1852 m 090°–270°
123		*Cable landing beacon (example)*	
124		*Refuge beacon*	Ref. / Ref.

Fig. 5-9. Trial course symbols shown on Chart No. 1.

U.S. Coast Guard Buoy Tender passing by green-lighted radar-reflective buoy. Angle of buoy suggests current is moving from right to left in this photograph. Approximately 4,600 lighted buoys mark U.S. waters.
Official U.S. Coast Guard photograph.

Concluding Remarks

As noted, this chapter is long and quite detailed. Nonetheless, the information presented is very important, and bears reading (preferably with a nautical chart and Chart No. 1 readily at hand) and rereading to ensure complete familiarity with this important topic.

Unlike many of the other objects or features depicted on the chart, ATONs are deliberately placed so as to optimize information provided to the mariner. Because the cost of establishment and periodic maintenance are sufficiently high, ATONs are not casually placed. So it is certain that if an ATON has been put in a given place, it is because this location has real significance to the mariner. Therefore, it is particularly important that the mariner be familiar with the uses, significance, and chart conventions employed to depict this aid.

"The consequences [of poor cartography] could be dire. During the Napoleonic Wars, British losses by shipwreck, caused by bad charts as **well** *as bad weather, were eight times as great as those inflicted by the enemy.*

Wilford

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———: *Daybeacon.*

———: *Light.*

———: Marker.

———: Obscured Sector.

———: Range Line.

———: Riprap.

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CHAPTER 6

"Even with the best charts, we are cautious about fixing our position, for it is so easy to goof. And the easiest way of all is by taking a mark, assuming it is the right one, and ignoring any others that may be in sight."

Patrick Ellam

Landmarks

Introduction and Overview

According to accepted NOAA *Nautical Chart Manual* nomenclature, a *landmark...*

> "...is any fixed natural or artificial object on land which is prominent from seaward and can be used in determining a direction or position. The term excludes objects expressly erected for navigational purposes such as lights or daybeacons. Prominence is the first requisite for a landmark, but ease of positive identification is also important. The unusual or unique feature may qualify as a landmark because it is easy to identify although not particularly prominent."

A more complete list of landmarks typically charted is provided later in this chapter. Briefly, however, landmarks include such objects as buildings, stacks, tanks, domes, towers of various descriptions, spires and radio antennas. (Not all of these objects in a given area would be charted as landmarks, however.) Often, as in the examples presented in this brief list, landmarks are *artificial features.* But landmarks also include *prominent natural features* such as a mountain peak, glacier, volcano, cliffs, or other suitable natural objects.[1]

This chapter provides information on the type and utility of landmarks and how these are depicted on nautical charts. This chapter also identifies sources of additional information (e.g., the *U.S. Coast Pilot, Chart No. 1, United States of America Nautical Chart Abbreviations and Terms* and the *Light List*), which supplement that provided on the nautical chart. Finally, the chapter concludes with practical pointers on the selection of landmarks for navigation and why landmarks are sometimes not seen or identified when underway.

Importance of Landmarks in Coastal Navigation

All mariners, with varying degrees of formality, employ landmarks for navigation. Used in conjunction with "seaman's eye" or informal navigation, landmarks serve to determine an approximate position, define hazardous areas, provide directions for harbor

[1]It is important that natural features have clearly defined reference points that can be accurately located if these are to be charted as *landmarks.* Mountains with rounded peaks would probably *not* be charted as landmarks, although the topography would be shown.

entry, etc. For example, directions to a favorite anchorage based on recent local knowledge might be given as:

> "Stay in the main river channel until passing the red brick pump house on the left (when northbound) then alter course to starboard until the bow is aligned with the blue A-frame building between the flagpole and the marina and the stern with the pump house. Continue along an imaginary line joining these two landmarks until well past the small island on the right-hand side, then turn to port...."

More formally, landmarks are *charted* objects used for determining *LOP* (e.g., with a hand-bearing compass or radar)[2] and *circles of position* (e.g., with radar or an optical range finder for landmarks with charted height information) so as to determine a fix or estimated position for the vessel. Table 6–1 provides both general and specific illustrations of how information derived from landmarks can be used for marine navigation. As with ATONs, discussed in Chapter 5, landmarks can be used to fix the vessel's position, to serve as the visual equivalent of radio beacons for homing or tracking purposes, to evaluate whether or not a vessel is in dangerous waters (e.g., by use of a danger bearing or danger circle), to identify turn points, and for a variety of specialized purposes such as compass calibration or to determine whether or not the vessel's anchor is dragging. Included in the list of references at the end of this chapter are texts that discuss these topics in detail. Names enclosed in parentheses (e. g., Bowditch) denote particularly pertinent references.

In short, *charted landmarks are the logical equivalent of shore-based ATONs for use in coastal waters.* If accurately charted (more below), detectable, and readily identifiable, these can be superior to the use of floating ATONs (buoys)—recall that fixed structures are preferable to floating structures for position determination. In some areas of high population density or numerous conspicuous natural features, charted landmarks are actually more numerous than charted ATONs.

Table 6-1. Utility of Landmarks Shown on Nautical Chart

GENERAL:

- **Used for determining range or bearing by visual means (or radar) in coastal waters so as to determine a fix or estimated position;**

SPECIFIC ILLUSTRATIONS:

- **Used for determination of fix, running fix, estimated position, set and drift of current;**
- **Used for plotting danger bearings, danger circles, horizontal danger angles;**
- **Used (in conjunction with danger bearing or circle) for evaluation of vessel's position with respect to unobservable hazards to navigation;**
- **Used for establishing vessel turning bearings;**
- **Used as visual equivalent of RDF beacon for homing or tracking purposes;**
- **Used for compass calibration; and**
- **Used for determining whether or not an anchor is dragging.[a]**

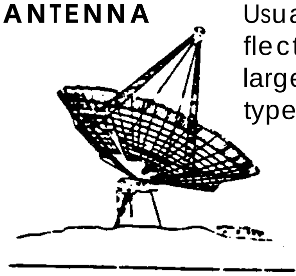
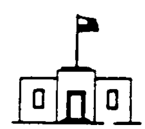
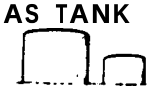
[a] The landmark need not be charted for this purpose.

[2] Landmarks are generally selected so as to be detectable and identifiable from the sea by visual means. Some may be detectable and identifiable by radar, but charting as a landmark offers no guarantee that the object can be detected and identified by radar. In particular, landmarks in built-up areas, such as cities, are often "lost" among many land returns.

Types of Landmark

Table 6–2 provides a list of the more common artificial landmarks depicted on nautical charts, together with pertinent brief remarks. Refer to the Glossary given in appendix A for more complete definitions. It is worthwhile to study these and to gain practical familiarity with landmarks by systematically comparing the chart representation of landmarks in your area with the physical appearance of the object. These “training sessions” can be made an enjoyable part of each cruise. An experienced navigator can often form a highly accurate mental picture of landmarks to be found in unfamiliar waters merely by studying the chart.

Table 6-2. Illustrative Landmarks

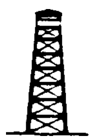
ANTENNA 	Usually reserved for those reflecting antennas which are large in size and of open or grid-type construction.	**DOME (RADAR)** 	A dome known to contain radar type of equipment shall be charted as DOME (RADAR). If the radar use is not known, simply chart as DOME. Their appearance looks like a large “golf ball.”
BUILDING 	See HOUSE.	**FLAGPOLE** 	A single staff flagpole rising from the ground and not attached to a building.
CHIMNEY 	A relatively small, upright structure projecting above a building for the conveyance of smoke.	**FLAGSTAFF** 	A flagpole rising from a building is not necessarily the most prominent part of a building for landmark recognition purposes.
CUPOLA 	A turret or small dome-shaped tower which rises from a building and is small compared to the building.	**FLAG TOWER** 	Any scaffoldlike tower on which flags are hoisted, such as a Coast Guard Skeleton steel flagpole.
DOME 	A large, hemispherical cupola, or a roof that is rounded or many sided. Their appearance looks like a large “golf ball.”	**GAS TANK**  or **OIL TANK**	Since a gas or oil tank differs in shape and size from a water tank, the compound name is used. These are usually cylindrical.

Continued on next page

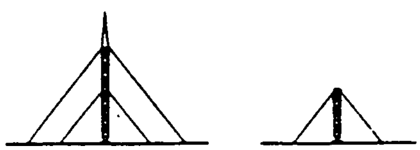
Table 6-2. Illustrative Landmarks (*continued*)

HOUSE or BUILDING
Charted when the building itself is the landmark.

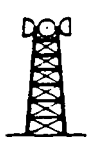
LOOKOUT TOWER
Any tower, usually of open construction, surmounted by a small house in which a watch is habitually kept, such as a Coast Guard Lookout Tower or a Fire Lookout Tower.



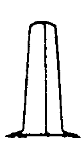
LORAN-C STATIONS
(*See:* Appendix A. Glossary.)



MICRO TR
A tower which contains microwave transmitters and receivers, used in the transmission of communication signals.



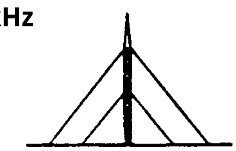
MONUMENT
A structure, such as a building or sculpture, erected as a memorial. Also used to denote a boundary marker for surveying or other purposes. There is no standard size or shape to a monument. Some, such as the Washington Monument, resemble an obelisk (i.e., a four-sided shaft that tapers to a pyramidal point), others assume a variety of shapes.



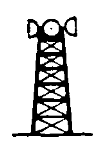
OIL TANK
See GAS TANK.

RADIO MAST
RADIO TOWER
Radio towers and radio masts are metal structures used to elevate antennas. A RADIO TOWER is a tall structure usually of open lattice-type construction and always self-supporting. A RADIO MAST is a very tall slim structure held vertical by guylines.

RADIO TOWER
KAGT
1340 kHz



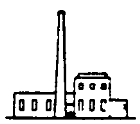
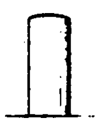
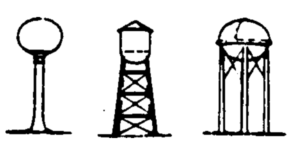
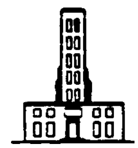
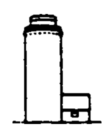
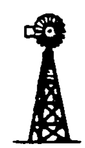
RADIO MAST 1015 FT
(TV, FM)
(STROBE, R LTS)



RADIO TOWER 215 ft
(MICROWAVE) or
MICRO TOWER

Continued on next page

Table 6-2. Illustrative Landmarks *(continued)*

SPIRE 	A slender point structure surmounting a building. It is rarely broken by stages or other features. The term SPIRE is not applicable to a short pyramid-shaped structure rising from a tower or belfry. Spires are often seen atop churches.
STACK 	This term is 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.
STANDPIPE; S'PIPE 	A tall cylindrical structure in a waterworks system, the height of which is several times greater than the diameter.
TANK 	A water tank elevated high above the ground by a tall skeleton framework or support. The word "elevated" is omitted since a tank would not be a landmark unless elevated.
TOWER; TR 	That part of a structure higher than the rest, but having vertical sides for the greater part of the height. Any enclosed structure, whether or not its sides are vertical, with base on the ground and high in proportion to its base.
TREE 	"Lone tree" or "conspicuous tree," are not used since the adjective is assumed. Otherwise the tree would not serve as a landmark.
WATER TOWER 	A decorative structure enclosing a tank or standpipe. Its appearance may prevent its being recognized as a water tank or standpipe.
WINDMILL 	A self-explanatory term.

OTHER EXAMPLES OF LANDMARKS NOT ILLUSTRATED ABOVE THAT MAY BE USED ON CHARTS:

Battery, Blockhouse, Buddhist Temple, Camping Site, Capitol, Castle, Cemetery, Chapel, Church, Church Tower, Church Spire, Church Cupola, Company, Courthouse, Cross, Elevator, Factory, Flare Stack, Fort, Fortified Structure, Gable, Government House, High School, Hotel, Institute, Josshouse, Magazine, Marabout, Minaret, Mine, Mosque, Pagoda, Pavilion, Quarry, School, Shinto Shrine, Silo, Small Fort, Telegraph, Telephone, Temple, Tomb, University, Well, Windmotor.

Sources: *Desk Reference Guide,* Bowditch, Chart No. 1.

For most landmarks (e.g., buildings, churches, radio towers), object definitions are familiar and the mariner should have little or no difficulty correlating the chart representation with the physical appearance of the object. In some cases (e.g., cupola, dome, chimney, stack), the definitions are more subtle and/or the objects may be less familiar so more study and on-the-water comparisons are appropriate.

Objects Not Normally Depicted As Landmarks

There are also several classes of objects that are *not typically selected as landmarks* on nautical charts. (These objects may be shown on certain charts in areas where suitable landmarks are few and far between.) Table 6–3 provides a list of those either intentionally or unintentionally omitted. In the main, the reasons for not selecting these objects as landmarks are obvious. For example, objects of a temporary nature, such as a construction crane, would be a poor choice for a landmark since the object would probably be moved to another location by the time that the chart was printed.

Trees are another example of an object not normally charted as a landmark. Think of the consequences, for example, if the tree were struck by lightning or chopped down. Even worse, suppose there were another tree standing one-half mile away!

The charting of movable objects as landmarks is generally avoided. A gantry crane at a shipyard may be a very prominent feature, but it would not have a fixed geographic position and, therefore, would have little utility for precise fixing of a vessel's position.

Signs are not typically charted as landmarks. However, an unusually conspicuous sign, especially in an area without other suitable landmarks, may be charted. The elevation and lighting of the sign are considered in making the determination of whether or not to select the sign as a landmark. Signboards displaying navigational information may be considered as landmarks if they display navigationally relevant information, for example, signboards used to mark distances along a waterway. As another example, signs providing water-level information are normally charted even if not visible from a distance.

Table 6-3. Items Generally Not Charted as Landmarks on the Nautical Chart

INTENTIONALLY NOT SELECTED:

- **Objects of a temporary nature (e.g., vertical construction crane, exploratory oil-drilling rig, dredge);**
- **Inconspicuous objects, unless specifically requested by a competent authoritative source (e.g., survey tower or target, object used by the USCG in buoy placement);**
- **Objects which move in position;**
- **Classified military objects for which no release by competent authority can be obtained;**
- **Signs, unless unusually tall, large, or otherwise conspicuous or in an area devoid of other objects of landmark value;**
- **Multiple objects of the same type very close together or in a relatively small area (in this case only the tallest or largest items, and/or those on the outer limits of the complex will be charted);**
- **Trees unless (in exceptional circumstances) no other visual references are available to the mariner; or**
- **Omni stations, unless recommended by a reliable source.**

UNINTENTIONALLY OMITTED:

- **Objects missed in a previous survey or those which have been constructed since the last survey.**

It may come as a surprise to some readers that not all items potentially suitable as landmarks are actually charted. To be sure, in sparsely populated flat land areas, nearly all suitable landmarks would be charted. But in built-up areas, only a few otherwise suitable objects would be plotted as landmarks.[3] For example, large cities, such as Boston, New York, and Philadelphia, have literally thousands of buildings that might be suitable landmarks. However, in practice only a handful—those believed sufficient for safe and efficient navigation—are actually depicted as landmarks on the chart. Figure 6–1 provides such an illustration for the Philadelphia, PA–Camden, NJ, area. Indeed, one of the criteria for charting landmarks in the *Desk Reference Guide,* is that "consideration should be given to the number and quality of other charted landmarks or reported objects of landmark value in the area." Therefore, the mariner should not expect that the nautical chart will depict *all* possible structures as landmarks. Generally, this poses no particular problem to the informed mariner. But while underway this can sometimes lead to confusion and identification problems. For example, several water tanks may be visible in an area in which only one or two are charted. In this case, the mariner might be faced with the problem of "which of the tanks in view are those charted?"

How Landmarks Are Depicted on the Chart

Landmarks are charted in the exact position reported on source documents. Both a *symbol* and one or more *labels* usually accompany a charted landmark.

–Symbols

In certain cases, the outline shape of a prominent structure may be charted to scale if it is relatively large or of particular interest and of landmark value (e.g., the Pentagon, Fort McHenry). More typically, however, landmarks are charted with standard *symbols.* Landmark symbols are shown in Section E of Chart No. 1. According to the accuracy with which the landmark's location is known, the symbols include:

- An *accurate landmark symbol,* consisting of a black circle 1.18 mm (0.047") in radius with a center dot 0.25 mm (0.010") in diameter in cases where the position of the landmark is considered to be located within 10 feet of its correct geographic location.

- An *approximate landmark symbol,* consisting of a smaller black circle 0.5 mm (0.020") in radius without any center dot in cases where the landmark is less accurately located than above, but generally considered to be within 100 feet of its correct geographic location.

- An approximate landmark symbol explained above, but with the letters "PA" *(position approximate)* as part of the label in cases where the location of the object is considered to be within 101 to 300 feet of its correct geographic location. Such landmarks, sometimes referred to as *inexact position landmarks,* are only charted if they serve a "critical" navigation need.

In some cases a landmark, such as a building, will be drawn to scale and, additionally, have some contained feature depicted with the accurate or approximate position label. For example, the Customs House in Philadelphia, shown in figure 6–1 is drawn to scale. Additionally, the tower atop this building is shown as a landmark with the accurate position symbol. Identifying particular portions of structures as landmarks makes it possible to take accurate bearings.

Excepting those landmarks which are drawn to scale, charted landmarks are shown

[3]Aside from the logistics and compilation problems of charting all possible landmarks, the resultant chart (with requisite labels) would be physically impossible to produce. Moreover, NOAA is actively seeking ways to reduce chart "clutter" and make more "user-friendly" products.

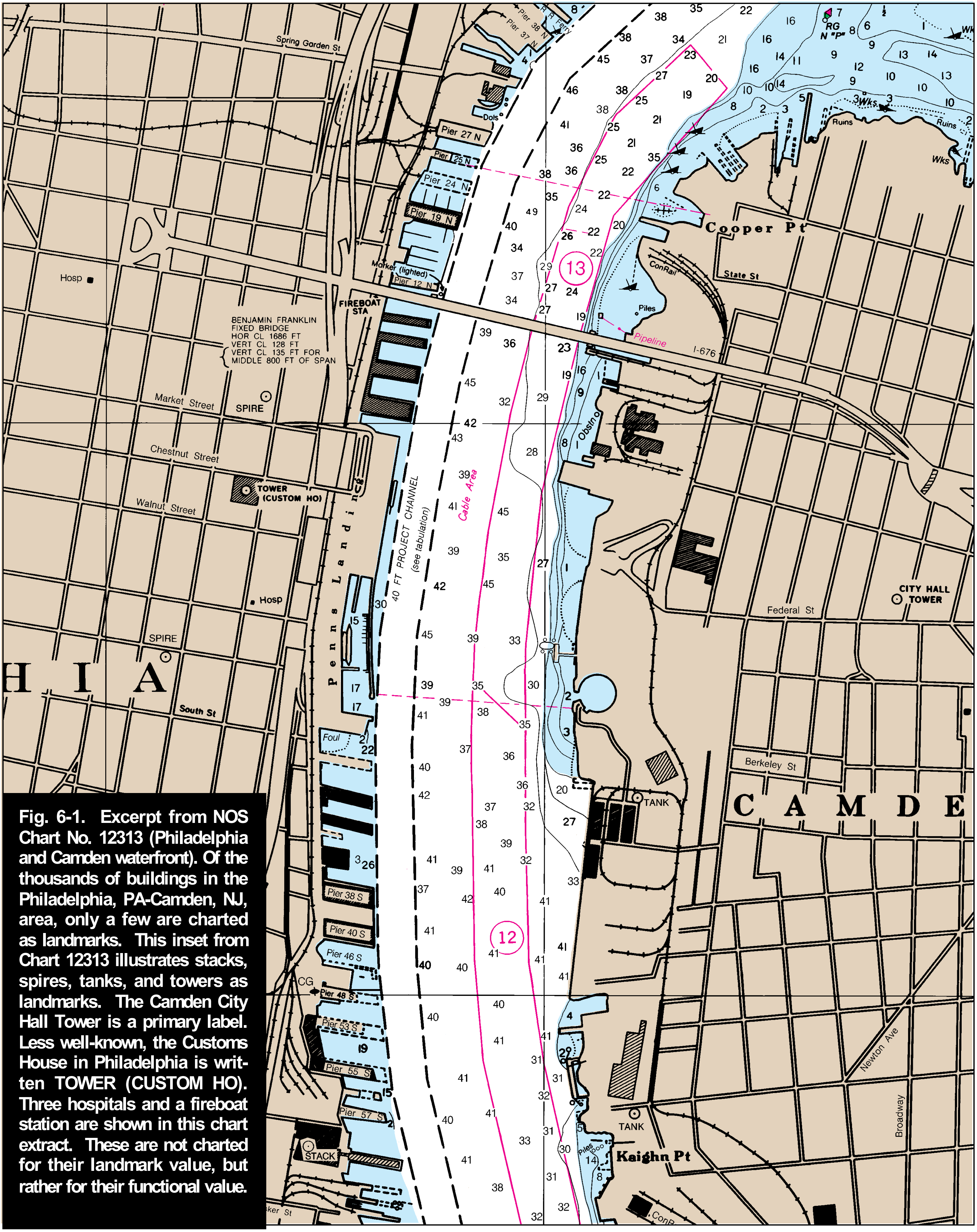


Fig. 6-1. Excerpt from NOS Chart No. 12313 (Philadelphia and Camden waterfront). Of the thousands of buildings in the Philadelphia, PA-Camden, NJ, area, only a few are charted as landmarks. This inset from Chart 12313 illustrates stacks, spires, tanks, and towers as landmarks. The Camden City Hall Tower is a primary label. Less well-known, the Customs House in Philadelphia is written TOWER (CUSTOM HO). Three hospitals and a fireboat station are shown in this chart extract. These are not charted for their landmark value, but rather for their functional value.

in only one of two sizes (1.18 mm radius circle and 0.5 mm radius circle) regardless of actual dimensions. In this sense, all landmarks are alike. Something more is clearly needed to help the navigator identify the landmark. This additional information is provided in *labels* that are printed next to the landmark symbol.

–Labels

Accompanying the landmark symbol is one or more *labels.* Labels are used to provide additional information useful in identifying the landmark. The label also provides a redundant indication of the accuracy with which a landmark is located.

The first label depicts the primary nature or descriptive term most likely to identify the object (e.g., TOWER, STACK, CHIMNEY) set in 6 pt. Newton Medium type and placed in close proximity to the landmark symbol. *Landmarks charted with the accurate landmark symbol are labeled entirely in vertical capital letters, those charted with the approximate landmark symbol are labeled with initial capitals only.* Thus, for example, a tower considered to be located within 10 feet of its correct position would include the accurate landmark symbol and the label "TOWER," whereas one located to within 100 feet of its true location would have the approximate landmark symbol and the label "Tower."[4] A tower with a location uncertainty greater than 100 feet would carry the label "Tower PA." A partial list of standardized labels and authorized abbreviations are shown in table 6–4.

Table 6-4.
Labels and Authorized Abbreviations

ANTENNA (ROUND, PARABOLIC, OR RECTANGULAR)
CHIMNEY (CHY)
CUPOLA (CUP)
DOME (a dome known to contain radar equipment shall be labeled DOME (RADAR)
FLAGPOLE (FP)
FLAGSTAFF (FS)
FLAGTOWER (F TR)
GAS TANK or OIL TANK
HOUSE or BUILDING (HO or BLDG) (if the structure encloses equipment of navigational use, a one-word description shall follow the primary level (e.g., BUILDING (VOR))
LOOKOUT TOWER (LOOK TR)
LORAN STATIONS
MICRO TR
MONUMENT (MON)
RADIO MAST (R MAST) followed by, if known, radio frequency, height, call letters. Also (TV, FM, AM, STROBE, or RLTS).
RADIO TOWER
SPIRE
STANDPIPE (S'PIPE)
TANK
TOWER (TR)
TREE
WATER TOWER
WINDMILL

Secondary and descriptive labels may be added for clarity and are enclosed in parentheses to the side or underneath the primary label. The capitalization convention for the secondary label(s) is the same as that for the primary label. Consider a lighthouse, for example. If operational, this would *not* be considered a landmark—rather it would be included as an ATON (see Chapter 5). However, if no longer used as a lighthouse, it would be classed as a "tower." But, because the term "tower" includes many different types of structures, it is desirable to add a secondary or descriptive label, "abandoned lighthouse," to supplement the primary label. Accordingly, such a landmark (if accurately located) would be labeled TOWER (ABAND LT HO).

Names of certain locally well-known buildings may be shown as secondary labels to facilitate identification. For example, DOME

[4]The lone exception to this rule is the case where an acronym is used in the primary or secondary label of an approximately determined landmark. Here the *acronym* would be included in capital letters, e.g., Tower (USCG). The primary label would be shown in initial capitals only.

(STATE HOUSE) or BUILDING (RITZ TOWER) or TOWER (CUSTOM HO) might be shown on secondary labels. Well-known and unusually prominent landmarks are, on occasion, depicted using the name of the landmark as the primary label. For example, EMPIRE STATE BUILDING and WASHINGTON MONUMENT are shown on nautical charts.

Descriptive labels that identify the *relative size or location* or other *distinguishing characteristics* of the landmark may also be shown in parentheses following or below the primary name. When only one object of a group of similar objects is charted, the descriptive label includes the number of objects in the group. Examples include STACK (TALLEST OF THREE), HOUSE (WEST GABLE), SIGN (LIGHTED).

A descriptive label may also relate to the *shape* of the object. Examples include TANK (OBLONG), TANK (BALL), or TANK (BALL ON TEE). *Color is not normally noted*[5] in a label because this may be only temporary. *Painted names on objects are not normally shown* unless the name or abbreviation is displayed in very large and conspicuous letters that are easily identified. *The material of construction is not described in a secondary label* because the mariner usually cannot identify the material from a distance.

In some cases both a secondary name and descriptive label are included. For example:

STACK (FLARE)
(TALLEST OF THREE)

might be found in a shore side petroleum refinery.

The height of the object is also sometimes included. Heights can be used for determining the vessel's distance from the landmark (see Bowditch) and, with bearing data, to fix the vessel's position. In the case of landmarks, the height is given in feet (or meters for metric charts) measured from the top of the landmark relative to mean high water except in nontidal areas where these are measured relative to the sounding datum. Height information is provided for only a minority of charted landmarks, however.

Aircraft obstruction lights are typically regarded as secondary importance as an aid to navigation. Therefore, these are not normally charted with a light dot and magenta flare unless listed in the *Light List* and given a *Light List* number. Obstruction lights on landmark objects are not labeled unless specifically requested by a reliable source. In this case, no differentiation is made between occulting and fixed lights. For example, a stack (with accurate location) with a white strobe and red obstruction lights would be labeled:

STACK (STROBE, R LTS).

An obstruction recommended for charting as a landmark that is identified only as an aircraft obstruction light is charted with the appropriate landmark symbol and labeled:

OBSTN (R LT).

Radio structures are labeled with the type of function and height (when considered of significant importance for visual sighting). AM broadcast stations will have the call letters and frequency included in the label, as will other stations known to be used for marine navigation assistance. Here are a few examples:

RADIO MAST 862 FT
(TV)
(STROBE, R LTS)

RADIO MAST 483 FT
WSSO
1230 KHZ
(R LTS)

RADIO TOWER 315 FT
(FM, MICROWAVE)
(R LTS)

In very congested areas, a list of stations may be provided elsewhere on the chart to avoid the elimination of important topography and/or hydrography as a result of labeling.

The foregoing provides a useful summary of key charting conventions for landmarks.

[5]Color may be included, however, in *U.S. Coast Pilot* or *Light List* descriptions.

–Other Sources of Landmark Information

In most cases the position and the label(s) shown on the chart will be sufficient for the navigator to use the landmark for navigation. However, other sources may offer useful information as well.

Pictures of selected landmarks are included on the back of certain conventional and small-craft nautical charts. These photographs are very useful in identifying landmarks. For example, the back of NOS Chart No. 13221 (Narragansett Bay) contains several photographs of landmarks and ATONs in the area.

Commercially produced cruising guides of the area sometimes provide descriptions and/or photographs of landmarks.

An important source of collateral information on landmarks is the *U.S. Coast Pilot.* Imbedded in the general text and, in some areas, highlighted in a special section called "Prominent Features," the *U.S. Coast Pilot* provides information on the location, appearance, and suitability of landmarks for navigation. Guidance for the preparation and revision of the *U.S. Coast Pilot* is provided in the *Coast Pilot Manual.* Here is an excerpt from this document regarding how "Prominent Features" should be described:

> "Prominent Features. Describe the best charted landmarks for navigation, such as land formations, lights, tanks, stacks, towers, buildings, etc. Note the color, form, and height of headlands and peaks. Streaks of color in bluffs may be useful in identifying features. If objects such as mountains, hills, cliffs, islets, or rocks are recommended as landmarks, give their measured or estimated heights....
>
> " ...In highly developed areas where there are numerous charted structures, the Coast Pilot supplements the charts in two important ways: by identifying the best landmarks and by describing the structures for positive identification. Give the height, color, and painting pattern of prominent structures if available. Describe the general shape of unusual objects...."

Here are a few passages from *Volume 3, Atlantic Coast: Sandy Hook to Cape Henry* (1993) that illustrate the type of information presented:

- "When approaching Maurice River, mariners should use care and not confuse the structure of East Point Light with a private house with a tower about 1.3 miles to the east, both landmarks are similar in appearance."

- "In 1967, the monument on Liston Point was reported destroyed; and in 1983, the monument on the south side of the entrance to Hope Creek was also reported destroyed. Remains of the structure from Liston Point may exist up to 100 feet offshore and may be covered during high tide."

- "A large, cylindrical water tank, about 1.5 miles west of Ocean City Inlet, is prominent and is a good landmark while entering the inlet."

- "Assateague Light and the lookout tower on the southern tip of Assateague Island are good marks for approaching Chincoteague Inlet."

- "Abandoned Navesink Lighthouse is in a cleared space on the easternmost spur at a ground elevation of 180 feet; the two 73-foot brownstone towers, the north one octagonal and the south square, are connected by a dwelling."

As a final example, consider this description of the entrance to Bridgeport, CT, harbor, taken from *Volume 2, Atlantic Coast: Cape Cod to Sandy Hook* (1993):

> "Prominent Features. The large red and white horizontally banded stack of a power plant on Tongue Point is the most prominent landmark in this area. Other prominent landmarks include a

group of stacks on Steel Point: the towers of a high-voltage line; several church spires; a gas tank with a red-and-white checkered band at the top, on the west side of Pequonnock River; the radio towers at Pleasure Beach; the Bridgeport Harbor Light 13A. The rays of an aerolight about 1.3 miles northwestward of Stratford Point can be seen from offshore."

The *U.S. Coast Pilot* is invaluable as a supplement to nautical charts for many reasons. These few examples illustrate why this is so for the identification of landmarks.

Practical Pointers and Limitations Relevant to Landmarks

The balance of this chapter provides some practical pointers relevant to the use of charted landmarks in navigation. The first part of this section presents practical ideas on the selection of charts and landmarks for navigation. The second part addresses the important topic of why some charted landmarks may not always be able to be seen (or identified) from the vessel.

–Pointers

Perhaps the most important suggestion is to *select the largest scale chart of the area for navigation.* This point is made in several places in this manual, but it is worth restating here. Large-scale charts offer the greatest amount of detail for a small area, and offer the greatest number of charted landmarks—hence the largest number of options for position fixing. Any landmark shown on a small(er)-scale chart will also be shown on the large(er)-scale chart of the area, but many landmarks shown on large-scale charts are not depicted on small-scale charts because it is necessary to generalize charted features from large scale to small scale. As well, the *latest edition of this chart—with corrections given in the NM—*should be used. Although landmarks are relatively permanent (recall that permanence is one of the criteria for charting a landmark), they do change on occasion. Structures are torn down, and new ones are periodically constructed, so it makes sense to have the latest information at hand.

Another important point to reemphasize is that *all sources* of information should be used to fix the vessel's position—not just landmarks. Maintenance of a dead reckoning plot, use of depth information, ATONs, and other means should all be used. Knowledge of even the vessel's approximate position can be helpful in identifying landmarks that might be used for more exact fixes. Moreover, other information (e.g., the depth of water at the vessel's location) can be used to increase the confidence in—or rule out—the tentative identification of a landmark.

–Selecting Landmarks For Use

In low-lying land areas of low population density (e.g., portions of the Delaware and Virginia coast) landmarks may be few and far between, and the mariner may have little choice as to which landmarks to use. Selection guidelines for landmarks are not relevant in this case.

However, other coastal areas offer many more charted landmarks, and the mariner often has a choice of which to use for navigational purposes. Here are four useful selection criteria for suitable landmarks in cases where choices are available:

- Objects should be selected that are *detectable and readily identifiable.* Many features might be used for position fixing, but objects selected by cartographers as landmarks are likely to be conspicuous (see below). Landmarks depicted with the accurate position symbols are to be preferred over those depicted with the approximate location symbol. Refer also to the *U.S. Coast Pilot* or commercially produced cruising guides for information on the appearance of conspicuous landmarks.

- Objects selected should be in a *geometrical configuration suitable to their intended navigational purpose.* For example, if a landmark is to be used to establish a danger bearing, it should be

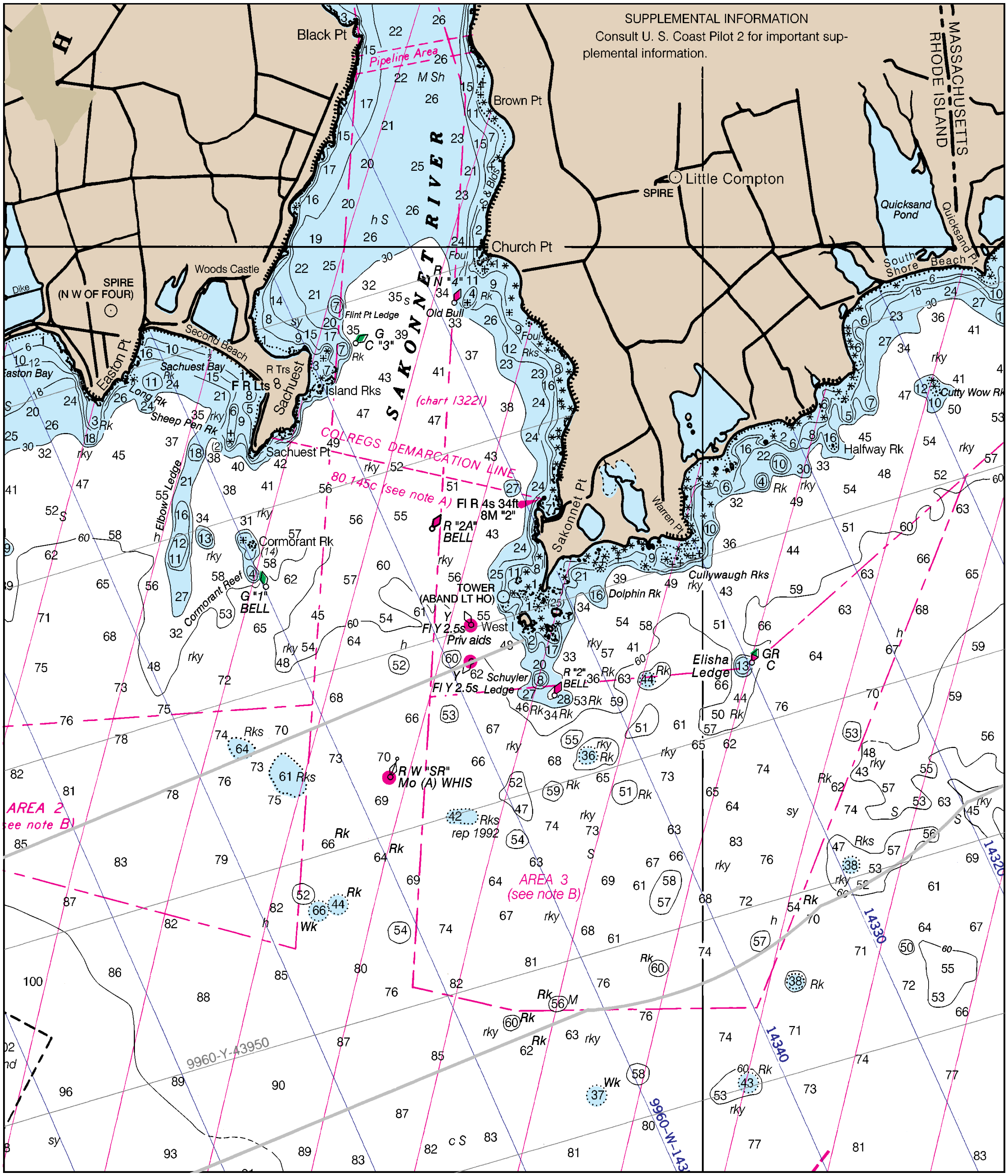


Fig. 6-2. Excerpt from NOS Chart 13218 (Martha's Vineyard to Block Island). The TOWER (ABAND LT HO) off Sakonnet Point is ideally situated to define a danger bearing to avoid Schuyler Ledge when approaching from the south. The accurately known landmark is likely to be conspicuous. Indeed, the lighthouse was probably there precisely for this purpose.

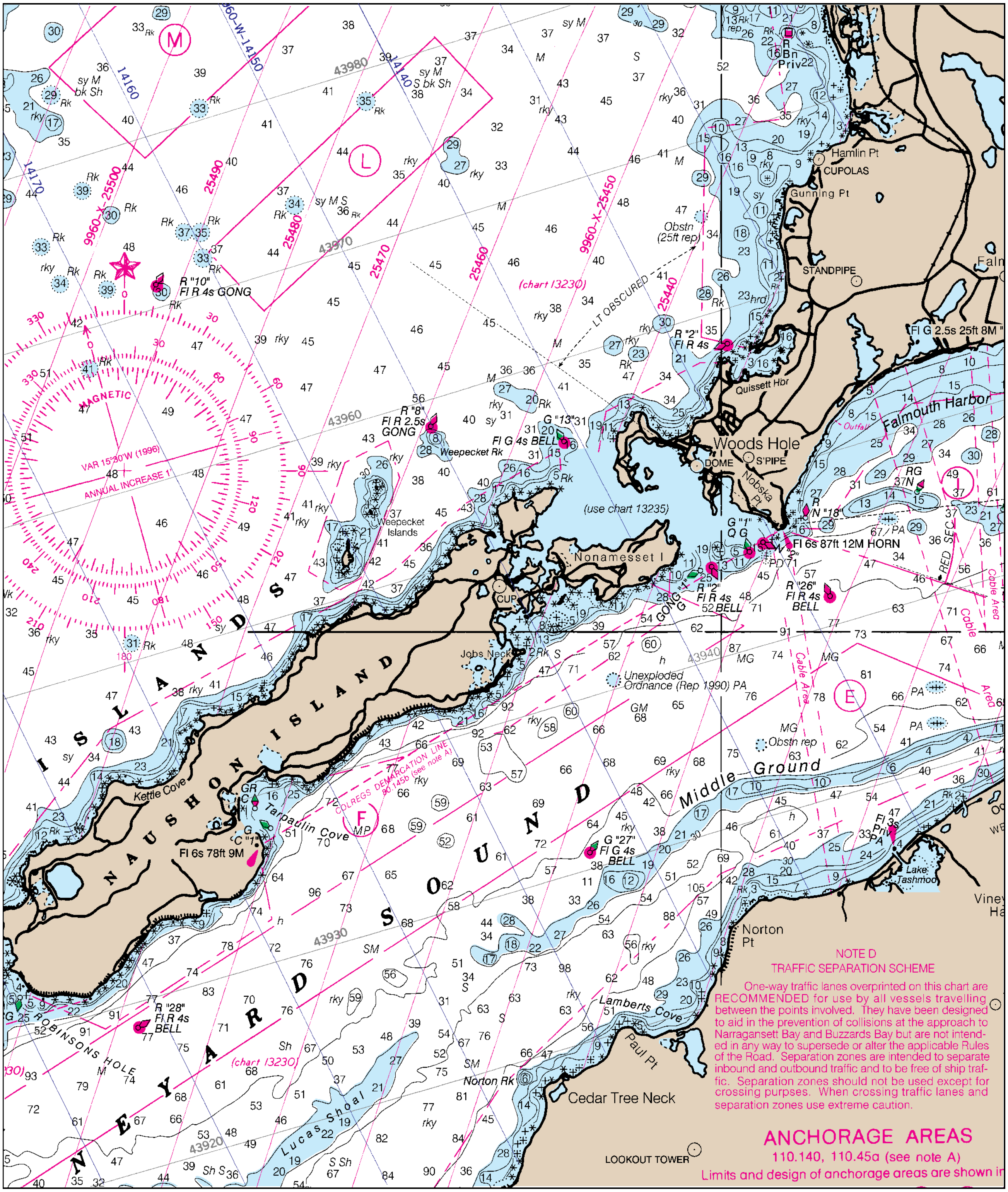


Fig. 6-3. Excerpt from NOS Chart 13218 (Martha's Vineyard to Block Island). The DOME and S'PIPE near Woods Hole would offer a poor crossing angle for a vessel attempting to fix its position in the vicinity of the Middle Ground. Use of either landmark and the CUPOLA at the east end of Naushon Island would be preferable.

appropriately positioned relative to the hazard to be avoided as illustrated in figure 6–2. If more than one landmark is to be used—as, for example, to plot a two or three bearing fix—the landmarks should be chosen so that the resulting crossing angles of the lines of position are best. For two objects, a crossing angle of 90° is optimal, and crossing angles less than 20° or 30° should be avoided. (Refer to figure 6–3 for an illustration.) For three objects, 60° crossing angles are best. (Bowditch, Maxim.) Selection criteria for horizontal sextant angles are more complex, and the reader is directed to some of the references (Bowditch, *Admiralty Manual of Navigation*) for details.

- *Landmarks closer to the vessel are generally preferable to those further away.* This is because errors in bearing (taken with a hand-bearing compass or radar) are nearly independent of the distance, and the position error associated with a given error in azimuth increases directly with distance. If a compass bearing is inaccurate by 5° (a plausible figure, see Dahl), for example, the linear error is approximately 5,300 feet if the landmark is 10 miles distant, but only about 260 feet if the landmark is 1/2 mile distant. (For more detail, see Dahl, Moody, or Brogden.)

- *Taller landmarks should generally be chosen in preference to shorter objects.* Other things being equal, taller objects can be seen at a greater distance than shorter objects due to the curvature of the earth. If He is the height of the observer's eye (in feet) and Ho is the height of the object in the same units, then maximum distance, D (in nautical miles), at which the object can be seen (as a result of the curvature of the earth (Bowditch)) is given by the equation, $D = 1.17\sqrt{He} + 1.17\sqrt{Ho}$.
Assuming a height of eye of 10 feet, a 20 foot object would be just visible over the horizon at 8.9 nautical miles, a 100 foot high object might be seen at 15.4 nautical miles. (See table 3-1.) Of course, use of this criterion depends upon the height of the object being known and recorded on the chart. Height information is not provided for all landmarks and certain tall landmarks, such as radio towers, may be difficult to see (Eyges) in hazy conditions because these are generally slender objects.

–Limitations

Even experienced mariners occasionally have trouble detecting and identifying charted landmarks (Graves, Eyges). So it is worthwhile to enumerate some of the reasons why landmarks may not be seen. These include:

- *The landmark may no longer be there.* Although landmarks are selected so as to be relatively permanent, artificial structures are occasionally destroyed by natural disasters or demolition activities. Ultimately, this fact is reported to NOAA and the chart is updated to delete the landmark, but this process takes time, and even the latest corrected chart of the area may show "phantom" landmarks.[6] Along with demolition, new construction may create problems regarding landmarks, because new structures (see below) may be confused with charted landmarks.

- *The landmark may not be visible* as a result of horizon geometry (see above) or poor atmospheric visibility. Knowledge of the vessel's approximate position and the prevailing visibility, as well as the landmark's height, can be helpful in determining whether or not a landmark is likely to be visible. Statistical visibility data for various locations

[6]In cases where changes in landmarks are viewed as critical to navigation safety, landmark changes will be reported in the *NM.* Such listing is relatively rare, however.

can be found in the *U.S. Coast Pilot*. These data can be useful for trip planning purposes. Table 6-5, for example, shows the average annual number of days with visibility less than or equal to 1/4 mile for selected locations in the United States, ranked in descending order. In Nantucket, MA, for example, poor visibility occurs an average of 96 days out of each year—approximately one day out of four. St. Croix, San Juan, Hilo, and Honolulu enjoy nearly total freedom from episodes of 1/4-mile visibility. Data in the *U.S. Coast Pilot* also show the distribution of reduced visibility episodes by month. Figure 6-4 shows this information plotted for Nantucket, MA. As can be seen, the worst months at this location are June, July, and August.

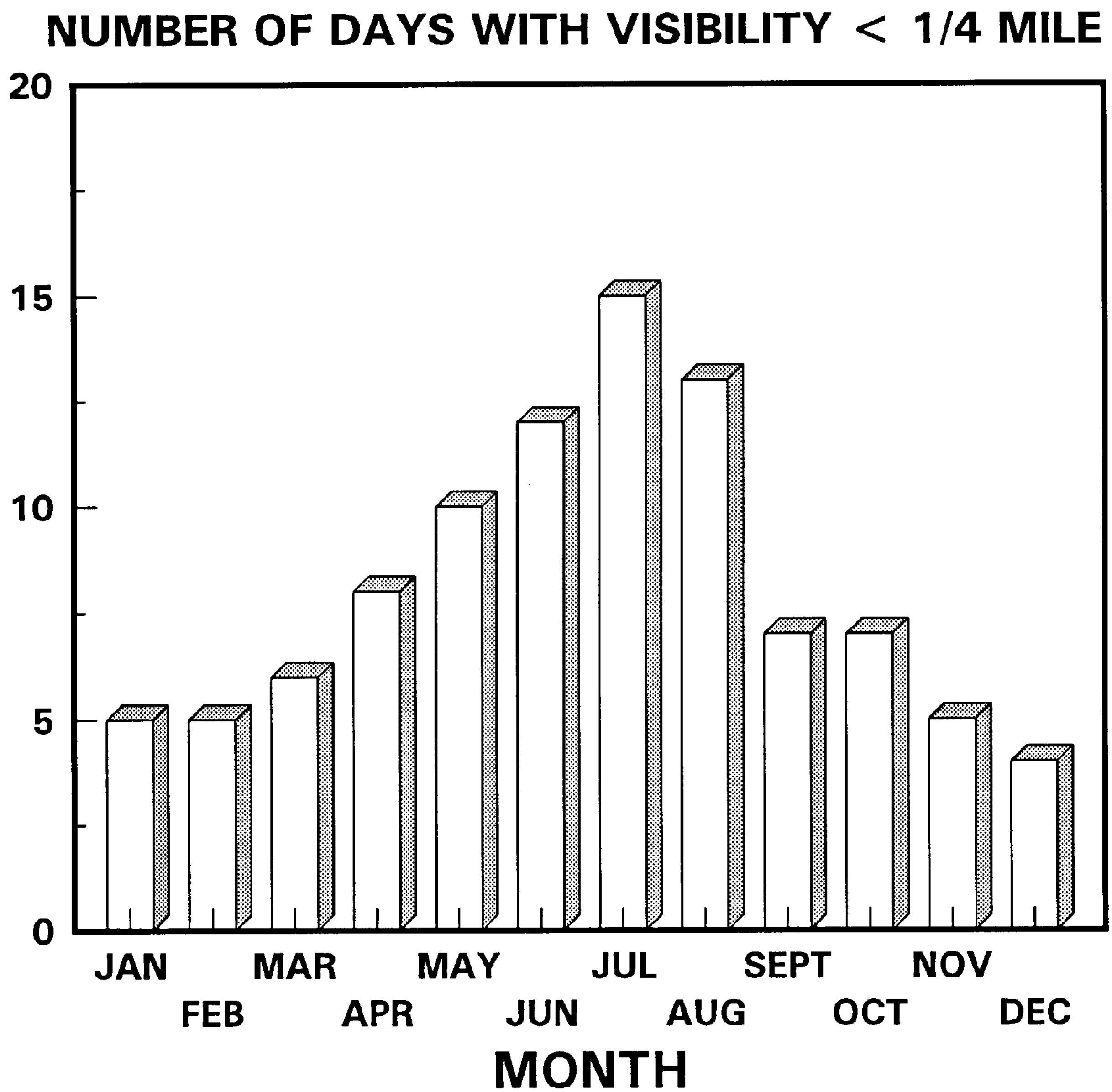
- *The landmark may be masked by other structures, terrain features, or vegetation.* At the time that an object is selected as a suitable object for charting as a landmark, a determination is made that it is "conspicuous." However, in the years since originally charted, events may have occurred which limit the visibility of the object. For landmarks in built-up areas, such as cities, new construction may have taken place which *masks* the landmarks from some or all approach angles. In rural areas, trees or other vegetation may obscure the structure—at least from some ap-

Table 6-5.
Annual Days With Visibility Less Than or Equal to 1/4 Mile for Selected Locations Ranked in Descending Order

LOCATION	STATE/ TERRITORY	ANNUAL DAYS WITH VSBY. LESS THAN OR EQUAL TO 1/4 M	LOCATION	STATE/ TERRITORY	ANNUAL DAYS WITH VSBY. LESS THAN OR EQUAL TO 1/4 M
NANTUCKET	MA	96	CORPUS CHRISTI	TX	29
BLOCK ISLAND	RI	79	CHARLESTON	SC	29
SAN FRANCISCO	CA	64	SAN DIEGO	CA	28
TATOOSH IS	WA	59	NEW HAVEN	CT	28
QUILLAYUTE	WA	49	APALACHICOLA	FL	28
EUREKA	CA	49	BROWNSVILLE	TX	27
ATLANTIC CITY	NJ	48	PROVIDENCE	RI	25
LOS ANGELES	CA	44	PHILADELPHIA	PA	25
SEATTLE	WA	43	WILMINGTON	NC	24
ASTORIA	OR	43	TAMPA	FL	24
PORT ARTHUR	TX	41	NORFOLK	VA	23
HOUSTON	TX	41	FT MEYERS	FL	23
SAVANNAH	GA	40	BOSTON	MA	23
WILMINGTON	DE	39	JUNEAU	AK	22
MOBILE	AL	39	NEWARK	NJ	20
PENSACOLA	FL	37	CAPE HATTERAS	NC	19
SACREMENTO	CA	35	ANNETTE	AK	16
JACKSONVILLE	FL	35	WASHINGTON	DC	13
PORTLAND	OR	33	WEST PALM BEACH	FL	8
NEW YORK	NY	33	MIAMI	FL	7
DAYTONA	FL	32	KEY WEST	FL	1
NEW ORLEANS	LA	31	ST CROIX	VI	0
HARTFORD	CT	30	SAN JUAN	PR	0
BRIDGEPORT	CT	30	LIHUE	HI	0
BALTIMORE	MD	30	HILO	HI	0
RICHMOND	VA	29	HONOLULU	HI	0

SOURCE: U.S. COAST PILOT

FIGURE 6-4. SEASONAL VARIATION IN THE NUMBER OF DAYS WITH REDUCED VISIBILITY AT NANTUCKET, MA: SUMMER MONTHS ARE WORST AT THIS LOCATION



SOURCE: U.S. COAST PILOT

proach angles. (In this case, landmarks may be visible in certain seasons—e.g., winter—and not in others.) Remember also that landmarks are selected to be visible from the sea, but *not necessarily from all possible approach angles.* (Inspection of terrain features and elevations can sometimes help to identify terrain masking.)

- *The detectability of an object by visual means is a complex function of atmospheric visibility, background contrast, and lighting. Landmarks may be "camouflaged"* as a result of limited contrast with background areas or because of lighting conditions at the time of observation. (See Eyges for several illustrations.)

- *The mariner may be disoriented and looking in the wrong place on the chart.* It is commonplace in navigation that it is much easier to determine your position if you already know where you are. On reflection this statement is not as trivial as it seems. A practical tip in identifying landmarks is to plot the vessel's dead reckoning position (or estimated position if one LOP is available). Then, based on this position on the chart, plot the bearings to each of the charted landmarks. Next (binoculars with a built-in compass are best) look along these plotted bearings for the landmark. If the vessel's assumed position is nearly correct (and the visibility is sufficiently great and the landmarks are above the horizon), the landmarks should be visible on bearings within a few degrees of those plotted. This technique will not work if the vessel's position is grossly in error, but can be very helpful otherwise. (For additional details, see Bright (1990).)

- The mariner may actually see the landmark, but *not be able to establish positive identification.* This may occur because of confusion among several possible objects (see below), but may also occur because of ambiguity over the identity or appearance of the object. For example, the term "tower" may be used to describe many related but different objects. Towers (not otherwise distinguished) could include structures as diverse as aircraft control towers, tall buildings (the John Hancock building in Boston, MA), and abandoned lighthouses. (In some cases a secondary label will be included to narrow down the possibilities.) The mariner should study the definitions of each of the landmark terms to maximize the possibility of correct identification.

- Finally, it sometimes occurs that several objects can be seen from the vessel, but it is not immediately apparent *which* is the charted landmark. In other words, *the landmark may be detectable but not identifiable.* For example, only some of the many water tanks in the Philadelphia–Camden area are charted as landmarks. Depending upon the vessel's position, it is not always possible to identify which are the charted landmarks. In such cases the mariner is well advised to search for other identifiable landmarks that could be used to fix the vessel's position. Even an approximate fix may be sufficient to enable correct identification of the original landmark. This technique is known as "shooting up"—measuring the bearing of—each of several candidate landmarks and choosing the one that provides a line of position that passes closest to the vessel's position. (For additional details, see Mellor.)

The competent mariner regards each voyage as a learning experience. *In cases where a landmark is missed, or misidentified, the mariner should make every attempt to determine the reason(s) why this occurred.* If the reason is that the landmark was improperly charted, the mariner should bring this matter to the attention of NOAA and USCG so that appropriate corrections can be made. Every error offers the opportunity to learn a valuable lesson.

Concluding Comments

Landmarks are very useful for coastal navigation and serve to complement the system of ATONs. Careful study of the chart conventions presented in this chapter and the definitions presented here and in the Glossary will pay dividends in improved navigational skills. Student navigators—and that includes all of us—would do well to take the opportunity of comparing the chart presentation of familiar areas with what is observable from aboard the vessel. Finally, prudent mariners do not rely on any one aid or technique for navigation. The navigator should use all available data (e.g., dead reckoning positions, ATONs, depth information, electronic position data, and visual or radar observation of landmarks) to navigate safely.

Exhortation to Apprentices of the Art of Navigation

"When so ever any Shipmaster or Mariner shall set forth from land out of any river or haven, diligently to mark what buildings, castles, towers, churches, hills, downes, windmills and other marks are standing upon the land...all of which, or many of them, let him portray with his pen, how they bear and how far distant."

A. Ashley, 1583, quoted in Naish

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CHAPTER 7

"A collision at sea can ruin your entire day."

Attributed to Thucydides,
Fifth century B.C. quoted in Heinl

Areas, Limits, Tracks, and Routes

Introduction and Overview

This chapter addresses *areas, limits, tracks,* and *route information* provided on the nautical chart. "Areas and limits" (referred to in Section N of Chart No. 1) refer to a collection of charting practices (symbols, labels, and notes) used to depict certain areas and limits of importance to the mariner. All these areas have statutory or regulatory significance (e.g., the "three mile limit," a COLREGS demarcation line, or a designated anchorage), but most also pertain to navigation safety (e.g., a danger area or safety zone). "Track/route" information (referred to in Section M of Chart No. 1) depicted on the nautical chart contains guidance (or regulations) relevant to the selection of routes and/or procedures to be followed for safe navigation. This chapter provides background, summarizes the utility of area/limit/track/route features, describes the charting conventions (e.g., symbols, labels, and notes), identifies other relevant sources of information (e.g., the *U.S. Coast Pilot),* and presents practical pointers on how this information can be used by the prudent mariner.

No attempt has been made to enumerate all areas/limits/tracks/routes depicted on the nautical chart nor to provide an exhaustive discussion of the many legal and policy issues relevant to each. Instead, the chapter focuses upon those features likely to be of greatest potential relevance to the recreational and commercial vessel operator. The omission of any charted feature in this chapter does not relieve the mariner of the responsibility of complying with any applicable regulations.

As noted above, many of the charted features discussed in this chapter have statutory or regulatory significance. This is a chart user's manual, which provides general information on the charting conventions and the types of regulations that may be applicable to designated areas. It does not purport to give legal advice pertaining to any rules or regulations summarized herein. *Mariners are advised to read carefully the general and specific regulations applicable to these areas. If in doubt, the mariner should seek advice from competent authority or legal counsel.*

Many specialized terms used in this chapter are defined in the Glossary in appendix A. Names enclosed in parentheses (e.g., Bowditch) denote references listed at the end of this chapter that contain additional relevant detail or useful general information. Letter and number designators in the subsection titles and/or text (e.g., N 1.2) refer to sections of Chart No. 1. It is recommended that Chart No. 1 be kept at hand when reading this chapter.

Utility of This Information

In most other chapters of this manual, a separate section is included on the uses of the information presented. Because of the diversity of the features treated in this chapter, this utility is best discussed on an item-by-item basis. In broad terms, however, this information is charted to alert the mariner to certain dangers to navigation (e.g., danger areas, safety zones) and/or to applicable legal requirements when entering or using these waters.

Federally Regulated Areas (N 1.2, N 2.2, N 31)

Certain waters are subject to general and permanent federal regulations, published in a multi-volume series termed the CFR. The most pertinent portions of the CFR for chart users are Title 33, *Navigation and Navigable Waters,* and Title 40, *Protection of the Environment*. Federally regulated areas include danger areas, seaplane operating areas, seaplane restricted areas, restricted areas, safety zones, defense areas, security zones, and regulated navigation areas (not otherwise classified). Although there are some differences among these areas or zones, it is convenient to discuss these as a group under the broad rubric of *federally regulated areas.*

–Regulated Navigation Areas

A *regulated navigation area* is a water area within a defined boundary for which specific regulations (in addition to the Navigation Rules) have been established. Regulated navigation areas (not otherwise classified) have been established in various areas of the waters of the United States. Regulated areas are established to prevent damage or marine casualties, to protect waterfront facilities, and to safeguard ports, harbors, and the environment. The establishment of these areas is under the jurisdiction of the USCG or the USACE.

The phrase "regulated navigation area" is sometimes used in a more general sense to include all waters for which usage or entry restrictions have been established. In this more general sense, a regulated navigation area is an inclusive term encompassing many of the areas described below.

–Danger Area

According to official charting definitions in the *Desk Reference Guide,* a *danger area...*

> "...is a specified area above, below, or within which there may exist potential danger from military, civil, natural or manmade sources. A danger area may be categorized as a prohibited area, exercise area, firing area, or missile test area."

An *exercise area* (also called a *military practice area*) is an area shown on charts within which troop, ship, or aircraft exercises are carried out. A *missile test area* is an area restricted so that missile range and reliability tests may be conducted by the military. When in use, missile debris may be deposited at frequent and irregular intervals. A *firing area* is a military target area for bombing and/or gunnery practice. A *prohibited area* is a danger area shown on nautical charts within which navigation and/or anchoring is prohibited except as authorized by appropriate authority. Danger areas are typically related to potentially hazardous military activity.

–Seaplane Restricted Areas/Seaplane Operating Areas (N 13, N 14)

As the name implies, seaplane operating areas and seaplane restricted areas refer to designated areas containing seaplane bases. The Inland Navigation Rules normally applicable to seaplane operations are changed in designated *seaplane restricted areas.* Under Rule 18 (Responsibilities Between Vessels), paragraph (d), of the Inland Navigation Rules, which applies to the conduct of vessels in sight of one another, "...a seaplane on the water shall, in general, keep well clear of all vessels and avoid impeding their navigation. In circumstances, however, where risk of collision exists, she shall comply with the Rules of this Part."

Seaplanes are in "last place" in the normal right-of-way hierarchy. However, seaplane restricted areas have been established where the conventional right-of-way hierarchy among vessel types described in Rule 18 is altered and/or vessels are prohibited from entering. For example, in the seaplane restricted area described in 33 CFR § 162.15 in Manhasset Bay, NY, the applicable rules (found in 33 CFR or in the *U.S. Coast Pilot)* read: "(1) vessels shall not anchor or moor within the restricted area" and "(2) all vessels traversing the area shall pass directly through without unnecessary delay, and shall give seaplanes the right-of-way at all times." As a practical matter, seaplanes on the water are not highly maneuverable (they cannot operate in reverse, for example, and "taxiing" or "sailing" a single-engine seaplane is not an easy skill to acquire), a fact recognized in the navigation regulations applicable to seaplane restricted areas.

As the name implies, *seaplane operating areas* are areas frequented by seaplanes. The seaplane operating area designation is typically less restrictive than a seaplane restricted area—warning mariners of the anticipated presence of seaplanes in the area but not necessarily prohibiting entry or anchoring.

Although the number of seaplane operating and restricted areas throughout the country is not large, it is important for the mariner to be aware of the special rules which govern vessel operations in these areas.

–Restricted Area (N 20)

According to official charting definitions in the *Desk Reference Guide,* a *restricted area...*

> "...is a specified area designated by an appropriate authority and shown on charts, above, below, or within which navigation is controlled in accordance with certain specified conditions. These control measures are employed to prevent or minimize danger or interference between parties using the area."

Restricted areas are typically associated with military or other federal (e.g., Federal Correctional Institutions) installations. Figure 7–1 provides an excerpt from NOS Chart No. 12283 (Annapolis Harbor) which shows, *inter alia,* a restricted area in the vicinity of the U.S. Naval Academy (Anchorage areas shown in this illustration are discussed in a later section of this chapter.).

–Safety Zones/Defense Areas/Security Zones

The *Desk Reference Guide* defines *safety zones, defense areas,* and *security zones* as follows:

> "A safety zone is a water area and/or shore area to which, for safety or environmental purposes, access is limited to authorized persons, vehicles, or vessels. It may be stationary and described by fixed limits, or it may be described as a zone around a vessel in motion.

> "A defense area is a sea area, usually including the approaches to and the waters of important ports, harbors, bays, or sounds, for the control and protection of shipping, for the safeguarding of defense installations bordering on waters of the areas, and for provision of other security measures required within the specified areas. It does not extend seaward beyond the United States territorial waters.

> "A security zone is all areas of water which are so designated by the Captain of the Port for such time as he deems necessary to prevent damage or injury to any vessel or waterfront facility, to safeguard ports, harbors, territories, or waters of the United States or to secure the observance of the rights and obligations of the United States."

Safety zones are defined to minimize safety or environmental hazards associated with non-military activities. For example,

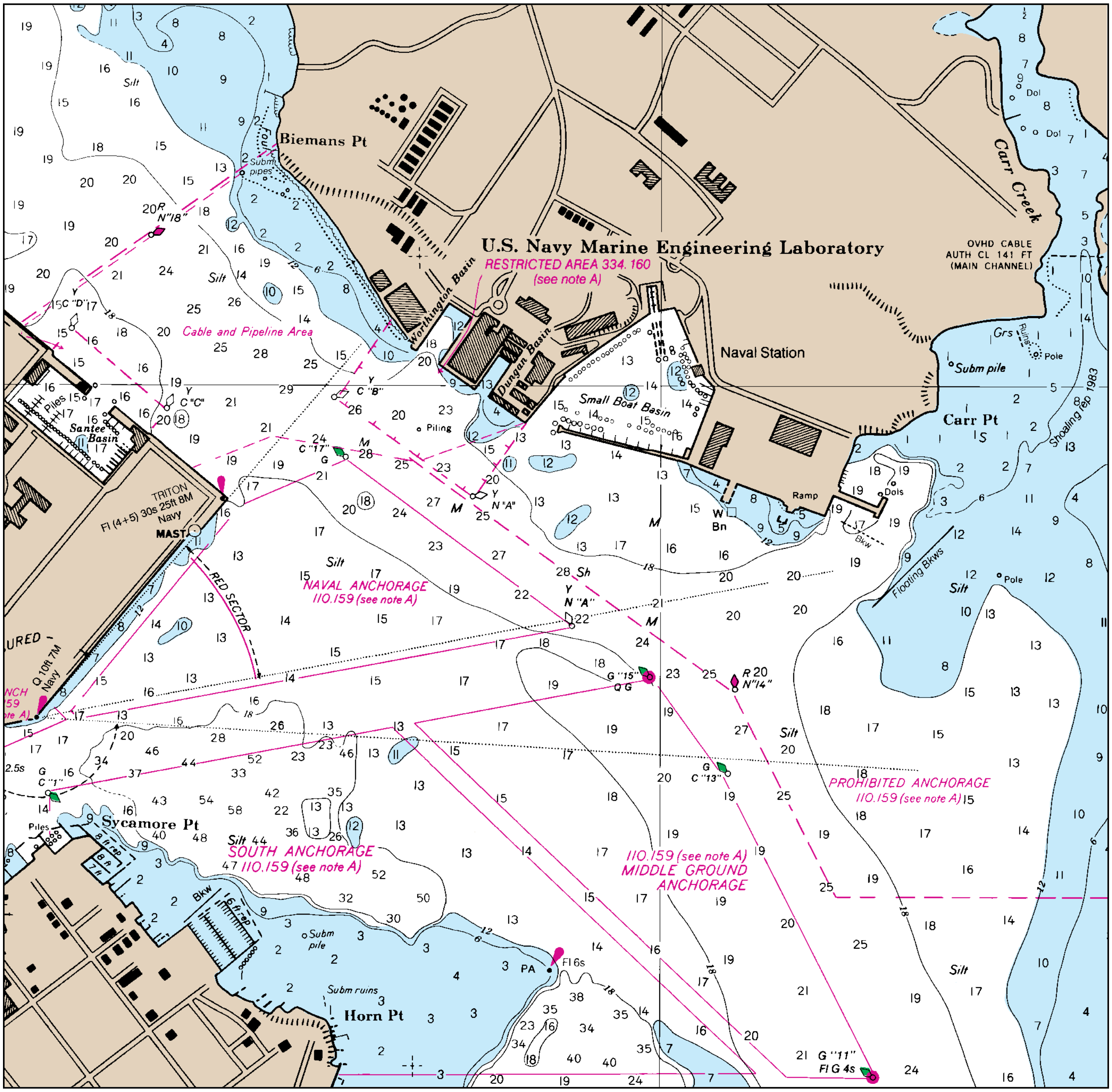

Fig. 7-1. Excerpt from NOS Chart No. 12283 (Annapolis Harbor) showing a restricted area, a prohibited anchorage, a naval anchorage, and two additional anchorages.

safety zones are typically established around facilities (berths, moorings, gas or oil transfer areas) where hazardous materials, such as *liquified natural gas* (LNG) or liquified petroleum gas products, are handled or shipped. Safety zones are also established around certain *Outer Continental Shelf* (OCS) oil and gas operations (see 33 CFR Part 147). Safety zones may be either permanent or temporary—but, for obvious reasons, only permanent safety zones are depicted on NOAA charts.

The purpose of a security zone is to safeguard vessels, harbors, parks, and waterfront facilities from destruction, loss, or injury from sabotage, or other subversive acts, accidents, or other causes of a similar nature. Security zones are generally established around military facilities, such as ammunition depots (e.g., the Naval Ammunition Depot in the vicinity of Sandy Hook Bay, NJ), submarine bases, and submarine construction yards (e.g., the waters of the Thames River near the Electric Boat Division). As with safety zones, security zones may be temporary or permanent—but only permanent security zones are depicted on NOAA charts.

–Relevance to the Mariner

Knowledge of the location, dimensions, and rules and regulations applicable to these areas is important to the mariner for obvious reasons of safety. Being hit by a stray round, torpedoed, or involved in a collision with an LNG tanker is certainly no one's idea of an interesting diversion during an otherwise routine voyage. Moreover, the penalties for unauthorized operations in federally regulated areas can be substantial, including seizure and forfeiture of the vessel, fines, and prison sentences.

–Charting Practices

This section provides information on charting practices and related information for federally regulated areas. Charting conventions consist of a *symbol* and associated *labels and notes.* With few exceptions, NOAA charts show only the type of regulated area, its location, and a CFR section number. Specific regulations applicable to the area are provided elsewhere (e.g., 33 CFR or the *U.S. Coast Pilot*).

–Symbol (e.g., N 1.2, N 2.2, N 31)

Danger area limits are charted with a dashed magenta line. To emphasize the possibility of danger in these areas, a magenta screened band may be added to highlight the dashed limit line.

Seaplane landing areas and seaplane restricted areas (N 13, N 14) are charted with a solid magenta line.

Restricted area limit lines are charted with a T-dashed magenta line.

Safety zone, defense area, and security zone limit lines are charted with a dashed magenta line.[1]

A regulated area, not otherwise classified, is depicted by magenta dashed or T-dashed limit lines. Figure 7–2 shows a regulated area (not otherwise classified) in the vicinity of the Chesapeake Bridge Tunnel as shown on NOS Chart No. 12221 (Chesapeake Bay Entrance).

These areas are charted with their exact geographic limits as defined in 33 CFR.

–Labels and Notes

Labels and notes are printed in magenta italic type. Regulated areas are identified on the chart only by the primary title of the area (e.g., labeled *"DANGER AREA," "PROHIB-*

[1]Where a defense area, safety zone, or security zone line and the three-mile-limit line coincide, the three-mile line takes precedence. The label is charted along the line.

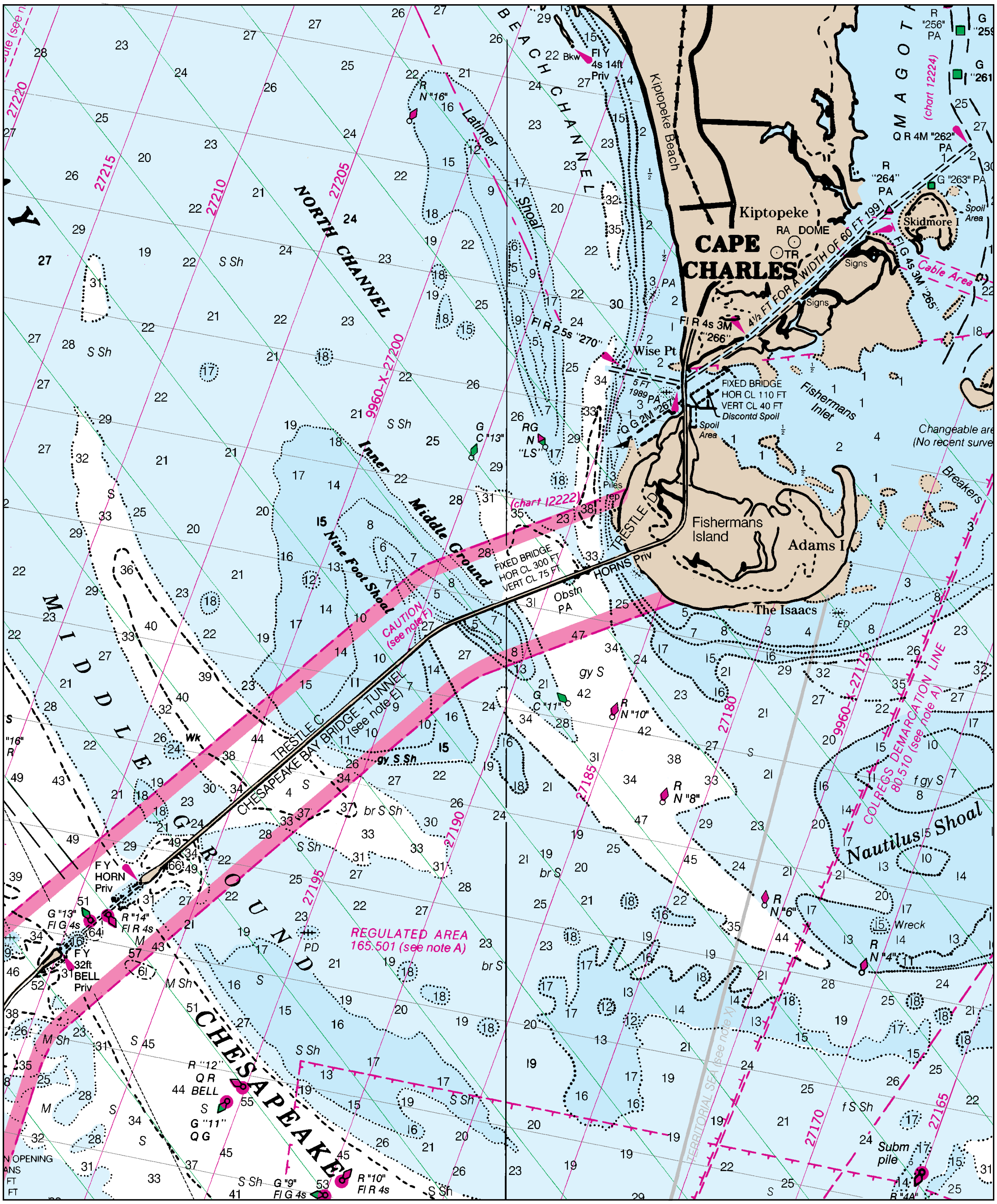

Fig. 7-2. Excerpt from NOS Chart No. 12221 (Chesapeake Bay Entrance) showing a regulated area (not otherwise classified) and other features of interest.

ITED AREA," "SAFETY ZONE," "DEFENSE AREA," "SECURITY ZONE," "REGULATED AREA," etc.), an alphanumeric designator for the area (if one has been assigned), the CFR section number, and a reference to standard note A (shown below).

For example, referring to the excerpt from NOS Chart No. 13218 (Martha's Vineyard to Block Island) presented in figure 5-3 (refer to Chapter 5), the prohibited area in the vicinity of Nomans Land is labeled as follows:

PROHIBITED AREA
334.70 (see note A)

The number 334.70 refers to the CFR section number which discusses this prohibited area. "Note A," typically found in an uncluttered land area on the chart, contains the standard text,[2]

"NOTE A

Navigation regulations are published in Chapter 2, U.S. Coast Pilot ______. Additions or revisions to Chapter 2 are published in the Notice to Mariners. Information concerning the regulations may be obtained at the Office of the Commander, ____ Coast Guard District in ______, __, or at the Office of the District Engineer, Corps of Engineers in _____, __."

Blanks in the above note are filled in with the appropriate information.

The regulations applicable to the specific regulated area are always found in Chapter 2 of the indicated volume of the *U. S. Coast Pilot.* (Except when specifically requested by appropriate authority, these regulations are *not* shown on the nautical chart, however.)

–Examples

Here is an excerpt from the text describing the *prohibited area* described in Section 334.70 of 33 CFR as contained in *U.S. Coast Pilot Volume 2 (1993) Atlantic Coast: Cape Cod to Sandy Hook:*

> " **334.70 Buzzards Bay, and adjacent waters, Mass.; danger zones for naval operations.** (a) Atlantic Ocean in vicinity of Nomans Land-(1) The area. The waters surrounding Nomans Land within an area bounded as follows:
>
> [geographic coordinates of area omitted in this citation]
>
> "(2) The regulations. No vessel shall at any time enter or remain within a rectangular portion of the area bounded on the north by a latitude 41° 16'00", on the west by longitude 70° 47' 30", or within the remainder of the area between 1 November and 30 April, inclusive, except by permission of the enforcing agency.
>
> "(3) The regulations in this paragraph shall be enforced by the Commandant, First Naval District, and such agencies as he may designate."

The textual description in the *U.S. Coast Pilot* provides information on the geographic limits of the area, applicable regulations, and the enforcing agency. The text applicable to this area in the *U.S. Coast Pilot* is relatively brief. Entries for other areas are often more detailed and may run to several pages. However, the above excerpt illustrates the general format.

Many of the areas discussed in this section have *general* as well as *specific* regula-

[2]On NOAA charts, Note A is reserved for the note listing the publications that contain navigation regulations relevant to that chart; other charted notes begin with Note B or some other reference label *even if there is no Note A on that chart.*

tions that apply. For example, the general regulations pertaining to a *safety zone* are found in 33 CFR §165.23, shown below:

> "Unless otherwise provided in this part:
>
> "a. No person may enter a safety zone unless authorized by the COTP [Captain of the Port] or the District Commander [USCG];
>
> "b. No person may bring or cause to be brought into a safety zone any vehicle, vessel, or object unless authorized by the COTP or the District Commander;
>
> "c. No person may remain in a safety zone or allow any vehicle, vessel, or object to remain in a safety zone unless authorized by the COTP or the District Commander; and
>
> "d. Each person in a safety zone who has notice of a lawful order or direction shall obey the order or direction of the COTP or District Commander issued to carry out the purposes of this subpart."

Specific regulations may amend or extend the above general regulations, and are found in the CFR (or *U.S. Coast Pilot*) in a separate section. Mariners need to consult both specific and general regulations.

As an example of specific rules pertaining to a *safety zone,* consider this entry from the *U.S. Coast Pilot Volume 3 (1993) Atlantic coast: Sandy Hook to Cape Henry* describing a safety zone located in the Chesapeake Bay:

> **§165.506 Chesapeake Bay, Hampton Roads, Elizabeth River Southern Branch Liquified Petroleum Gas Carrier Safety Zone.**
>
> "(a) The waters within 250 feet from the port and starboard sides and 300 yards from the bow and stern of a vessel that is carrying liquified petroleum gas in bulk as cargo are a safety zone while the vessel transits the Chesapeake Bay and Elizabeth River between Thimble Shoal Lighted Buoy #3 and the Atlantic Energy Terminal on the Southern Branch of the Elizabeth River.
>
> "(b)Except as provided in paragraph (c) of this section, the general safety zone regulations in §165.23 [also contained in this volume of the *U.S. Coast Pilot]* apply to the safety zone. Permission to enter the safety zone may be obtained from the Captain of the Port or a designated representative, including the duty officer at the Coast Guard Marine Safety Office, Hampton Roads, or the Coast Guard Patrol Commander.
>
> "(c) A vessel that is moored at a marine, wharf, or pier or is at anchor may remain in the safety zone while a vessel carrying liquified petroleum gas passes its location if the vessel remains at its moorage or anchorage during the period when its location is within the safety zone.
>
> "(d) A vessel that has had liquified petroleum gas in a tank is carrying the liquified petroleum gas in bulk as cargo for the purposes of paragraph (a) of this section, unless the tank has been gas free since the liquified petroleum gas was last carried as cargo.
>
> "(e) The Captain of the Port, Hampton Roads will issue a Marine Safety Information Broadcast Notice to Mariners to notify the maritime community of the scheduled arrival and departure of a liquified petroleum gas carrier."

–Illustrative Regulations

Table 7-1 provides an illustrative list of regulations which may be applicable to various federally regulated areas. In the example of the prohibited area near Nomans Land, entry

Table 7-1.

Illustrative Types of Regulations Applicable to Federally Regulated Areas.

Regulations are area-specific. Consult the current *U.S. Coast Pilot* for regulations pertaining to each individual area.
• Enforcement authority (agency, facility)
• Advance notification of restrictions (e.g., published in *Notice to Mariners*)
• Warning signals (e.g., patrol vessels, display of flags, low aircraft passes, etc.)
• Outright prohibitions to entry
• Requirements for expeditious passage
• Requirements to vacate area promptly upon warning
• Limits to entry (e.g., during exercise periods, during certain times of day, during certain seasons, etc.)
• Minimum separation distances from naval or other designated vessels
• Limits to activity (e.g., no loitering, no stopping, no anchoring, no trawling, no fishing, no towing, no docking, no entry onto land, etc.)
• Maximum height (e.g., for vessels operating in restricted areas associated with certain coastal airports in circumstances of reduced visibility)
• Minimum equipment
• Requirements for a pilot on vessels larger than a specified displacement

is prohibited to all but authorized vessels only for specific months of the year. Depending upon the area, the duration of the prohibition may be only for certain times of day, certain days of the year, only when actual exercises or vessel transits are taking place (when the area is said to be "hot"), or at all times. Alternatively, entry may be permitted, but a requirement for expeditious passage, or a requirement to vacate the area promptly upon notification may be imposed.

In the Nomans Land example, entry is forbidden, in other areas entry may be permitted, but limits may be placed upon specific activities of vessels while in the area (e.g., no loitering, no stopping, no anchoring, no trawling, no fishing, no towing, no docking, no entry onto land, etc.). Minimum separation distances (e.g., from naval vessels or carriers of hazardous cargo) may also be mandated in these areas.

In some regulated areas (e.g., that shown in figure 7–1) yet other requirements may be imposed. These include requirements that vessels drawing less than a specified draft not enter certain channels (unless the vessel is crossing the channel), a prohibition on the entry of vessels above a designated size with impaired maneuverability, technical requirements on tows, requirements for operating radar in vessels above a designated size during periods of reduced visibility, and requirements for pilots with local knowledge aboard vessels greater than a certain size (e.g., 100 gross tons).

Finally, the height of vessels permitted to operate in the regulated area may be limited. The height constraint is applicable in certain restricted areas associated with some coastal airports and is intended to lower the risk of collision with low-flying aircraft and reduce the possibility of interference with navigational equipment. For example, in the restricted area (33 CFR § 162.20) contiguous to La Guardia Airport, Flushing, NY, no vessels with a height greater than 35 feet may enter whenever the prevailing visibility is less than 1 mile.

In cases where entry is prohibited only during times when the area is being used, the

U.S. Coast Pilot will indicate how notification is given, either in advance (e.g., in the *Notice to Mariners),* or shortly before the activity commences (e.g., by display of warning flags, the presence of patrol vessels, low aircraft passes, etc.).

–Summary

It is a surprisingly common misconception that federally regulated areas cannot be entered at any time. In fact, many of these areas are not denied (or at least not denied at all times) and these areas can be safely used if the prescribed regulations are followed. The mariner should consult 33 CFR or the *U.S. Coast Pilot* to determine the restrictions to entry and other pertinent regulations. *However, unless the specific regulations are consulted* (e.g., as found in 33 CFR or the *U.S. Coast Pilot), the prudent mariner has no alternative but to remain well clear of federally regulated areas.* Do not radio the USCG with a request for real-time information on navigation regulations applicable to, or the status of, these areas. Not all USCG units have this information readily available. The USCG will respond to written or telephone inquiries, but does not necessarily offer “real time” response.

Civil Reservations

Civil reservations include a variety of non-military areas such as state and national parks, reservations, wildlife preserves, wildlife refuges, marine sanctuaries, Indian reservations, and similar specially designated areas. Generally, reservation areas are charted only if requested by the cognizant agency. With certain exceptions, these areas provide interesting background rather than information relevant to navigation. (These areas are charted in blue, as noted below, so as to reserve the use of magenta and black for charting features that are of greater navigational importance to the mariner.) Mariners are advised, however, to consult the CFR and other sources for any regulations applicable to these areas.

As an illustration of one type of civil reservation, figure 7–3 provides an excerpt from NOS Chart No. 12274 (Head of Chesapeake Bay) which shows, *inter alia,* a portion of the Susquehanna National Wildlife Refuge. Applicable rules for operating in wildlife refuges and other regulations are given in 50 CFR Parts 25, 27, and 32. These regulations include the Navigation Rules, state regulations, and several additional regulations. The additional regulations include a prohibition on leaving boats (outside of designated mooring or beaching areas) unattended for a period greater than 72 hours without the permission of the refuge manager, a ban on use of government-owned docks for loading and unloading of boats (except in emergency), special rules for water skiing, regulations applicable to marine sanitation devices, and a variety of special rules which limit or prohibit hunting and fishing activities. Some wildlife refuge regulations are site specific.

–Charting Practices

This section provides information on charting practices and related information for civil reservations. Charting conventions consist of a *symbol* and associated *labels* and *notes.*

–Symbol (N 22)

Civil reservations are charted with a blue long-short dashed line. A more prominent blue screened band may be added to the inside edge of the entire outline if needed to avoid confusion. For example, where different reservations overlap, the screened band may be used to denote the reservation(s) of greater importance.

–Labels and Notes

Labels and notes are printed in blue type. If the boundary is chiefly in the water, italic type is used; if chiefly on land, conventional type is used. The label type should be consistent on overlapping charts. The label consists of the *name* of the reservation (e.g., *“SUSQUEHANNA NATIONAL WILDLIFE REFUGE”)* in italic capitals and a *description* (e.g., *“protected area”)* in lower case italic type if appropriate. The label “see note A” is included only when the cited federal regulations are given in the *U.S. Coast Pilot.* Where ref-

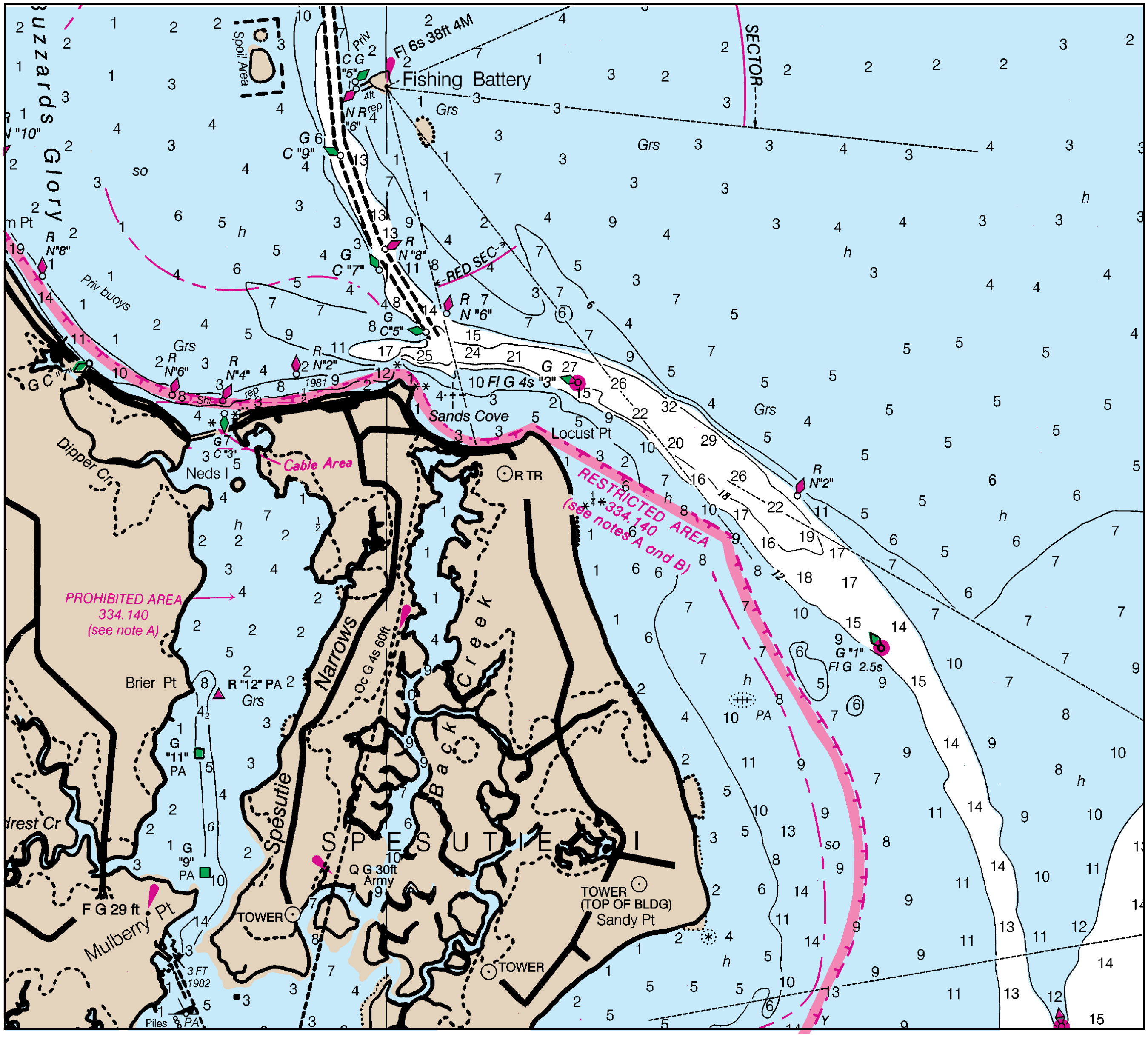

Fig. 7-3. Excerpt from NOS Chart No. 12274 (head of Chesapeake Bay) showing a restricted area and portion of Susquehanna National Wildlife Refuge.

erence to note A is not appropriate, the label may refer to another note or the CFR.

–Relevance to the Mariner

Generally speaking, civil reservations are of only limited interest to the mariner. This is reflected in the choice of color for their depiction on the nautical chart. Nonetheless, these features are charted to alert the mariner to possible regulations which may affect entry and/or limit activities.

The *U.S. Coast Pilot* provides relevant information for some, but not all, of these areas. Mariners interested in using these waters should consult appreciable sections of the CFR. (Refer to the CFR Index to find the appropriate section(s).)

Federally Regulated Anchorage Areas/ Grounds

Federally regulated anchorage areas and grounds are important features depicted on NOAA charts. It is convenient to group federally regulated anchorage areas into three broad classes: (i) anchorage grounds, (ii) special anchorage areas, and (iii) fairway anchorages. These are discussed below.

–Anchorage Grounds

The USCG is authorized (under Section 7 of the River and Harbor Act of March 4, 1915) to define and establish anchorage grounds for vessels "whenever it is apparent that these are required by the maritime or commercial interests of the United States for safe navigation." Further, the USCG is authorized to establish rules and regulations applicable to these designated anchorage grounds.

Several types of anchorage grounds have been established by the USCG, including (but not limited to) general anchorages, commercial anchorages, deep-draft anchorages, small-craft anchorages, special anchorages, quarantine anchorages, temporary anchorages, dead-ship anchorages, explosive anchorages, forbidden anchorages, nonanchorage grounds, and restricted anchorages. For the most part, terms used to describe these anchorage grounds (e.g., commercial anchorages) are *not defined explicitly in the CFR.* Rather, the definitions are implicit and made clear by the specific rules and regulations pertaining to each designated anchorage. For example, a *dead-ship anchorage* is designed to lay up ships for extended periods, a *quarantine anchorage* is designed to accommodate ships requesting quarantine inspection, a *deep-draft anchorage* is designed principally for deep-draft ships. Forbidden, prohibited, nonanchorages, and restricted anchorages all have regulations which limit or prohibit anchoring by various types of vessels, or require special authorization for anchoring. A description of these designated anchorage grounds and the regulations applicable to each can be found in the CFR and the *U.S. Coast Pilot.*

Anchoring berths are usually circular areas located within certain established anchorage grounds as a convenience in assigning anchoring locations for both military and commercial vessels. Information concerning anchoring berths may be published in the CFR (and *U.S. Coast Pilot),* but may also be developed by local users and available from the originator.

–Special Anchorage Areas

An Act of Congress of April 22, 1940, provided for the designation of *special anchorage areas* wherein vessels not more than 65 feet in length, when at anchor, are not required to carry or exhibit anchor lights. These special anchorage areas (33 CFR § 109.10) are "well removed from fairways[3] and located where general navigation will not endanger or be endangered by unlighted vessels." Special anchorage areas are established for the convenience of small (typically recreational) vessels.

–Fairway Anchorages

According to 33 CFR § 166.105, *"shipping safety fairway* means a lane or corridor in which no artificial island or fixed structure, whether temporary or permanent, will be permitted." These fairways are established to control the erection or structures so as to provide safe approaches through: (i) oil fields in the Gulf of Mexico to entrances to the major ports along the gulf coast (33 CFR § 166.200), (ii) the coast of California (33 CFR § 166.300), (iii) the coast of Alaska (33 CFR § 166.400), and (iv) the Atlantic coast (33 CFR § 166.500). A *fairway anchorage* "means an anchorage area contiguous to and associated with a fairway, in which fixed structures may be permitted within certain spacing limitations."

–Relevance to the Mariner

Knowledge of the presence and location of designated anchorage grounds/areas are relevant to the mariner for two principal reasons:

> First, and perhaps most important, charting these areas serves to inform the mariner that various rules and regulations may apply to each designated area. (Sources for these regulations are identified below.) Table 7–2

[3]Shipping safety fairways are also charted.

provides a sampling of some of the types of rules that may apply to any of these areas. In brief, there may be outright prohibitions on anchoring, limits on the type, number, or duration of stay of vessels in an anchorage, limits or prohibitions on certain activities within an anchorage (e.g., no lightering or fishing), requirements to plot position and/or maintain a communications guard, notification requirements, and technological requirements (e.g., use of multiple anchors, requirements to have tugs present, etc.). Not all of the restrictions identified in table 7–2 are applicable to each anchorage, but each of the rules are applicable to some of these areas. Failure to follow the rules could entail significant operating risks, and may involve legal penalties as well.

Second, designated anchorage grounds should alert the mariner to areas where anchored vessels may be encountered. Therefore, these areas are generally to be avoided, except by vessels intending to use the anchorage. (By design, these designated anchorage areas are not located in main channels, so avoidance is not particu-

Table 7-2
Illustrative Regulations That May Pertain to Designated Anchorages

Regulations are anchorage-specific; not all anchorages will have each of the illustrative regulations given. The current *U.S. Coast Pilot* should be consulted to find the specific regulations applicable to each designated anchorage.

- Controlling authority and permit requirements
- Limits to type of vessel (e.g., recreational, commercial, naval, (submarines, aircraft carriers, destroyers, etc.) explosives, vessels under the custody of the United States, dead ships)
- Maximum or minimum length and/or draft of vessel
- Priority among vessels (e.g., priorities accorded naval vessels, commercial vessels, or vessels awaiting quarantine inspection, etc.)
- Freedom from requirements to display anchor lights (for vessels less than 65 feet long in designated special anchorages)
- Conditions of use (e.g., during emergencies only)
- Limits on navigation, transit speeds, or on certain activities (e.g., fishing, lightering, etc.)
- Cargo restrictions
- Limits on the number of vessels that can use an anchorage
- Prohibition of certain types of vessels (e.g., fishing vessels, vessels being dismantled)
- Minimum distances among anchored ships
- Limits on placement of anchors and requirements for multiple anchors
- Permission or limits on placement of moorings, floats, or buoys
- Notification Requirements (e.g., when anchoring, and prior to engaging in certain operations, or getting underway)
- Maximum time to get underway (e.g., “warm start” capability, prohibition on “dead” ships, or requirement that “dead” ships have tugs alongside)
- Requirements to maintain a communications guard and/or to plot position
- Requirements for wooden ships to have radar reflectors aboard
- Prohibitions on use by unseaworthy ships
- Time limits (e.g., 24-hours, 48-hours, 30-days)

larly burdensome.) In special anchorage areas, vessels less than 65 feet in length are not required to display anchor lights, which means that vessels transiting these areas at night are well advised to exert special vigilance to avoid possible collisions with unlighted vessels at anchor.

–Charting Practices

This section provides information on charting practices and related information for federally regulated anchorages. Charting conventions consist of a *symbol* and associated *labels* and *notes.* With few exceptions, NOAA charts show only the type of anchorage, its location, and a CFR section number. Specific regulations applicable to the area are provided elsewhere (e.g., 33 CFR or the *U.S. Coast Pilot).*

–Symbol (e.g., N 11.1 - N 20)

Federally regulated anchorages are depicted by magenta limit lines which show the exact geographic boundaries of the anchorage. The line thickness and whether or not it is solid or dashed varies with the type of anchorage, as shown in table 7–3. A magenta screen may be added for emphasis.

Anchoring berths (N 11.1, N 11.2) are charted as solid or dashed circles of specified diameter with a small center-position circle (solid or dashed to correspond the berth limit symbol) and a designator. Circles and designators may be shown in magenta or a screened green. (If another color is required for clarity, berths may be printed in black.)

Figure 7–4 provides an excerpt from NOS Chart No. 12221 (Chesapeake Bay Entrance) showing two naval anchorages, a commercial explosive anchorage, and an anchorage berth.

–Label

The charted anchorage area is identified with a magenta label in italic type that includes the primary title of the area as given in the CFR, an alphanumeric designator (if assigned), the CFR section number, and a reference to the standard note A discussed earlier in this chapter. Examples include:

SPECIAL ANCHORAGE
110.1, 110.126a (see note A)
COMMERCIAL EXPLOSIVE ANCHORAGE
110.168 (see note A)
FAIRWAY ANCHORAGE
166.200 (see note A)

Bottom characteristics (see Chapter 4) are depicted in designated anchorage areas and other areas where vessels are expected to anchor.

–Notes

Anchorage areas also refer to the standard note A. This note directs the mariner to the appropriate section of the *U.S. Coast Pilot*. Applicable regulations can be found in either the CFR or the *U.S. Coast Pilot*. Regulations may consist of both *specific* regulations applicable to the designated anchorage area and *general* regulations (i.e., common regulations applicable to several anchorages in the same area). For example, there are numerous general regulations applicable to Anchorage E shown in figure 7–4. But there are additional specific regulations given in the CFR and the *U.S. Coast Pilot*. The specific regulations (33 CFR § 110.168) include:

"(4) Anchorage E. (i) A vessel may not anchor in Anchorage E without a permit issued by the Captain of the Port.

"(ii) The Captain of the Port shall give commercial vessels priority over naval and public vessels.

"(iii) The Captain of the Port may at any time revoke a permit to anchor in Anchorage E issued under the authority of paragraph (f)(4)(i) of this section.

"(iv) A vessel may not anchor in Anchorage Berth E-1 unless it is carrying or handling dangerous cargo or military explosives.

Table 7-3.
Charting Symbols for Federally Regulated Anchorages

Type of Anchorage	Subtype (if defined)	Charting Symbol
Commercial anchorage	N/A	0.2 mm solid magenta line; anchoring berths may also be shown
Dead-ship anchorage[a]	N/A	
Deep-draft anchorage	N/A	
General anchorage	N/A	
Military anchorage	Naval[b]	
	Naval and General	
Small-craft anchorage	N/A	
Special anchorage	N/A	
Temporary anchorage	N/A	
Explosive anchorage	Commercial explosive	0.2 mm dashed magenta line; anchoring berths may also be shown
	Emergency explosive	
	Naval explosive	
	Temporary explosive	
Forbidden anchorage	N/A	
Prohibited anchorage	N/A	
Nonanchorage	N/A	
Quarantine anchorage	N/A	
Restricted anchorage	N/A	
Fairway anchorage	N/A	0.5 mm solid magenta line; anchoring berths may also be shown

SOURCE: Adapted from information given in the *Nautical Chart Manual*

NOTES:

[a] See: e.g., 33 CFR § 110.158.

[b] Some naval anchorages are further subdivided into submarine anchorages (33 CFR § 110.150), aircraft carriers, destroyers (33 CFR § 110.182), small craft (33 CFR § 110.159), or emergency naval anchorages (33 CFR § 110.155).

"(v) A vessel may not anchor within 500 yards of Anchorage Berth E-1 without the permission of the Captain of the Port, if the berth is occupied by a vessel carrying or handling dangerous cargo or military explosives."

Nonfederally Regulated Anchorages (N 12.1)

State and local governments may establish anchorages in waters under their jurisdiction. These areas may also be charted at the discretion of NOAA. Chart conventions

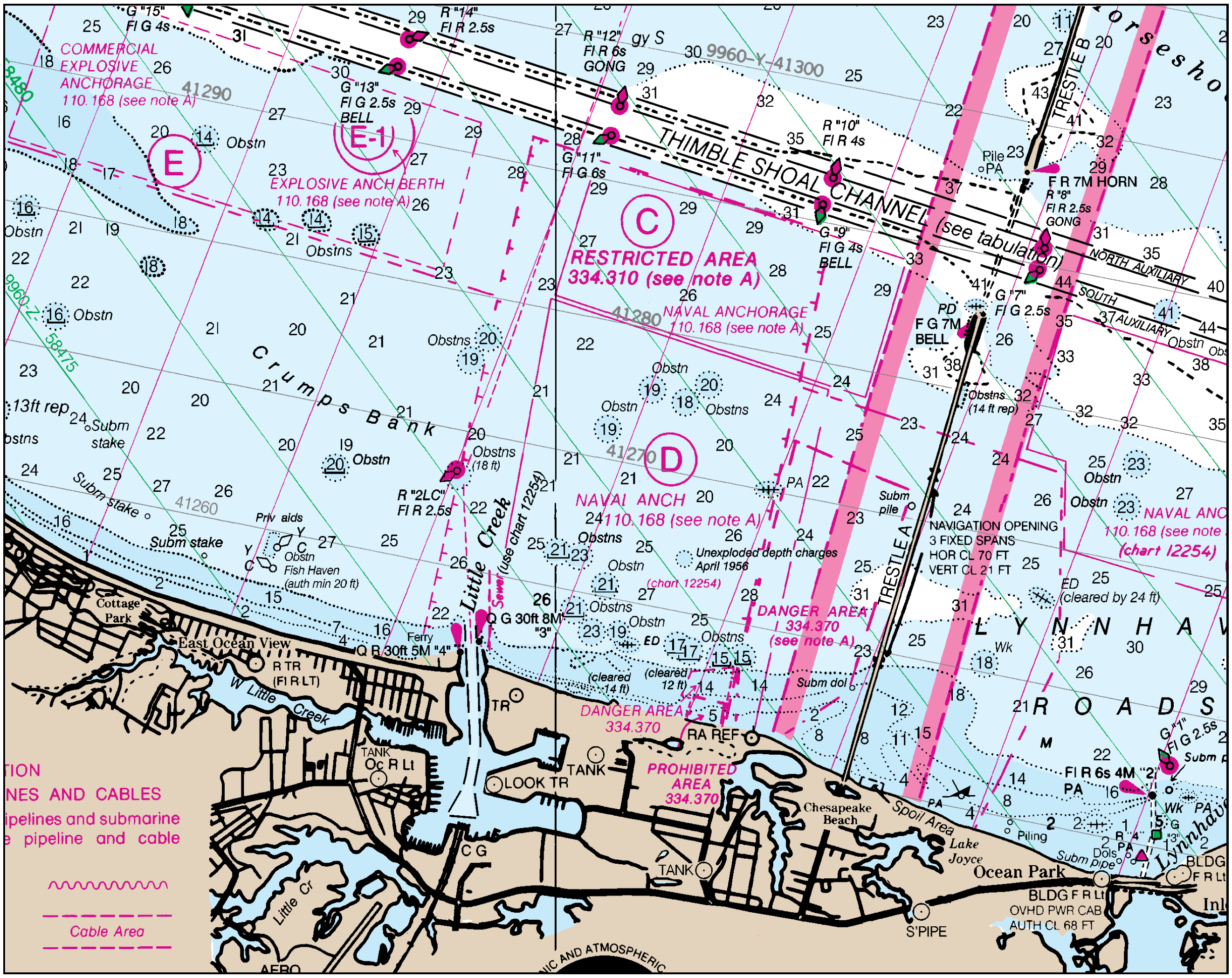

Fig. 7-4. Excerpt from NOS Chart No. 12221 (Chesapeake Bay Entrance) showing a variety of anchorages and berths along with other features of interest.

parallel those for federally regulated anchorages, except that a black dashed line is used rather than a magenta line. Applicable rules and regulations for these areas are not published in the *U.S. Coast Pilot,* but must be obtained by the agency having jurisdiction over the anchorage area.

Harbors of Refuge (N 10)

Harbors of Refuge are recognized anchorage areas without defined limits. These harbors provide passing vessels with good holding ground and temporary refuge from storms. For this reason, vessel operations (particularly operators of small vessels) should be familiar with the location of the various Harbors of Refuge along a proposed route. A harbor of refuge may or may not be considered a part of a shipping port. A harbor of refuge is identified with a black anchor symbol (N 10) and a label *"HARBOR OF REFUGE"* in black italic capital letters.

Dumping/Disposal Areas

Dumping/disposal areas have been established for various purposes, such as for ocean dumping of toxic wastes (now prohibited) or depositing dredged materials. These areas may constitute hazards to navigation and are charted for this reason. Three general classes (determined by the federal regulatory authority that has jurisdiction over their establishment) of dumping areas are shown on NOAA charts. These are briefly described below.

–EPA–Established Dumping Areas (N 24, N c, N d, N g)

The U.S. *Environmental Protection Agency* (EPA) established ocean dumping sites (40 CFR Part 227) for the purpose of disposing of toxic and nontoxic materials including dredged material, industrial waste, acid waste, municipal waste, sludge, etc. These areas are charted in all cases where hydrography and other navigational detail are shown in the area.[4]

Dumping areas designated in 40 CFR § 228.12 are shown by a black dashed limit line. A label is added in black to identify the area in italic type, capital and lowercase letters, in a size appropriate to the charted feature. A label refers to note S. A descriptive term such as "dredged material" may be added to the label to reflect the primary use of the area as identified in the regulations. Examples include:

Dump Site
(see note S)
Dump Site
(dredged material)
(see note S)

Note S is charted in the vicinity of note A and states;

"NOTE S
Regulations for Ocean Dumping Sites are contained in 40 CFR, Parts 220-229. Additional information concerning the regulations and requirements for use of the sites may be obtained from Environmental Protection Agency..."

Hydrography and tints (see Chapter 4) are retained in the dumping areas because these areas are not intended to interfere with navigation. The date of the hydrography is stated as follows:

"Depths from survey of _____"

On small-scale charts, the dimensions of the dump site may preclude its being charted to scale. In this event, a minimum-size symbol (a 2.0 mm dashed square) is used in lieu of attempting to depict the actual size. If this symbol is used for all dump sites shown on a particular chart, these are identified by label, without reference to note S, e.g.:

Dump Site
(dredged material).

–Navy–Established Dumping Areas

The Navy designated certain areas, generally in deep water at a considerable distance offshore, for disposal of ammunition, chemicals, and explosives. These areas are shown on NOAA charts to inform chart users, notably trawlers, who might tangle with dangerous materials. The same chart conventions are used as for Environmental Protection Agency (EPA)–established dumping areas.

–U.S. Army Corps of Engineers Areas

The USACE has authority to establish dumping areas with the approval of EPA. These dumping areas are classified variously as *spoil areas, disposal areas,* or *dumping grounds.* The following note is added in black to all charts containing spoil areas, disposal areas, and dumping grounds where dumping is regulated by this agency:

[4]Refer to Chapter 4 for information on areas where hydrography is omitted.

"DUMPING CAUTION

Dumping dredged or fill materials in spoil areas, disposal areas, and dumping grounds is illegal without authorization from the U.S. Army Corps of Engineers. Regulations and permission for dumping in area (or areas) charted, may be obtained at the office of the District Engineer, Corps of Engineers, New Orleans, Louisiana."

Spoil areas (N 62.1) are established for the disposal of dredged material removed from the bottom of channels and harbors during dredging operations. If inactive, the area is still charted, but labeled in black italic capital and lower-case letters, *"Discontinued Spoil Area."* These areas are generally located near and parallel to the dredged channel and are potentially dangerous to navigation. Active spoil area limits are shown by a black dashed line delineating the extent of the area, a label (in italic, capital and lowercase letters) *"Spoil Area,"* with blue tint No. 1 added to accentuate their potentially dangerous nature. Spoil areas that uncover are tinted green. Soundings and depth curves (see Chapter 4) are omitted within spoil areas, although islets and areas bare at MLLW are charted.

Disposal areas (N d) are established or approved (see 33 CFR Parts 323-324) for depositing dredged material in waters where existing depths and currents indicate that the dumping will not cause sufficient shoaling to create a danger to surface navigation. Disposal area limits are shown by a black dashed line, except that soundings, tints, and depth curves are retained inside the limits of these areas. The following note is shown in italic type:

"Disposal Area
Depths from survey of ______"

–Dumping Grounds (N c)

Dumping grounds are areas formerly designated by the USACE (under 33 CFR Part 205, now revoked) for dumping (by permit) various types of materials. These dumping grounds are typically located well offshore in deep water.

Dumping ground area limits are shown by a black dashed line. Soundings and depth curves may be charted within the limits. A blue tint is added when justified by the charted hydrography (see Chapter 4). Finally, the label *"Dumping Ground"* in black italic type (capital and lower-case letters) is added inside the limits of the area.

–Relevance to the Mariner

Generally speaking, these areas are depicted on nautical charts to alert the mariner to the possibility of danger when transiting the area (e.g., spoil areas) or when engaging in certain activities (e.g., trawling in the vicinity of Navy-established dumping areas). Depiction of these areas on the nautical chart also serves to alert the mariner to the types of vessels that may frequent these areas. A spoil area, for example, might be frequented by dredges, tugs, and barges.

Spoil areas are of particular concern, because of their generally shallow depths and proximity to dredged channels. There are numerous instances of vessels running aground in these spoil areas. Avoidance is the safest course of action lest they spoil your voyage in more ways than one.

–Illustration

Figure 7–5 shows an excerpt from NOS Chart No. 11361 (Mississippi River Delta) showing the Southwest Pass at the mouth of the Mississippi River. Several features of this chart excerpt are of interest. Note the oil platforms, oil pipelines, and the safety fairway for vessels entering and existing the Southwest Pass. Note also the blue tinted spoil area on either side of the channel. The blue tint alerts mariners to the danger posed by these areas. See also the dump site to the west of the channel. The northern portion of the dump site overlays the spoil area. The cartographer elected to tint the entire dump site area blue, to emphasize the possible dangers in this area.

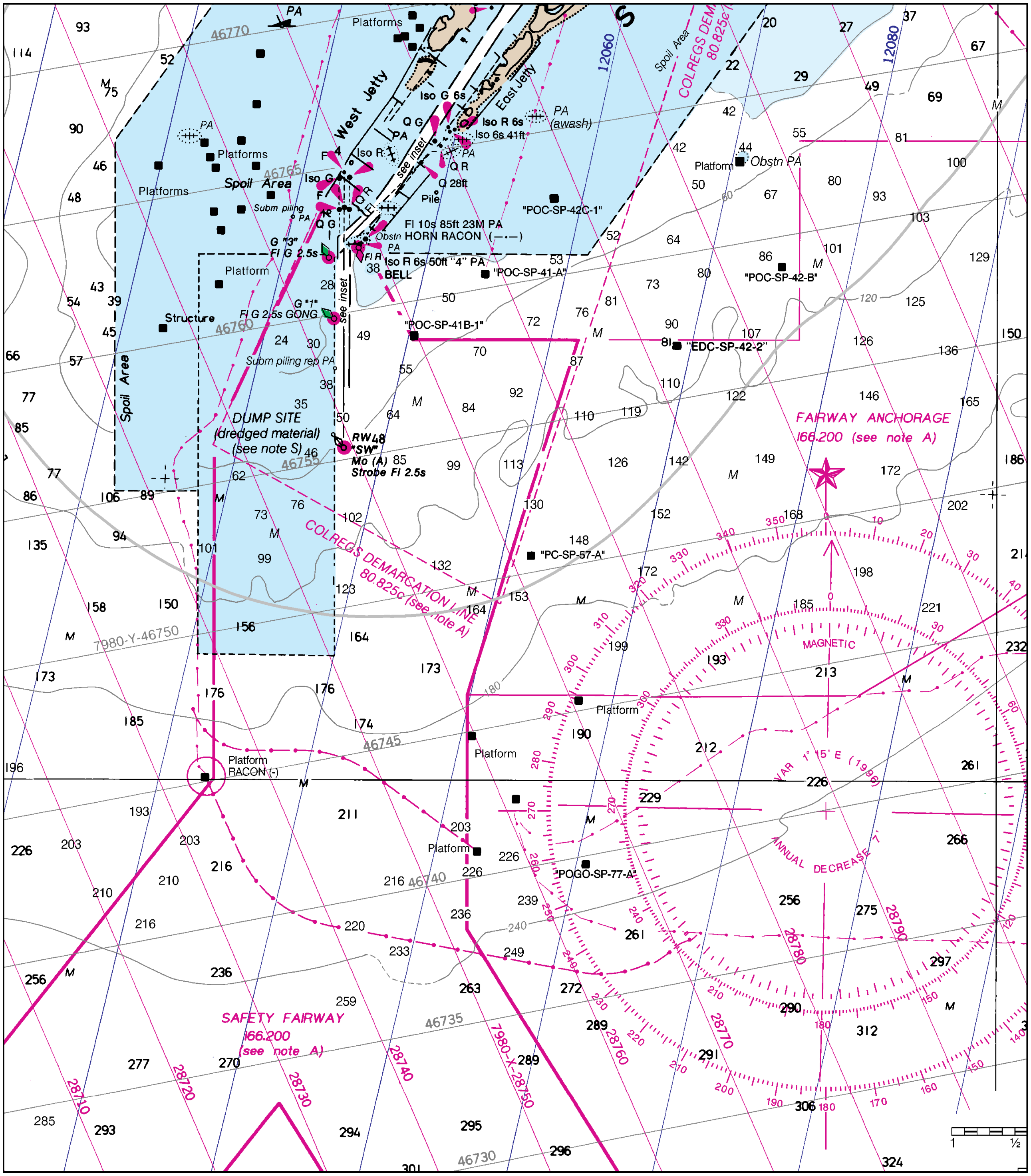

Fig. 7-5. Excerpt from NOS Chart No. 11361 (Mississippi River Delta)

However, soundings south of the southern boundary of the original spoil area were retained, as these were judged unlikely to change materially as a result of the dumping activities. This area was the site of a collision between a northbound Dutch cruise ship *Noordham* and a southbound freighter *Mt. Ymitos* in November of 1993 (see *Professional Mariner,* Issue No. 5). The accident investigation is still pending as of this writing, so it would be premature to speculate on the cause of the accident. However, one aspect of this collision is of interest here. The Captain of the southbound *Mt. Ymitos* reportedly claimed that he could not alter course to the right (i.e., westward) because of the proximity of the dump site. Moving westward of the buoyed channel when north of the fairway buoy "SW" would entail some risk of grounding. For positions south of this buoy, the soundings and the included 120-foot depth curve shown on the chart offer more comfort. Presumably, any vessel of sufficient draft to be accommodated in the channel (40 feet) could transit this area without appreciable risk of grounding.

COLREGS Demarcation Line (N a)

A COLREGS demarcation line (see 33 CFR Part 80) divides U.S. waters into two areas. Landward of this line the Inland Navigation Rules apply, seaward of this line the International Navigation Rules apply. (The USCG publishes both sets of rules in COMDTINST M16672.2B, see references.) Although many of the navigation rules are common to both sets, some differ. For example, required lights and whistle signals under the inland rules differ from those under the international rules. For this reason it is important that the mariner be aware of the water areas where each set of navigation rules apply. The COLREGS demarcation lines are published in CFR and in COMDTINST M16672.2B in terms of the latitude and longitude of linear segments, but these coordinates are not convenient for use. For this reason, the COLREGS demarcation lines are printed on NOAA charts.

–Charting Practices

Charting conventions for COLREGS demarcation lines consist of a symbol, label, and note, as discussed below.

–Symbol (N a)

COLREGS demarcation lines are shown on all coastal series charts (scale 1:150,000 and larger) and on other charts as needed using a magenta dashed line (N a).

–Label

The label *"COLREGS DEMARCATION LINE"* in magenta italic capital letters (see figure 7–2 or figure 7–5) is placed along the line, either inside or outside as space permits. If labels cannot be placed along the COLREGS line, these may be placed on land and parallel to the chart base. Labels in other locations (where space is limited) where labeling may be critical are abbreviated *"COLREGS."* This abbreviated label may be omitted in cases where the labels would be extremely close together or where several chart lines are in close proximity.

Some charts depict only areas where the international rules apply. This includes certain areas of New England, Florida, Puerto Rico, the Aleutians, and other areas. The following note is added to these charts in lieu of the addition to the Symbols and Abbreviations note:

"COLREGS, 80.____ (see note A)
International Regulations for Preventing
Collisions at Sea, 1972"

In areas where COLREGS lines are shown and space permits, the second line of the label shows the CFR section number and the reference to note A, e.g., *"80.325a (see note A)."*

Degaussing Range (N 25)[5]

A degaussing (demagnetizing) range is an area within which a vessel's magnetic field may be measured. These measurements are used to determine the required degaussing coil current settings and other corrective action(s). Sensing instruments and cables are installed on the sea bed in the range, with the cables leading from the range to a control position ashore. This range is usually marked by distinctive buoys identifying the purpose of the range. Although there are relatively few degaussing ranges, their presence and location are relevant to the mariner because of the specific rules and regulations that may apply therein. These include (but are not limited to) a prohibition on the introduction of external magnetic field sources, anchoring, trawling, and a requirement to avoid the range when it is in use. For an interesting article on the use of the degaussing range, see Ryan.

The limits of the degaussing range are shown by a dashed line (N 25). Submarine cables extending from the shore are charted in their exact position and shown in magenta. The label *"DEGAUSSING RANGE"* is shown in black capital italic letters in a type size appropriate to the feature.

Maritime Boundaries

There are numerous maritime boundaries (e.g., the Three Mile Line) referred to in state or federal laws. (A description of the provisions of the various laws having maritime boundaries is beyond the scope of this manual. The reader is referred to other sources for this information.) The shoreline and the low-water line are used as "baselines" for determining the various maritime boundaries described by geographic coordinates in legal references. The nautical chart is the legal graphic authority for most of these boundaries.

Maritime boundaries reference to the low-water line that are found on NOAA charts include the following:

- Exclusive Economic Zone (200 nautical miles)
- Magnuson Fishery Conservation and Management Act Amendments (Alaska fishing limits)
- Marine Sanctuaries
- National Parks
- National Seashores
- Natural Resources Boundary (3 leagues or 9 nautical miles; Texas, Florida-Gulf of Mexico coast, Puerto Rico)
- Political Boundaries
- Territorial Sea and Contiguous Zone (12 miles)
- Three Nautical Mile Line
- State Parks.

Some of the more important of these boundaries are explained below.

–International Boundaries (N 40, N 41)

International boundaries are charted with a solid black crossed dashed line (N 40, N 41).

–Exclusive Economic Zone (N 47)

In 1983, a 200-mile *Exclusive Economic Zone* (EEZ) was established. This zone is described in the *Coast Pilot Manual* as follows:

> " ...the EEZ of the United States is a zone contiguous to the Territorial Sea and Contiguous Zone (12 nautical miles) of the United States, the Commonwealth of Puerto Rico, the Commonwealth of the Northern Mariana Islands (to the extent consistent with the Covenant the United Nations Trusteeship Agreement), and the United States overseas territories and possessions. The EEZ extends to a distance 200 nautical miles from the baseline from which the breadth of the territorial sea is measured..."

[5]Some degaussing ranges (e.g., 33 CFR § 334.870) are also restricted areas.

The significance of this zone is described in the *Coast Pilot Manual* as follows:

"Within the EEZ, the United States has asserted, to the extent permitted by international law, (a) sovereign rights for the purpose of exploring, exploiting, conserving and managing natural resources, both living and nonliving, of the seabed and subsoil and the superadjacent waters and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds; and (b) jurisdiction with regard to the establishment and use of artificial islands, and installations and structures having economic purposes, and the protection and preservation of the marine environment.

"Without prejudice to the sovereign rights and jurisdiction of the United States, the EEZ remains an area beyond the territory and territorial sea of the United States in which all states enjoy the high seas freedoms of navigation, overflight, the laying of submarine cables and pipelines, and other internationally lawful uses of the sea."

The seaward boundary of the EEZ is coincidental with that of the *Fishery Conservation Zone* (FCZ) over which the United States exercises exclusive fishery management authority over all species of fish, except tuna.

The EEZ limit is shown by a black screened line interspersed at regular limits by a "fish" symbol (N 47). This line is labeled *"EXCLUSIVE ECONOMIC ZONE"* in black italic capital letters.

–Closing Line/Three Nautical Mile Line/ Territorial Sea and Contiguous Zone (N 42, N 43, N 44)

The closing line (baseline) is the dividing line between inland waters and marginal seas across the entrance of a bay. The Three Nautical Mile Line marks the boundary of the waters within a three-mile zone adjacent to the coast and seaward of the closing line. The Territorial Sea and Contiguous Zone marks the boundary of the waters within a 12-nautical mile zone adjacent to the coast and seaward of the closing line.

Each of these lines are black screened unbroken lines of 0.5 mm lineweight. These lines are labeled in black italic type as follows: *"THREE NAUTICAL MILE (see note X)," "TERRITORIAL SEA (see note X),"* and *"TERRITORIAL SEA AND CONTIGUOUS ZONE (see note X)."*

The text of note X differs slightly according to whether or not the natural resources boundaries of Puerto Rico or the gulf coast are shown. One version of this note is as follows:

"NOTE X

The 12-nautical mile territorial sea was established by Presidential Proclamation 5928, December 27, 1988, and is also the outer limit of the U.S. contiguous zone for the application of domestic law. The 3-nautical mile line, previously identified as the outer limit of the territorial sea, is retained because the proclamation states that it does not alter existing State or Federal law. The 9 nautical mile natural resources boundary off Texas, the Gulf coast of Florida, and Puerto Rico, and the 3 nautical mile line elsewhere remain the inner boundary of the Federal fisheries jurisdiction and the limit of states' jurisdiction under the Submerged Lands Act (P.L. 83-31; 67 Stat.

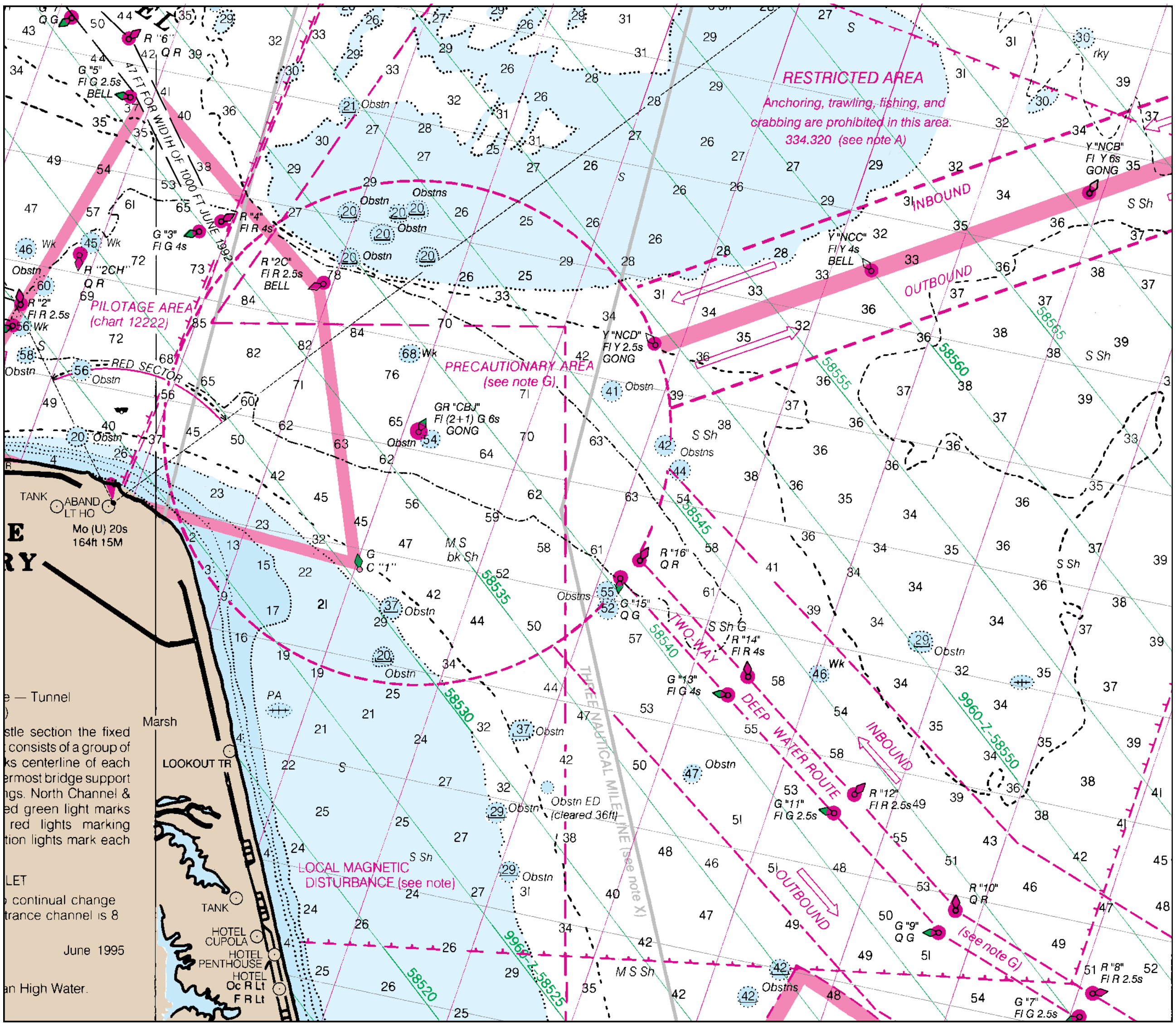

Fig. 7-6. Excerpt from NOS Chart No. 12221 (Chesapeake Bay Entrance) showing a variety of features of interest, including a traffic separation scheme and a Three-Mile Limit Line.

29, March 22, 1953). These maritime limits are subject to modification, as represented on future charts. The lines shown on the most recent chart edition take precedence."

Figure 7–6 provides another excerpt from NOS Chart No. 12221 (Chesapeake Bay Entrance) showing a Three-Mile Limit Line among other features of interest.

Traffic Separation Schemes and Related Matters

TSS and *Vessel Traffic Services* (VTS) are related systems used to aid in the prevention of collisions in the approaches to many major harbors.[6] Briefly, a TSS consists of a series of "highways in the water" that segregate traffic, while a VTS is a land-based system which provides advice and control of participating vessels in a manner similar to—but less elaborate than—the system employed for air traffic control. Centers for VTS have communications equipment and radar and optical systems for observation. TSS and VTS are discussed in 33 CFR Part 161 (Vessel Traffic Management) and 33 CFR Part 167 (Offshore Traffic Management Schemes). All vessels are obliged to follow Rule 10 (International Navigation Rules) regarding TSS, and there are specific rules and regulations (including whether participation in an associated VTS is voluntary or mandatory) applicable to each area. (Refer to the *U.S. Coast Pilot* or 33 CFR for details.)

A TSS is a routing measure designed to separate opposing streams of traffic by the establishment of traffic lanes. Vessels need not use a TSS (i.e., participation is voluntary). However, under Rule 10, paragraph (h), "...a vessel not using a traffic separation scheme shall avoid it by as wide a margin as is practicable." A TSS may include traffic lanes, separation zones, roundabouts, precautionary areas, inshore traffic zones, deep-water routes, areas to be avoided, and (in the case of a corresponding VTS) calling-in points. It is convenient to include pilot boarding areas in this section. Definitions and charting practices are described below. Figures 7–7 and 7–8 provide excerpts from Chart No. 1 which illustrate many of the chart symbols used to depict TSS/VTS features. Figure 7–6 depicts a TSS in the vicinity of Chesapeake Bay, which includes traffic lanes, separation zones, and a precautionary area. This excerpt also shows a pilot boarding area.

A *traffic lane* means an area within defined limits in which one-way traffic is established. When joining or leaving a traffic lane (Rule 10 paragraph (b) (iii)) vessels are required to do so at as small an angle as possible. As far as practicable, vessels should avoid crossing traffic lanes (Rule 10 paragraph (c)). However, vessels crossing a traffic lane should do so on a heading as nearly as practicable at right angles to the lane. Vessels are encouraged to navigate at or near the center of the traffic lane. Otherwise (see Cockcroft and Lameijer),

[6]Although it is convenient to discuss TSS and VTS in the same section, as both relate to routing and employ similar charting conventions, it is important to distinguish between these two systems. A TSS is a set of "paper" conventions (routes) established by the host country in consultation with the *International Maritime Organization* (IMO). (The IMO (formerly IMCO) is an organ of the United Nations, based in London, England, established to deal with recommendations relative to maritime safety and pollution.) A TSS is the subject of Rule 10 of the International Navigation Rules. A VTS, however, is a physical entity, consisting of a control facility termed a *Vessel Traffic Center* (VTC), manned by personnel from the host country (principally the USCG in the United States, although a new private VTS has been commissioned in Los Angeles/Long Beach, CA, and others are planned for Tampa, FL, and Philadelphia, PA), communications facilities, and systems of observation (television cameras and radar) and operates in accord with published rules and regulations (CFR) under Rule 10 of the Inland Navigation Rules. Some major harbors and harbor approaches (e.g., New York) have a TSS and a VTS. Others (e.g., the approaches to the Chesapeake or Delaware Bays) have only a TSS. Yet others (typically those entirely within inland waters, e.g., the St Marys River) have a VTS, but no TSS (although routing regulations are published for this area). Finally, most harbors and harbor approaches have neither a TSS nor a VTS.

> "...there is danger that a vessel which sets a course near the edge of a lane will stray into the separation zone or the traffic lane designated for traffic proceeding in the opposite direction."

Vessels should also keep clear of the outer limit of the traffic lane lying on the vessel's starboard side,

> "...particularly if this line separates the lane from an inshore zone which is likely to contain traffic moving in the opposite direction. On the edge of the lane two power-driven vessels meeting on reciprocal courses would each be required to alter course to starboard by Rule 14. Such action may cause both vessels to be involved in further meeting situations making it difficult for them to return to their correct lane or zone."

Natural obstacles, including those forming separation zones may constitute a boundary. Traffic lanes are depicted in nautical charts by a distinctive symbol (M 13). Arrows are drawn to indicate the general direction of flow. If the traffic lane is wider than 5.0 mm at chart scale, the arrows are staggered within the lane. If not, arrows are placed in the center of the lane. A label *"INBOUND,"* or *"OUTBOUND,"* may be added in magenta capital italic type as shown in figure 7–6.

A *separation zone* or line means a zone or line which separates the ships proceeding in opposite or nearly opposite directions; or separating a traffic lane from the adjacent sea area; or separating traffic lanes designated for particular classes of ships proceeding in the same direction. Separation lines are represented by a magenta-screened line at least 3 mm wide. Figure 7–6 shows a separation zone in the eastern inbound-outbound approach to Chesapeake Bay.

A *roundabout* is a routing measure comprising a separation point or circular separation zone and a circular traffic lane within defined limits. Traffic within the roundabout is separated by moving in a counterclockwise direction around the separation point or zone. A roundabout is depicted by a unique symbol (M 21, M d). As of this writing, there are no roundabouts in U.S. waters

A *precautionary area* means a routing measure comprising an area within defined limits where ships must navigate with particular caution and within which the direction of traffic flow may be recommended. A precautionary area is depicted by a unique symbol (M 16, M 24), and may include a label, *'PRECAUTIONARY AREA,"* in magenta italic capital letters. Figure 7–6 shows a precautionary area near the entrance to the Chesapeake Bay. Note that vessels not using the TSS may enter the precautionary area. In the TSS shown in figure 7–6, many vessels (e.g., recreational, tugs with barges, etc.) entering the Bay from the north or south along the coast—and not using the TSS—routinely enter this precautionary area.

A *deep-water route* is a route in a designated area within definite limits which has been accurately surveyed for clearance of sea bottom and submerged obstacles as indicated on the chart. A deep-water route may be either one-way or two-way. It is labeled, *"DEEP WATER ROUTE,"* or *"TWO-WAY DEEP WATER ROUTE,"* in magenta italic capital letters. Note the two-way deep-water route in the southern approach to Chesapeake Bay shown in figure 7–6.

Examples of Routing Measures

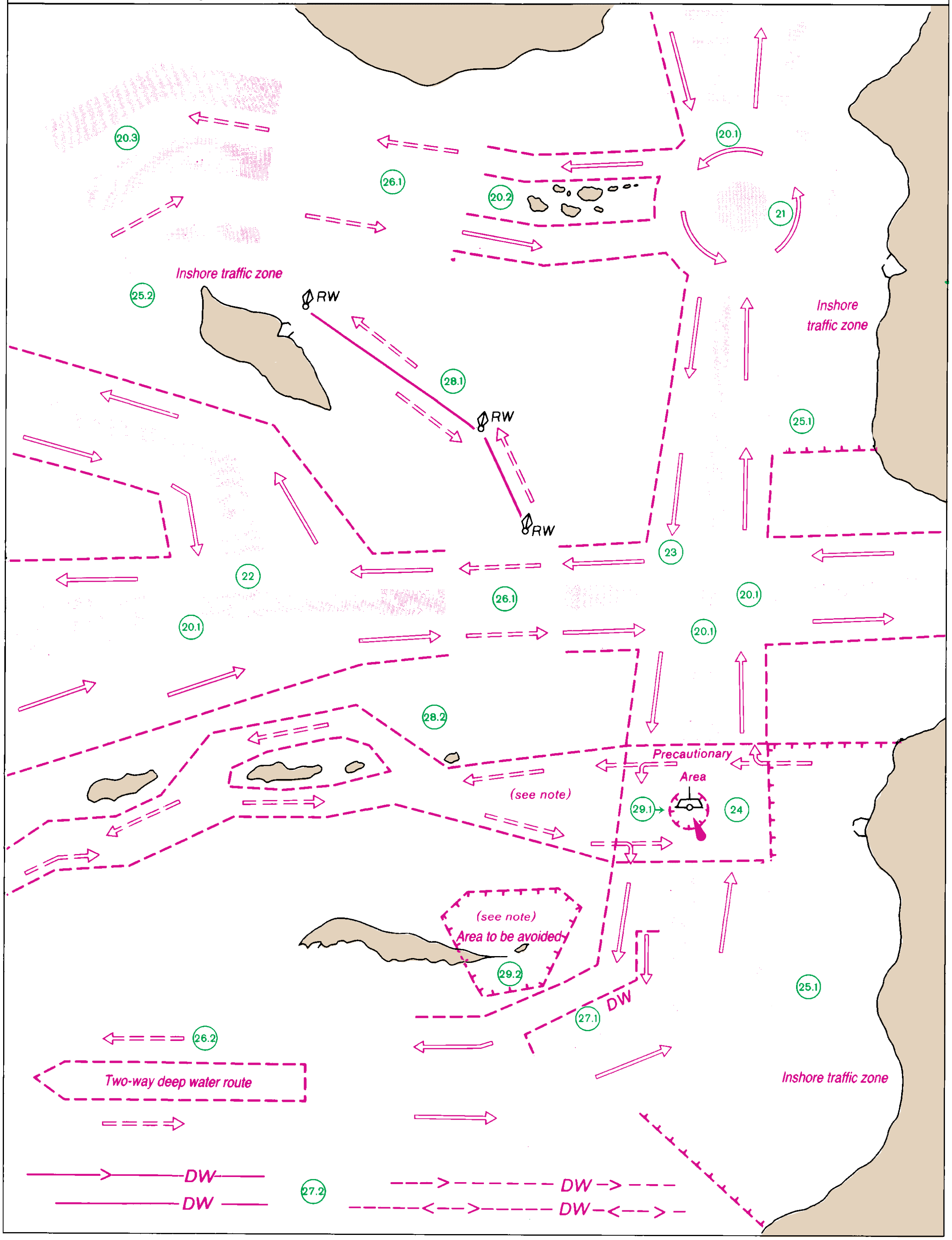

Fig. 7-7. Excerpt from Chart No. 1 Showing Charting Conventions for Routing Measures.

20.1	*Traffic separation scheme, traffic separated by separation zone*
20.2	*Traffic separation scheme, traffic separated by natural obstructions*
20.3	*Traffic separation scheme, with outer separation zone, separating traffic using scheme from traffic not using it*
21	*Traffic separation scheme, roundabout*
22	*Traffic separation scheme, with "crossing gates"*
23	*Traffic separation schemes crossing, without designated precautionary area*
24	*Precautionary area*
25.1	*Inshore traffic zone, with defined end-limits*
25.2	*Inshore traffic zone without defined end-limits*
26.1	*Recommended direction of traffic flow, between Traffic separation schemes*
26.2	*Recommended direction of traffic flow, for ships not needing a deep water route*
27.1	*Deep water route, as part of one-way traffic lane*
27.2	*Deep water route, centerline as recommended One-way or Two-way track*
28.1	*Recommended route (often marked by centerline buoys.)*
28.2	*Two-way route with one-way sections*
29.1	*Area to be avoided, around navigational aid*
29.2	*Area to be avoided, because of danger of stranding*

Fig. 7-8. Legend for Figure 7-7

An *inshore traffic zone* is a routing measure comprising a designated area between the landward boundary of a TSS and the adjacent coast, not normally to be used by through traffic (although under Rule 10 it may always be used by vessels under 20 meters in length and sailing vessels) and where special rules may apply. An inshore traffic zone must be explicitly designated, it is not simply the area between the boundary of the TSS and the land. It is labeled, *"INSHORE TRAFFIC ZONE,"* in magenta italics. It may have defined endpoints; if so, these are designated by T-shaped dashed magenta lines (identical to those used to depict a restricted area). Reference to figure 7–6 indicates that there is no inshore traffic zone established for this TSS, because there is no label "INSHORE TRAFFIC ZONE" included in the chart excerpt. (In fact, as of this writing, no inshore traffic zones have been established in U.S. waters.)

An *area to be avoided* is an area which is not recommended for navigation because of shoal hydrography, obstructions, or local and federal regulations. These areas are denoted with a unique symbol (M 29.1, M 29.2). For example (IMO), off the coasts of the United States there are areas to be avoided in the vicinity of the Louisiana Offshore Oil Port (safety concerns near the platform pumping complex and single point mooring buoys), in the region of Nantucket Shoals (because of the great danger of strandings and for environmental protection), in the region of the Northwest Hawaiian (Sandwich) Islands (to avoid the risk of pollution in a designated wildlife refuge), off the California coast near the Channel Islands National Marine Sanctuary (pollution concerns), and throughout the Florida Keys (to avoid risk of pollution and damage to the environment).

Calling-in points, requiring participating vessels to report to a traffic control center, have been established in certain waterways and port approaches (e.g., the New York Vessel Traffic Service, the Berwick Bay Vessel Traffic Service, etc.) to assist in traffic control. (Refer to the appropriate rules and regulations published in the CFR for details.) Where established, calling-in (reporting) points are denoted on the nautical chart by a unique magenta symbol (M 40) consisting of a circle enclosing an alphanumeric designator with one or two arrowheads attached. The alphanumeric designator corresponds to a calling-in point given in the CFR. (Generally numeric or alphanumeric designators indicate mandatory calling-in points, while alphabetic designators depict voluntary calling-in points.) The arrowhead(s) indicate that position reports are required for vessels bound in one or two directions. Whenever numeric or alphanumeric designators are charted, the following note is added in light magenta type:

> "Vessel Traffic Services calling-in point with numbers; arrow indicates direction of vessel movement."

Pilot boarding areas denote meeting or boarding places where vessels pick up or disembark pilots. (Discussions on pilotage regulations can be found in the *Coast Pilot Manual,* appendix B, and in the CFR.) The limits of pilot areas are usually charted with a 2.5 mm magenta-screened band, or a magenta symbol (T 1.1) if the chart scale is too small to show the area. These areas are labeled *"PILOT BOARDING AREA,"* or (as shown in figure 7–6), *"PILOTAGE AREA,"* in magenta italic type. A pilot boarding area is not part of a TSS, but is included in the section because pilot boarding areas are often located near elements of a TSS.

–Notes

All TSS are described in the applicable *U.S. Coast Pilot.* But, as of this writing, not all TSS are described in the CFR. A note is added on the nautical chart which provides additional information on any TSS not described in the CFR. The exact text of the note varies with the TSS, but the following serves as an illustration.

> **"NOTE G**
> **TRAFFIC SEPARATION SCHEME**
>
> One-way traffic lanes overprinted on this chart are RECOMMENDED for use by all vessels traveling between the points involved. They have been designed to aid in the prevention of collisions at the approaches to major harbors and along heavily traveled coastal waters, but are not intended in any way to supersede or to alter the applicable Rules of the Road. Separation zones are intended to separate inbound and outbound traffic and to be free of ship traffic. Separation zones should not be used except for crossing purposes. When crossing traffic lanes and separation zones use extreme caution. A Precautionary Area has been established at San Pedro Bay. It is recommended that vessels proceed with caution in this area."

This note is "customized" as appropriate to each TSS and is removed upon inclusion of the TSS in the CFR.

–Additional Information

Additional information regarding any TSS or VTS in U.S. waters can be found in the *U.S. Coast Pilot.* The following excerpt from the *U.S. Coast Pilot,* for example, provides information on the TSS shown in figure 7–6:

> "**Traffic Separation Schemes (Chesapeake Bay Entrance and Smith Point)** have been established for the control of maritime traffic at the entrance of Chesapeake Bay and off Smith Point Light (37°52.8'N., 76°11.0'W.). They have been designed to aid in the prevention of collisions, but are not intended in any way to supersede or alter the applicable Navigation Rules. (See Traffic Separation Schemes, Chapter 1, for additional information.)
>
> "(30) **Traffic Separation Scheme (Chesapeake Bay Entrance).—**The scheme provides for inbound outbound traffic lanes to enter or depart Chesapeake Bay from the northeastward and from the southeastward. (See NOS chart 12221.)
>
> "(31) A precautionary area with a radius of 2 miles is centered on Chesapeake Bay Entrance Junction Lighted Gong Buoy CBJ (36°56.1'N., 75°57.5'W.).
>
> "(32) The northeastern inbound/outbound traffic lanes are separated by a line of four fairway buoys on bearing 250°–070°. The outermost buoy in the line is 6.4 miles 313° from Chesapeake Light and the innermost buoy is 4.5 miles 074° from Cape Henry Light.
>
> "(33) The southeastern approach is marked by Chesapeake Bay Southern Approach Lighted Whistle Buoy CB (36° 49.0'N., 75°45.6'W.). A RACON is on the buoy. The inbound/outbound traffic lanes are separated by a **Deep-Water Route** marked by lighted buoys on bearings 302° –122° and 317° –137°. The Deep-Water Route is intended for deep draft vessels and naval aircraft carriers entering or departing Chesapeake Bay. A vessel using the Deep-Water Route is advised to announce its intentions on VHF–FM channel 16 as it approaches Lighted Whistle Buoy CB on the south end, and Lighted Gong Buoy CBJ on the north end of the route. All other vessels approaching the Chesapeake Bay Traffic Separation Scheme should use the appropriate in-

bound/outbound lanes of the northeasterly or southeasterly approaches.

"(34) The Coast Guard advises that upon entering the traffic lanes, all inbound vessels are encouraged to make a security broadcast on VHF–FM channel 13, announcing the vessel's name, location, and intentions.

"(35) **Exercise extreme caution where the two routes converge off Cape Henry.** Mariners are also warned that vessels may be maneuvering in the pilotage area which extends into the western part of the precautionary area."

Additional material on TSS can also be found in other publications (e.g., IMO).

–Relevance to the Mariner

TSS/VTS have been established to promote the safe and expeditious flow of traffic. Whether voluntary or mandatory, participation by all vessels operating in the vicinity of a TSS is desirable. The introduction of the TSS has been hailed as a significant "breakthrough" in reducing the incidence of collisions. As Cahill (*Strandings and Their Causes)* noted:

> "The most effective way of achieving a reduction in ship casualties is through reduction of the risks to which mariners are exposed. A dramatic and conclusive example of the truth of this proposition is before us in the results achieved by the introduction of traffic separation schemes; specifically that in the Dover Strait. That scheme is arguably the most significant contribution to ship safety since the introduction of steam propulsion."

For a more critical view of VTS specifically, see Young.

Including TSS information on the nautical chart certainly simplifies compliance with the routing instructions.

However, participating vessels should be aware that some vessels (either because they choose not to participate or because they fail to read and understand the procedures) will not follow the charted patterns. When transiting these, as well as other areas, caution is the watchword. As noted in one of the standard reference works (Farwell's):

> "Even with up-to-date charts there remain instances of ships proceeding contrary to the direction of traffic flow laid down for traffic separation schemes. Where collisions have occurred, the courts have been consistent in finding that, despite the rogue vessel's contravention of International Regulations... the other rules of the collision regulations applied in all respects."

There have been numerous instances of collisions with "rogue" vessels in areas with established routes (see Cahill, *Collisions and Their Causes,* or Holdert and Buzek), but perhaps the most famous was the *Andrea Doria-Stockholm* collision in 1956 (see Marriott or Hoffer).[7]

–Smaller Vessels

In the days before the "electronic revolution," some might have argued that it was a challenge for operators of smaller vessels (e.g., recreational or small fishing vessels) to comply fully with an established TSS—particularly in areas sufficiently far offshore to prevent visual fixes being taken on land-based objects and/or for a TSS that is not well marked by *aids to navigation* (ATONs). Opting for an inshore route might have been preferable to attempting to use the lanes without suitable means for fixing the vessel's position.

[7]This did not involve a TSS *per se,* but rather ignoring the 1948 *Safety of Life at Sea* (SOLAS) recommendation on traffic separation—a precursor to today's TSS.

Now, however, it is common for even small vessels to have LORAN-C or GPS receivers on board. Use of these electronic aids greatly simplifies compliance with the established TSS, regardless of the prevailing visibility. The traffic lanes can be identified by a sequence of waypoints (defining the center of linear portions of the lanes), and the "off course" alarm feature common to most of these receivers can be set so that the operator is warned if the vessel strays from the charted traffic lane.[8] Waypoints can also be used to mark calling-in points for a VTS.

Rule 10, paragraph (e) (ii), permits fishing within a separation zone of a TSS. The "off course" alarm feature of most modern LORAN-C or GPS receivers can also be used to warn the operator if the fishing vessel wanders out of the designated separation zone.

Some final tips relevant to use of a TSS include:

> Expect to find a significant amount of traffic in a TSS. These lanes concentrate traffic from a wide ocean area, so that traffic densities can be quite high. Vessels should maintain an alert lookout (both visual and with radar if so equipped).
>
> Ensure that your vessel is equipped with a radio if using a TSS. This enables you to communicate with other vessels using the TSS. A radio is essential if using a VTS.
>
> Equip your vessel with a radar reflector if operating in a TSS and your vessel is not radar conspicuous. Recreational vessels, in particular, are often difficult to "see" on radar.
>
> A deep-water route is primarily intended to be used by deep-draft ships. Vessels not requiring such channel depths should avoid using these routes to limit traffic congestion.
>
> When feasible, sailing vessels are probably well advised to remain well clear of a TSS. The slow speed and restricted maneuverability of a sailing vessel could create a collision hazard.
>
> Read Rule 10 of the International Navigation Rules carefully before attempting to use a TSS. A TSS is no place for the ill-informed or naïve mariner.

Course Lines

Some Great Lakes charts show course lines that are unofficial traffic separation scheme devised by shipping interests for their own benefit. These course lines have not been established by the USCG, nor are regulations published in the CFR.

These course lines are charted with a black dashed line on charts with English units and magenta dashed line on metric charts. In either case, the labels for the course lines are shown in magenta. The labels include distance (in statute and nautical miles) and bearings along a course. The point where a course changes direction is shown with a black dashed line to a point of land or object ashore. The bearing of the line and the distance offshore of the turning point are included in a black label along the dashed line.

If course lines are shown, the following sailing directions note (in black vertical letters) is included on Great Lakes metric charts with Mercator projections:

[8] It is recommended that the off-course alarm be set up to warn the mariner well before the limits of the traffic lane so as to allow an ample margin of safety.

"SAILING DIRECTIONS.

Bearings on sailing courses are true and distances given thereon are in statute miles (St M) and nautical miles (NM) between points of departure. The true bearing between any two points on this chart may be determined by connecting the two points with a straight line and measuring the angle of the intersection with a meridian line."

This note is included in the group of notes aligned under the chart title.

Courses

Courses, also called *tracks,* are a feature included on some nautical charts. Courses/tracks are usually shown in rivers, bays, and other inshore waters and are intended primarily to help mariners avoid shoal depths rather than to regulate shipping movement. The decision whether or not to follow a charted course is left to the discretion of the mariner rather than a matter of regulation—although some courses are charted in connection with a TSS.

Bearings charted along courses are given in degrees and tenths of a degree with respect to true (not magnetic) north. Reciprocal bearings are charted along two-way courses.

Distances along courses may also be charted (in statute or nautical miles). Distances may also be shown as a series of mileage "ticks." These ticks are generally charted (in magenta) in statute miles at 1-mile or 5-mile intervals depending upon the scale of the chart.

Recommended courses marked by fixed or floating ATONs (M 3) are charted with a solid black line. Traffic flow directional arrows may be inserted at regular intervals along the line.

Recommended courses not marked by ATONs (M 4) are charted with a dashed magenta line.

An alternate course (M c) is a secondary course available to shallower draft vessels. Usually an alternate course will rejoin the recommended course. The alternate course is charted with a dashed magenta line whether or not it is marked by ATONs. Arrows are used to indicate the direction of traffic flow if so recommended.

Concluding Comments

The material in this chapter is quite detailed. Although nearly all the topics discussed have regulatory significance, knowledge of the various areas, limits, routes, and tracks, and how these are depicted on the nautical chart is also very important to the mariner to ensure safe passage.

A study of collateral information, such as the CFR or the *U.S. Coast Pilot,* is particularly important with respect to the charted features discussed in this chapter. Charted features, for the most part, are there to alert the mariner to applicable rules and regulations and/or potential hazards.

"The greatest hazard to navigation is a bored navigator."

Anonymous, quoted in Schlereth

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———: *Civil Reservation.*

———: *COLREGS.*

———: *Course Lines.*

———: *Danger Area.*

———: *Explosive Economic and Fishery Conservation Zones.*

———: *Pilot Areas.*

———: *Recreational Areas and Structures.*

———: *Restricted Area.*

———: *Safety Fairway.*

———: *Territorial Sea and Contiguous Zone.*

———: *Traffic Separation Scheme.*

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APPENDIX **A**

Glossary

Introduction

This appendix is an authoritative source for terms used in mapping, charting, and geodesy used in the nautical charting program. Terms and definitions are of specific cartographic interest and may be found in this manual, on individual charts of maps, applicable source material, or encountered in archival research.

Where possible, contradictory, controversial, incomplete, or duplicative definitions have been excluded from this Glossary. Multiple definitions for a single term are included where appropriate. Definitions used in this Glossary have been taken from authoritative government sources, but chiefly from the U.S. Department of Commerce, Coast and Geodetic Survey, *Nautical Chart Manual, Seventh (1992) Edition, Volume Two: Definitions, Abbreviations, Symbology, and References,* Washington, DC, 1992. Words set in bold type, within definitions, are defined elsewhere in this Glossary.

This appendix is intended to serve both as a basic reference document and tutorial. Although it is true that the working vocabulary of most mariners is less extensive than presented here, mariners are encouraged to become familiar with the contents of this appendix. As the classic text, *Mixter's Primer of Navigation* (Mixter, G.W., edited by McClench, *Primer of Navigation,* Fifth Edition, Van Nostrand Reinhold, New York, NY, 1967, p. 143), notes:

> "It is not sufficient to partially understand a chart. The navigator must train himself to interpret the meaning of every mark on a chart and to convey every detail he observes along the coast or at sea into the symbols and terms used on charts."

A Strategy for Study

It is very much easier to learn the many terms in this Glossary if attention is paid to the logical relationships between or among similar words. For example, the terms *mud, clay, silt, sand, stones, gravel, pebble, shingle, cobble, rock,* and *boulder* are obviously related. Indeed, all are descriptors used in Chart No. 1 to describe the "nature of the bottom." In increasing order of particle diameter, these are clay (<0.002 mm), silt (0.002 mm to 0.0625 mm), sand (0.625 mm to 2 mm), gravel (2 mm to 4 mm), pebble (4 mm to 64 mm), cobble (64 mm to 256 mm), and rock or boulder (>256 mm). Mud is used as a general term which includes both clay and silt. Stones are a general term, which includes gravel, pebble, and cobble. Shingle consists of an aggregate of stones ranging from 16 mm to 256 mm in diameter. Chart No. 1 is a useful source for related terms.

It also helps to relate the terms defined in this Glossary to practical aspects of navigation and/or seamanship. Think about the relevance of each of these terms to typical voyages that you might make. Continuing the example given in the above paragraph, terms relating to the nature of the bottom have practical significance for evaluating the suitability of a place to anchor and/or the type of anchor to deploy if the vessel is equipped with more than one anchor. Thus, for example, silt and gravel generally offer only poor holding power, and clay is often regarded as having good holding qualities. A burying anchor is best for mud and sand bottoms, whereas a hooking anchor is preferable for rocky bottoms.

To help group terms, it may be useful to refer to the various categories provided in Chart No. 1. For example, Section F of Chart No. 1, "Ports," includes many of the following related terms: *breakwater, groin,* *mole, quay, wharf, pier, gridiron, landing, jetty, dock,* and *slip.* Read the definitions in the Glossary, taking care to note similarities and differences among these terms. On your next voyage into waters with these objects, compare the chart notations with what you observe.

Authoritative, But Not Exhaustive

Although intended to be authoritative, this Glossary is far from a complete listing of terms related to nautical charts. Space constraints preclude listing every potentially relevant term—and not even all the terms used in Chart No. 1, or this manual, are included herein. Continuing with "nature of the bottom" descriptors, this Glossary omits such terms as *radiolaria, pteropods, polyzoa, cirripedia,* and *fucus,* for example.

Finally, this Glossary omits terms so common, e.g., bell, boat, etc., as to be understood by virtually all mariners.

Abandoned. An adjective referring to an artificial facility no longer being used for its original purpose, as in "abandoned mine." The term may be used with a symbol (e.g., beside an airport symbol, or with a place name, e.g., Elma (Abandoned)).

Abyss. A very deep, unfathomable place. The term is used to refer to a particular deep part of the ocean, or to any part below 300 fathoms.

Accretion. The gradual building up of land over a long period of time, solely by the action of the forces of nature, on a beach by deposition of water or airborne material. Artificial accretion is a similar buildup of land by deliberate means. Also called *aggradation.*

Adrift. Afloat or unattached to shore or bottom.

Aerial cableway. A transportation device consisting of an endless cable supported on towers. Cars attached to the cable are used for moving people or materials.

Aeronautical beacon. A visual aid to navigation, displaying flashes of white or colored light or both, used to indicate the location of airports, landmarks, and certain points of the federal airways in mountainous terrain and to mark hazards.

Aeronautical light. A luminous or lighted aid to navigation intended primarily for air navigation. One intended primarily for marine navigation is called a "marine light." Often shortened to "aero light."

Aeronautical radiobeacon. A radiobeacon whose service is intended primarily for the benefit of aircraft.

Afloat. Floating, as opposed to being aground.

Aground. Touching, resting, or lodged on the bottom of shallow water. The opposite is afloat. When a vessel rests on something solid other than the blocks in a drydock or slipway it is said to be aground. A vessel "takes the ground" when the tide leaves it aground for want of sufficient depth of water, a fairly frequent occurrence in open docks.

Aid to Navigation (ATON). Buoys, beacons, fog signals, lights, radiobeacons, leading marks, radio position fixing systems, radars, inertial systems, and generally any charted or otherwise published device serving the interests of safe navigation. *See also:* **Navigational aid.**

Airfield. Landing facility for aircraft, usually without a passenger terminal. The services offered for aircraft supply and maintenance are substantially less than those of an airport (q.v.). Airfields usually have legal limits which are delineated at 1:50,000 and larger scale charts.

Airport. Landing facility for aircraft, usually with more than one runway and with facilities for handling passengers and air freight and for servicing aircraft. The legal limits of the airport are usually delineated at chart scales of 1:50,000 and larger.

Airstrip. Landing facility for aircraft consisting of a single runway, which is usually of gravel construction. Airstrips rarely have a boundary fence or a delineated legal limit.

Alternating. A light showing different colors alternately, or a continuous steady light, which shows a change of color.

Altitude. (1) The distance of a location above a reference surface. The most usual reference surface is sea level. (2) The distance of a location above the physical surface of the earth.

Anchorage. A place where a vessel anchors or may anchor. An area set apart for anchored vessels in a harbor. A suitable place for anchoring is sheltered from wind and sea, does not interfere with harbor traffic, and has a sea bottom that gives good holding to anchors. The anchorage space allotted to a vessel should include a circle with a radius equal to the combined length of anchor cable and ship. A depth of 7 to 8 fathoms at low water is usually considered sufficient for ordinary requirements. For additional types of anchorage, see Chapter 7.

Anchorage chart. A nautical chart showing prescribed or recommended anchorages. Such a chart may be a harbor chart overprinted with a series of circles, each indicating an individual anchorage.

Apparent shoreline. This is the seaward limit of marine vegetation, such as mangrove, marsh grass, or trees in water that would reasonably appear to the mariner from a distance to be the fast shoreline. The seaward limit of kelp, low grass in water, and other low-lying vegetation normally do not constitute an apparent shoreline.

Approximate contour. A contour substituted for a normal contour whenever there is a question as to its reliability (*reliability* is defined as being accurate within one-half the contour interval).

Approximate position. In charting, a position that is considered to be less than third-order accuracy, but is generally considered to be within 100 feet of its correct geographic location. The method of location may be an indication of the recorded accuracy.

Aqueduct. A conduit or artificial channel for the conveyance of water, often elevated, especially one for the conveyance of a large quantity of water that flows by gravitation.

Archipelago. An area of water studded with many islands or with a group of islands; also, such a group of islands.

Arc of visibility. The portion of the horizon over which a lighted aid to navigation is visible. The arc of a light sector, designated by its limiting bearings as observed from seaward.

Area feature. By definition, a feature extending over an area. It is represented on maps by an outline, a solid or screened color, cross-hatching, a regular pattern of symbols spread over the area, or a combination of these.

Areal feature. A topographic feature, such as sand, swamp, vegetation, etc., which extends over an area. It is represented on the published map or chart by a solid or screened color, by a prepared pattern of symbols, or by a delimiting line.

Area to be avoided. A routing measure comprising an area within defined limits in which either navigation is particularly hazardous or it is exceptionally important to avoid casualties and which should be avoided by all ships, or certain classes of ship.

Arm of the sea. A narrow portion of the sea projection from the main body. The expression is often shortened to "arm."

Arroyo. The course of an intermittent stream steep-cut in loose earth; a coulee; a steep-walled trenchlike valley. (Local in Southwest.)

Articulated light. An articulated light is a vertical pipe structure that oscillates around a universal coupling connected to a sinker. The structure is kept upright by the buoyancy of a submerged floatation chamber. It is designed primarily to mark narrow channels with greater precision than conventional buoys.

Artificial harbor. A harbor where the desirable shelter from wind and sea has been obtained artificially by the building of moles, piers, breakwaters, and jetties. Also applied to harbors created by sinking concrete barges, vessels, and the like to form a temporary sheltered anchorage. *See also:* **Natural harbor**.

Artificial island. An island constructed for the purpose of mineral or energy development.

Atoll. A coral island or islands, consisting of a belt of coral reef surrounding a central lagoon.

Audible aid to navigation. An aid to navigation transmitting information by sound waves.

Authorities note. The note included on a chart which gives the names of the federal agencies that have contributed to the information used in the compilation.

Awash. Situated so that the top is intermittently washed by waves or tidal action. The term applies both to fixed objects such as rocks, and to floating objects with their tops flush with or slightly above the surface of the water. *See also:* **Rock awash;**

Submerged.

Axis. (1) Any line along which measurements are made in determining the coordinates of a point, or any line from which angles are measured for the same purpose. An axis usually serves as a line reference such that one of the coordinates of a point lying on the axis is zero. (2) A line with respect to which a geometric figure is symmetrical. (3) Any line about which a body rotates or revolves. (4) A line connecting two distinguished points (e.g., the magnetic poles of the earth are joined by the magnetic axis).

Azimuth. A horizontal angle reckoned clockwise from the meridian.

Back range. A range observed astern, particularly one used as guidance for a craft moving away from the objects forming the range.

Backshore. That part of a beach which is usually dry, being reached only by the highest tides, and by extension, a narrow strip of relatively flat coast bordering the sea. *See also:* **Foreshore**. That zone of the shore or beach lying between the foreshore and the coastline and acted upon by waves only during severe storms, especially when combined with exceptionally high water. Also *backbeach.* It comprises the *berm* or *berms.*

Bald. A high rounded knob or mountain top, bare of forest. (Local in southern states.)

Bank. (1) An elevation of the seafloor typically located on a 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. (2) A shallow area of shifting sand, gravel, mud, etc., as a sand bank, mud bank, etc. (3) A ridge of any material such as earth, rock, snow, etc., or anything resembling such a ridge, as a fog bank or cloud bank. (4) The edge of a cut or fill. (5) The margin of a watercourse. (6) A number of similar devices connected so as to be used as a single device.

Bar. A ridge or mound of sand, gravel, or other unconsolidated material below the high-water level, especially at the mouth of a river or estuary, or lying a short distance from and usually parallel to the beach, and which may obstruct navigation.

Bare rock. A rock extending above the datum of mean high-water. On NOAA charts, bare rock symbols are used for rocks extending more than 1 foot above mean high water on the Atlantic coast, and extending more than 2 feet above the mean high water on the Pacific coast. *See:* **Rock; Rock awash; Sunken rock.**

Barrier beach. A bar essentially parallel to the shore, the crest of which is above high water.

Barrier island. A detached portion of a barrier beach between two inlets.

Barrier lagoon. A bay roughly parallel to the coast and separated from the open ocean by barrier islands. Also the body of water encircled by coral islands and reefs, in which case it may be called an "atoll lagoon."

Barrier reef. A coral reef which roughly parallels land but is some distance offshore, with deeper water adjacent to the land, as contrasted with a "fringing reef" closely attached to the shore. *See also:* **Fringing reef.**

Bar scale. A line or series of lines on a chart, subdivided and labeled with the distances represented on the chart. Also called *graphic scale. See also:* **Scale**.

Bascule bridge. A single- or double-leaf span, with the shoreward ends hinged, allowing the span to be elevated vertically.

Basic survey. A hydrographic survey so complete and thorough that it does not need to be supplemented by other surveys and is adequate to supersede, for charting purposes, all prior hydrographic surveys of the area.

Basin. (1) A depression of the seafloor more or less equidimension in plan view and of variable extent. (2) An area of water surrounded by quay walls, usually created or enlarged by excavation, large enough to receive one or more ships for a specific purpose. *See also*: **Graving dock; Nontidal basin; Scouring basin; Tidal basin; Turning basin**. (3) An area of land which drains into a lake or sea through a river and its tributaries. (4) A nearly land-locked area of water leading off an inlet, firth, or sound.

Basin, tidal. A basin affected by tides, particularly one in which water can be kept at a desired level by means of a gate.

Bathymetric chart. A topographic map of the ocean floor, or the bed of a lake.

Bathymetry. The determination of ocean depths. The general configuration of seafloor as determined by profile analysis of depth data.

Bay. (General) An indentation of the coast; an embayment; a subordinate adjunct to a larger body of water; a body of water between and inside of two headlands (according to Geneva Convention). A well-marked indentation whose penetration is in such proportion to the width of its mouth as to contain landlocked waters and constitute more than a mere curvature of the coast. The area of such an indentation must be as large as or larger than the semicircle whose diameter is a line drawn across the mouth of the indentation.

Bay deltas. Deltas formed at the mouths of streams which discharge into bays or estuaries. Their advance toward the bay mouths often extinguishes lagoons behind bay bars or completely fills open bays, thus simplifying the shoreline. When the delta forms at the head of the bay, it is a *bay-head delta.*

Baymouth bar. A bar extending partly or entirely across the mouth of a bay.

Bayou. A minor, sluggish waterway or estuarial creek, generally tidal or with a slow or imperceptible current, and with its course generally through lowlands or swamps, tributary to or connecting with other bodies of water. Various specific meanings have been implied in different parts of the southern United States. Sometimes called *slough.*

Beach. The zone of unconsolidated material that extends landward from the low-water line to the place where there is a marked change in material or physiographic form, or to the line of permanent vegetation (usually the effective limit of storm waves). A beach includes foreshore and backshore. The beach along the margin of the sea may be called a *seabeach.*

Beach berm. A nearly horizontal part of the beach or backshore formed by the deposit of material by wave action. Some beaches have no berms, others have one or several.

Beach face. The section of the beach normally exposed to the action of the wave uprush. The foreshore of a beach.

Beacon. A lighted or unlighted aid to navigation attached to the earth's surface. (Lights and daybeacons both constitute "beacons.")

Beam compass. A drafting instrument for drawing circles with a large radius. The point and pen, or pencil tip, are separate units, mounted to slide and clamp on a long bar or "beam" so that the distance between them is equal to the desired radius.

Bearing. The horizontal direction of a line of sight between two objects on the surface of the earth.

Bed. The ground upon which a body of water rests. The term is usually used with a modifier to indicate the type of water body, as river bed or sea bed. *See also:* **Bottom.**

Bell buoy. A steel float surmounted by a short skeleton tower in which the bell is fixed. Most bell buoys are sounded by the motion of the buoy in the sea. In a few buoys, the bells are struck by compressed gas or electrically operated hammers.

Bench. (1) A level or gently sloping erosion plane inclined seaward. (2) A nearly horizontal area at about the level of maximum high water on the sea side of a dike.

Berm. The nearly horizontal portion of a beach or backshore having an abrupt fall and formed by deposition of material by wave action, and marks the limit of ordinary high tides.

Berth. The place where a vessel lies when tied up or anchored. A place for securing a vessel.

Bifurcation. A division of a channel into two branches, a fork.

Bifurcation buoy. A buoy which, when viewed from a vessel approaching from the open sea, or in the same direction as the main stream of flood current, or in the direction established by appropriate authority, indicates the place at which a channel divides into two. *See also:* **Junction buoy.**

Bight. A bend or curve; a bend in a coast forming an opening bay; a small open bay formed by an indentation in the coast; a minor feature which affords little protection for vessels.

Blue tint curve. A blue tint is shown in the water areas to the curve, which is considered the danger curve for vessels expected to use that particular chart.

Bluff. A bold, steep headland or promontory. A high, steep bank or low cliff.

Bluffs and cliffs. A rigorous definition of either a bluff or cliff, or a precise distinction between the two, is difficult if not impossible. A feature that is called a cliff in one area may be called a bluff in another. However, most references describe a cliff as a near vertical surface composed of rock. Other promontories with steep surfaces, but not exhibiting both the near vertical face and the rock structure should be called bluffs.

Boat harbors and marinas. Areas of sheltered water, generally within harbors or ports, set aside for the use of small craft, usually with moorings, buoys, and, in the case of marinas, berthing facilities.

Boathouse. A building at or near a shore for storage of boats.

Bog. A small open marsh which yields under the foot.

Bold coast. A prominent land mass that rises steeply from the sea.

Bollard. A post (usually steel or reinforced concrete) firmly secured on a wharf, quay, etc., for mooring vessels by means of lines extending from the vessel and secured to the post.

Boom. A floating barrier of timber used to protect a river or harbor mouth or to create a harbored area for storage purposes. Also called *log boom.*

Border break. A cartographic technique used when it is required to extend cartographic detail of a map or chart beyond the neatline into the margin. This technique may eliminate the necessity of producing an additional sheet. Also called *blister.*

Border of chart. The neatline defining the limits of the area charted.

Bore. A very rapid rise of the tide in which the advancing water presents an abrupt front of considerable height. Bores generally occur in shallow estuaries where the range of tide is large.

Bottom. The ground under a body of water. The terms *bed, floor*, and *bottom* have nearly the same meaning, but bed refers more specifically to the whole hollowed area supporting a body of water, floor refers to the essentially horizontal surface constituting the principal level of the ground under a body of water, and bottom refers to any ground covered with water.

Bottom characteristics. Designations used on surveys and nautical charts to indicate the consistency, color, and classification of the sea bottom. Also called *nature* or *quality* or *character of the bottom.*

Bottom land. Lowland formed by alluvial deposit along a stream or in a lake basin; a flood plain.

Boulder. One of several descriptors of the "nature of the seabed" used in Chart No. 1 A detached water-rounded stone more than 256 mm in diameter (i.e., larger than a person's head).

Boundary line. A line separating two areas. In specific cases, the word "boundary" is often omitted, as in state line; or the word "line" is omitted, as in international boundary, county boundary, etc. The term *boundary line* is used to specify boundaries between political territories, as in state boundary lines between two states.

Bounding Meridian. A Meridian which is coincident with a part of the neatline on a chart.

Bounding parallel. A parallel which is coincident with a part of the neatline on a chart.

Bowditch. Popular title for Publication No. 9, *American Practical Navigator.*

Branch. A creek or brook, as used locally in southern states. Also used to designate one of the bifurcations of a stream, as a fork.

Breaker. A wave breaking on the shore, over a reef, etc. Breakers may be roughly classified into three kinds, although the categories may overlap: (1) spilling breakers break gradually over a considerable distance, (2) plunging breakers tend to curl over and break with a crash, and (3) surging breakers peak up, but then instead of spilling or plunging they surge up on the beach face.

Breakwater. A breakwater is a device protecting a shore area, harbor, anchorage, or basin from waves. A floating breakwater is a contrivance consisting of floating materials connected by mooring chains or cables attached to anchors or stone blocks in such a manner as to form a basin within which vessels may be protected from the violence of the waves. A breakwater may be attached to or separated from the shore. *See also:* **Jetty.**

Bridge. The term "bridge" means a lawful bridge over navigable waters of the United States, including approaches, fenders, and appurtenances thereto, which are used and operated for the purpose of carrying railroad traffic, or both railroad and highway traffic.

Brook. 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.

Buildings. Buildings exist in all sizes and shapes and exhibit various degrees of prominence. Those with true landmark value are discussed under **Landmark.** Many others, however, are sufficiently prominent so as to aid the mariner in becoming oriented, especially in harbor areas. These are buildings such as large warehouses, factories, maintenance facilities, etc., that will aid the mariner, for example, in identifying a particular berth.

Built-up area. An area where the buildings are so close together that for cartographic clarity a tint or hatching is used to indicate the extent of the area. Landmark buildings are usually depicted within the area. Cartographic agencies usually define by scale the extent of congestion required before the area tint or hatching is used, as well as the minimum dimensions of such areas or of clear areas within tinted or hatched areas.

Bulk cargo. Usually a homogeneous cargo stowed in bulk (i.e., loose in the hold and not enclosed in any container such as boxes, bales, bags, etc.). Bulk cargos may be free-flowing articles (such as oil, grain, or ore) which can be pumped or run through a chute or handled by dumping, or articles that require mechanical handling (such as coke, bricks, or pig iron).

Bulkhead. A structure or partition to retain or prevent sliding of the land. A secondary purpose is to protect the upland against damage from wave action. Bulkheads are frequently filled behind, thereby increasing the utility of the adjacent land area.

Buoy. A floating object, other than a lightship, moored or anchored to the bottom, and an aid to navigation.

Buoyage. A system of buoys. One in which the buoys are assigned shape, color, and number distinction in accordance with location relative to the nearest obstruction is called a *cardinal system.* One in which buoys are assigned shape, color, and number distinction as a means of indicating navigable waters is called a *lateral system. See also:* **IALA Maritime Buoyage System.**

Butte. A lone hill, especially one with steep or precipitous sides.

Cairn. A mound of rough stones or concrete, particularly one serving or intended to serve as a landmark. The stones are customarily piled in a pyramidal or beehive shape.

Caisson. A watertight gate for a lock, basin, etc. A steel structure which either floats or slides into place to close the entrance to a dry dock, lock, or nontidal basin.

Call letters. Identifying letters, sometimes including numerals, assigned by competent authority to a radio station. In the United States such identification is assigned by the *Federal Communications Commission* (FCC).

Canal. (1) An artificial waterway for navigation. (2) A long, fairly straight natural channel with steep sloping sides. (3) Any watercourse or channel. (4) A sluggish coastal stream, as used locally on the Atlantic coast of the United States.

Can buoy. An unlighted buoy of which the upper part of the body (above the waterline), or the larger part of the superstructure, has the shape of a cylinder or nearly so. Also called *cylindrical buoy.*

Canyon. On the seafloor, a relatively narrow, deep depression with steep sides, the bottom of which generally has a continuous slope.

Cape. A relative extensive land area jutting seaward from a continent, or large island, which prominently marks a change in or interrupts notably the coastal trend.

Captain of the Port. The officer of the U.S. Coast Guard, under the command of a District Commander, so designated by the Commandant for the purpose of giving immediate direction to U.S. Coast Guard law enforcement activities within his assigned area.

Cardinal point. Any of the four principal directions; north, east, south, or west. Directions midway between cardinal points are called intercardinal points.

Cardinal system. A buoyage system generally used to indicate dangers where the coast is flanked by numerous islands, rocks, and shoals as well as to indicate dangers in the open sea. In this system the bearing (true) of the mark from the danger is indicated to the nearest cardinal point.

Carse. A low, fertile river bottom. (Scottish origin.)

Cartographer. One who practices cartography, particularly a member of the profession regularly concerned with any stage in the evaluation, compilation, design, or drafting of a map or chart.

Cartographic feature. A term applied to the natural or cultural items shown on a map or chart. The three main categories are: "point feature," "line feature," and "area feature."

Cartographic license. The freedom to modify manuscript information in order to improve the clarity of the chart or map.

Cartography. The art, science, and technology of making charts or maps, together with their study as scientific documents and works of art. In this context, maps may be regarded as including all types of maps, plans, charts and sections, three-dimensional models and globes representing the earth or any celestial body at any scale.

Cascade. A fall of water over steeply sloping rocks, usually comparatively small or one of a series.

Cataract. A waterfall, usually larger than a cascade, over a precipice.

Catwalk. *See:* **Fore-and-aft bridge.**

Causeway. A raised way, as for a road, across wet ground, or water. A causeway is a raised roadway of solid structure built primarily to provide a route across wet ground or an intertidal area.

Cautionary characteristic. Of a light, a unique characteristic which can be recognized as imparting a special cautionary significance (e.g., a quick flashing characteristic phase indicating a sharp turn in a channel).

Cavern. A large, natural, underground cave or series of caves. Often, but not always, used to imply largeness or indefinite extent to distinguish from "cave."

Cay (also kay, key). A low, flat island of sand, coral, etc., awash or drying at low water; a term originally applied to the coral islets around the coast and islands of Caribbean Sea.

Ceja. The cliff at a mesa edge; an escarpment. Local in Southwest.

Central meridian. The line of longitude at the center of a map or chart projection. Generally, the basis for constructing the projection.

Centerline controlling depth. The controlling depth of a waterway, which applies only to the center of the waterway; it is usually the result of a reconnaissance-type survey consisting of only a few lines of soundings which do not provide adequate coverage to determine the controlling depth of the entire waterway.

Cerrito (or cerrillo). A small hill. (Local in Southwest.)

Cerro. Hill, highland; ridge. (Local in Southwest.)

Chain. A group of associated stations of a radionavigation system. A LORAN-C chain consists of a master station and two or more secondary stations.

Chalk. One of several descriptors of the "nature of the seabed" used in Chart No. 1 Chalk is soft earthy sandstone of marine origin, composed chiefly of minute shells. It is white, gray, or buff in color. Part of the ocean bed and shores and composed of chalk, notably the "white cliffs of Dover," England. Chalk exhibits variable, but sometimes poor, holding qualities.

Channel. (1) That part of a body of water deep enough for navigation through an area otherwise not suitable. It is usually marked by a single- or double-line of buoys and sometimes by ranges. (2) The deepest part of a stream, bay, or strait, through which the main current flows. (3) A name given to certain large straits, as the English Channel. (4) A hollow bed through which water does or may run. (5) A band of radio frequencies within which a radio station must maintain its modulated carrier frequency to prevent interference with stations on adjacent channels. Also called *frequency channel.*

Channel, sea. A long, narrow, U-shaped or V-shaped shallow depression of the seafloor, usually occurring on a gently sloping plain or fan.

Characteristic. (1) The color and shape of a daymark or buoy or the color and period of light used for identifying the aid. (2) The identifying signal transmitted by a radiobeacon.

Characteristic color. Of a light, the unique identifying color (e.g., in the U.S. buoyage system, green lights are used only on black buoys or on horizontally banded black-and-red buoys with the topmost band black).

Characteristics of light. All particularities of a light, such as color, period, group number, visibility, height above sea level, and character. Also called *light characteristics.*

Characteristic phase. Of a light, the sequence and length of light and dark periods by which a navigational light is identified (i.e., whether fixed, flashing, interrupted, quick flashing, etc.).

Chart agent. Business establishments that are under contract with NOAA and that receive discounts for resale of nautical and aeronautical navigational charts and related publications to the general public at retail prices stipulated by NOAA.

Chart, bathymetric. A topographic map of the bed of the ocean.

Chart datum. The datum to which soundings on a chart are referred. It is usually taken to correspond to a low-water elevation.

Charted visibility. The extreme distance, shown in numbers on a chart, at which a navigational light can be seen. This may be the geographic range when limited by the curvature of the earth and the heights of the light and the observer or the luminous range when limited only by the intensity of the light, clearness of the atmosphere, and sensitivity of the observer's eyes.

Chart, isogonic. Chart showing magnetic declination with isogonic lines and the annual rate of change in declination with isoporic lines.

Chartlet. A corrected reproduction of a small area of a nautical chart which is pasted to the chart for which it is issued. These chartlets are disseminated in *Notice to Mariners* when the corrections are too numerous or of such detail as not to be feasible in printed form. (Also called: *block, block correction, chart amendment patch.)*

Chart, Mercator. A chart on the Mercator projection. This is the chart commonly used for marine navigation. In Mercator Chart, a rhumb line is a straight line.

Chart, nautical. A chart specifically designed to meet the requirements of marine navigation, showing depths of water, nature of bottom, elevations, configuration and characteristics of coast, dangers and aids to navigation. (Also called: *marine chart, hydrographic chart,* or simply *chart.)*

Chart scale. The ratio between a distance on a chart and the corresponding distance represented, as 1:80,000 (natural scale), or 30 miles to an inch (numerical scale). May be called *map scale* when applied to any map. *See also:* **Representative fraction.**

Chart sounding datum. The tidal datum to which soundings and drying heights on a chart are referred. It is usually taken to correspond to a low-water stage of the tide. Often shortened to "chart datum," especially when it is clear that reference is not being made to a horizontal datum.

Chasm. A deep breach in the earth's surface; an abyss; a gorge; a deep canyon.

Chimney. A label on a nautical chart which indicates a relatively small, upright structure projecting above a building for the conveyance of smoke.

Circle, great. The circle formed by the intersection of a sphere with a plane that passes through the center of the sphere. The shortest distance between any two points on a sphere is along the arc of a great circle connecting the two points.

Circle of visibility. That circle surrounding an aid to navigation and in which the aid is visible.

Clay. One of several descriptors of the "nature of the seabed" used in Chart No. 1. *See under:* **Mud.**

Clearance, bridge. Minimum vertical or horizontal space available for passage.

Cliff. Land arising abruptly for a considerable distance above water or surrounding land. *See also:* **Bluff.**

Closed. A manned aid temporarily discontinued for the winter season.

Closing line. The dividing line between inland waters and the marginal sea across the entrance of a true bay. *See also:* **Marginal sea.**

Coast. The part of the land next to the sea. This term includes natural appendages of the territory which rise out of the water, although they may not be of sufficient firmness to be inhabited or fortified. Shoals perpetually covered with water are not included under the term "coast." Coast is the term used with reference to the land, while "shore" is the term used with reference to the sea.

Coast charts. These NOAA charts are published at scales from 1:50,000 to 1:150,000 and are intended for nearshore navigation inside outlying reefs and shoals, in entering or leaving bays and harbors of considerable size, and in navigating the larger inland waterways.

Coastal confluence zone. A coastal area of the United States which has an outer boundary of 50 nautical miles from shore or the 100-fathom curve, whichever is farther, and an inner boundary of the shoreline or the outer boundary of the harbor entrance, whichever is farther.

Coastal plain. Any plain which has its margin on the shore of a large body of water, particularly the sea, and generally represents a strip of geologically recent emerged sea bottom.

Coastal waters. (1) The U.S. waters of the Great Lakes (Erie, Huron, Michigan, Ontario, and Superior); (2) the territorial seas of the United States; and (3) those waters directly connected to the Great Lakes and territorial seas (i.e., bays, sounds, harbors, rivers, inlets, etc.), where any entrance exceeds 2-nautical miles between opposite shorelines to the first point where the largest distance between shorelines narrow to 2 miles as shown on the current edition of the appropriate NOAA chart used for navigation.

Coasting. Proceeding approximately parallel to a coastline (headland to headland) in sight of land, or sufficiently often in sight of land to fix the ship's position by observations of land features.

Coastline. Generally, where the shore directly contacts the open sea, the line on the shore reached by the ordinary low tides comprised the coastline from which the distance of three geographic miles is measured. The line has significance for both domestic and international law (in which it is termed the "baseline"), and is subject to precise definitions. Special problems arise when offshore rocks, islands, or other bodies exist, and the line may have to be drawn to seaward of such bodies.

Coastwise navigation. Navigation in the vicinity of a coast, in contrast with offshore navigation at a distance from a coast. *See also:* **Coasting.**

Cobble. One of several descriptors of the "nature of the seabed" used in Chart No. 1 *See under:* **Stones.**

COLREGS. Acronym for *International Regulations for Preventing Collisions at Sea.* Lines of demarcation delineating those waters upon which mariners must comply with the International Regulations for Preventing Collisions at Sea, 1972 (72 COLREGS) and those waters upon which mariners must comply with the Navigation Rules for Harbors, Rivers, and Inland Waters (Inland Rules). The waters outside the lines are COLREGS waters. For specifics concerning COLREGS demarcation lines see: *U.S. Code of Federal Regulations* (CFR), Title 33, Navigation and Navigable Waters; Part 82, COLREGS demarcation lines.

Commissioned. An aid previously reported closed or withdrawn which has been placed in operation.

Compass course. (1) Course relative to compass north. (2) Compass direction. Horizontal direction expressed as angular distance from compass north.

Compass direction. Direction as indicted by compass without any allowances for compass error. The direction indicated by a compass may differ by a considerable amount from true or magnetic direction.

Compass, gyroscopic. A compass consisting of a gyroscope suspended so that its axis of rotation points north.

Compass, magnetic. A device that indicates direction by means of a magnet supported at its midpoint so that the magnet aligns itself with the local magnetic field. The end of the magnet, which points in the general direction of north, is marked.

Compass north. The uncorrected direction indicated by the north-seeking end of a compass needle. *See also:* **Magnetic north.**

Compass rose. A circle graduated in degrees, clockwise from 0° at the reference direction to 360°. Compass roses are placed at convenient locations on the Mercator chart or plotting sheet to facilitate measurement of direction.

Compilation. (1) The production of a new or revised map or chart, or portions thereof, from existing maps, aerial photographs, surveys, new data, and other sources. (2) The production of a map or chart, or portions thereof, from aerial photographs and geodetic control data, by means of photogrammetric instruments.

Containerized cargo. Cargo which is carried in sealed, specially constructed containers. In roll-on/roll-off container operations, truck trailers, complete with chassis and wheels, are rolled onto and off of special types of ships or barges by means of ramps. In lift-on/lift-off operations, containers are loaded and unloaded by means of high-speed shipboard or shore-based cranes.

Conterminous United States. Comprises the 48 states of the United States and the District of Columbia; all of the states exclusive of Alaska and Hawaii. They have common boundaries and are not separated by foreign territory or the high seas.

Continental borderland. 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.

Continental margin. The zone, generally consisting of shelf, slope, and rise, separating the continent from the abyssal plain or deep sea bottom.

Continental rise. A gentle slope rising from the oceanic depths toward the foot of a continental slope.

Continental shelf. The submerged portion of a continent, which slopes gently seaward from the low-water line to a point where a substantial break in grade occurs, at which point the bottom slopes seaward at a considerable increase in slope until the great ocean depths are reached. The point of break defines the edge of the shelf, and the steeper sloping bottom the continental slope. Conventionally, the edge is taken at 100 fathoms (200 meters) but instances are known where the increase in slope occurs at more than 200 or less than 65 fathoms.

Contour. A line joining points of equal vertical distance above or below a datum. Such a line on a map is a type of Isoline.

Contour line. A line connecting points of equal elevation or equal depth. One connecting point of equal depth is usually called a fathom curve, or fathom line. *See also:* **Form line.**

Controlling depth. (1) The least depth in the approach or channel to an area, such as a port or anchorage, governing the maximum draft of vessels that can enter. (2) The least depth within the limits of a channel; it restricts the safe use of the channel to drafts of less than that depth. The centerline controlling depth of a channel applies only to the channel centerline; lesser depths may exist in the remainder of the channel. The mid-channel controlling depth of a channel is the controlling depth of only the middle half of the channel. *See also:* **Federal project depth.**

Conventional nautical charts. These charts are flat, printed reproductions published by NOAA of some portion of the navigational part of the earth's surface. Depending on their scale, these charts show the nature and shape of the coast, depth of the water, general configuration and character of the bottom, prominent landmarks, port facilities, cultural details, dredged channels, aids to navigation, marine hazards, magnetic variations, and seaward boundaries. Changes brought about by people and nature require that nautical charts be constantly maintained to aid safe navigation.

Coordinates. Linear or angular quantities, which designate the position of a point in relation to a given reference system.

Coral. In the strict sense, coral is a bottom-dwelling marine organism, which secretes an external skeleton of calcium carbonate and which frequently forms large, irregular colonies with numerous coral heads and pinnacle. In reality, coral formations are usually a mixture of coral and other marine organisms along with other debris and chemically precipitated rock. For shoreline mapping purposes, a rock or coral formation is a naturally occurring, consolidated rock, or coral mass, that differs conspicuously from adjacent objects and materials, and which is too large to be adequately represented on the shoreline map by a single rock (coral) symbol.

Coral head. A massive mushroom or pillar-shaped coral growth.

Coral reef. A reef made up of coral, fragments of coral and other organisms, and the limestone resulting from their consolidation.

Correction of soundings. The adjustment of soundings for any departure from true depth because of the method of sounding or any fault in the measuring apparatus.

Coulee. A steep-walled, trenchlike valley; a wash, gulch, or arroyo through which water flows intermittently. (Western United States.)

Course. The intended horizontal direction of travel. It is measured from 0° at the reference direction clockwise through 360°; strictly for marine navigation, the term applies to the direction to be steered, which sometimes differs from the direction intended to be made good over the ground. The course is designated as true, magnetic, or compass, as the reference direction is true, magnetic, or compass north respectively.

Course, recommended. A line shown on a chart, which has been specially examined to ensure that it is free of dangers, and along which ships are advised to navigate. Also called *recommended track.*

Cove. A small, sheltered recess in a coast, often inside a larger embayment.

Covers and uncovers (or discovers). Expression intended to indicate an area of a reef or other projection from the bottom of a body of water, which periodically extends above and is submerged below the surface. Also referred to as dries or uncovers.

Crag. A steep, rugged rock; a rough, broken cliff of a projecting point of rock; also a detached fragment of a rock.

Crater. The bowl-shaped depression around the vent of a volcano or a geyser; also a hole formed by the impact of a meteorite, the detonation of a mine, or the like.

Creek. (1) A stream of less volume than a river, but larger than a brook. (2) A small tidal channel through a coastal marsh. (3) A wide arm of a river or bay.

Crest. 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.

Crevasse. A deep crevice, or fissure, especially in a glacier. A break in a levee or other stream embankment.

Crib. A permanent marine structure, usually designed to support or elevate pipelines; especially a structure enclosing a screening device at the offshore end of a potable water intake pipe. The structure is commonly a heavy timber enclosure that has been sunken with rocks or other debris.

Culture. Artificial features that are under, on, and above ground, which are delineated on a chart or map. These features include roads, trails, buildings, canals, sewer systems, and boundary lines. In a broad sense, the term also applies to all names, other identification, and legends on a chart or map.

Cupola. A label on a nautical chart which indicates a small dome-shaped tower or turret rising from a building.

Current. Generally, a horizontal movement of water. Currents may be classified as tidal and nontidal.

Cut-off. A new, and relatively short, channel formed when a stream cuts through the neck of an oxbow or horseshoe bend. An artificial straightening or short cut in a channel.

Dalles. The nearly vertical walls of a canyon or gorge, usually containing a rapid. (Local in Northwest.)

Danger area. The specified area above, below, or within which there may exist potential danger. *See also:* **Prohibited area; Restricted area.**

Danger line. (1) A line drawn on a chart to indicate the limits of safe navigation for a vessel of specific draft. (2) A line used to draw the navigator's attention to a danger, which would not stand out clearly enough if it were represented on the chart solely by the specific symbols.

Danger sounding. A minimum sounding chosen for a vessel of specific draft in a given area to indicate the limit of safe navigation.

Dangerous cargo. The term "dangerous cargo" means all explosives and other hazardous materials or cargo covered by federal regulations.

Dangerous rock. A sunken rock of a small area (pinnacle), at such a depth as to be considered dangerous to surface navigation.

Dangerous wreck. A wreck submerged at such a depth as to be considered dangerous to surface navigation.

Datum, geodetic. A set of constants specifying the coordinate system used for geodetic control, i.e., for calculating coordinates of points on the earth.

Datum plane. A surface used as a reference from which heights or depths are reckoned. The plane is called a *tidal datum* when defined by a phase of the tide, for example, high water or low water.

Datum sounding. The horizontal plane or tidal datum to which the soundings on a hydrographic survey are reduced. Also called *datum for sounding reduction.*

Datum, tidal. A surface with a designated elevation from which heights or depths are reckoned, defined by a certain phase of the tide.

Datum, vertical. For marine applications, a base elevation used as a reference from which to reckon heights or depths.

Daybeacon. An unlighted fixed structure which is equipped with a daymark for daytime identification.

Deadhead. A submerged or barely awash log or tree trunk freely floating at varying attitudes in contrast to the plane formed by the still (undisturbed) surface of the water. At times, one end of a deadhead may become attached to the bottom with the opposite (unattached) end floating.

Dead reckoning. The process of determining the position of a vessel at any instant by applying to the last well-determined position (point of departure or subsequent fix) the run that has since been made. The position so obtained is called a *dead reckoning position.* When the principle purpose of dead reckoning is to lay down on the chart a reference plot for evaluating the reasonableness of positioning by other means, the dead reckoning plot is usually constructed without allowance for disturbing elements (such as current, wind, sea conditions, roughness of vessel's bottom, etc.), the course steered being used for direction and ordered speed being used for rate of movement along the course line.

Deep. A relatively small area of exceptional depth found in a depression. The term is generally restricted to depths greater than 3,000 fathoms.

Deep-draught route. A route which is primarily selected for use by ships which, because of their deep draught, may not be able to navigate safely outside such route.

Deep-water route. A route in a designated area within definite limits which has been accurately surveyed for clearance of sea bottom and submerged obstacles to a minimum indicated depth of water.

Defense Mapping Agency. The DMA (renamed National Imagery and Mapping Agency in 1995) was established as an agency of the Department of Defense (DOD) on January 1, 1972, under the provisions of the National Security Act of 1947, as amended (61 Stat. 495; 50 U.S.C. 401). The mission of the DMA is to provide mapping, charting, and geodetic support and services to the Secretary of Defense, the Joint Chiefs of Staff, the military departments, and other DOD components through the production and worldwide distribution of maps, charts, precise positioning data, and digital data for strategic and tactical military operations and weapons systems.

Degaussing. Neutralization of the strength of the magnetic field of a vessel, by means of suitably arranged electric coils permanently installed in the vessel. *See also:* **Deperming.**

Degaussing range. An area for determining magnetic signatures of ships and other marine craft. Such signatures are used to determine required degaussing coil current settings and other required corrective action. Sensing instruments and cables are installed on the sea bed in the range, and there are cables leading from the range to a control position ashore. The range is usually marked by distinctive buoys.

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.

Density of soundings. Intervals between lines of sounding and soundings in the same line. Density of soundings mostly depends on the scale and nature of the survey. Also called *frequency of soundings.*

Deperming. The process of changing the magnetic condition of a vessel by wrapping a large conductor around it a number of times in a vertical plane, athwartships, and energizing the coil thus formed. If a single coil is placed horizontally around the vessel and energized, the process is called *flashing* if the coil remains stationary, and *wiping* if it is moved up and down. *See also:* **Degaussing.**

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.

Depression contour. A closed contour delimiting an area of lower elevation than the surrounding terrain. Directional ticks extend from the contour in a downhill direction.

Depth. The vertical distance from a given water level to the bottom. The charted depth is the vertical distance from the tidal datum to the bottom. The least depth in the approach or channel to an area, such as a port or anchorage, governing the maximum draft of vessels that can enter is called the *controlling depth.*

Depth contour navigation. A method of position determination by utilizing the depth contours on the nautical chart. Consists in fitting a series of observed echo soundings to the depth contours by recording a number of soundings and simultaneous log distances and plotting them on a strip of transparent paper at the scale of the chart. The line of soundings is fitted to the depth contours by moving it so that it remains parallel to the true course steered.

Depth, controlling. The least depth in the approach or channel to an area, such as a port of anchorage, governing the maximum draft of vessels that can enter.

Depth curve. A depth curve is a line connecting points of equal water depth which is sometimes significantly displaced outside of soundings, symbols, and other chart details for clarity as well as generalization. Depth curves therefore often represent an approximate location of the line of equal depth as related to the surveyed line delineated on the source.

Depth finder. An instrument for the measurement of the depth of water, particularly an echo sounder.

Derelict. Any property abandoned at sea, often of sufficient size as to constitute a menace to navigation; especially an abandoned vessel. *See also:* **Wreck.**

Deviation. The angle between the magnetic meridian and the axis of a compass card, expressed in degrees east or west to indicate the direction in which the northern end of the compass card is offset from magnetic north. Deviation is caused by disturbing magnetic influences in the immediate vicinity of the compass, as within the craft.

Deviation table. A table of the deviation of a magnetic compass on various headings, magnetic or compass.

Diaphone. A sound signal emitter operating on the principle of periodic release of compressed air controlled by the reciprocating motion of a piston operated by compressed air. The diaphone usually omits a powerful sound of low pitch which often concludes with a brief sound of lower pitch called the *grunt.* The emitted signal of a two-toned diaphone consists of two tones of different pitch, in which case the second tone is of lower pitch.

Diaphragm horn. A sound signal emitter comprising a resonant horn excited at its throat by impulsive emissions of compressed air regulated by an elastic diaphragm. Duplex or triplex horn units of different pitch produce a chime signal. Also called *compressed air horn.*

Dike. A bank of earth or stone used to form a barrier, frequently and confusingly interchanged with **Levee,** definition 1. A dike restrains water within an area that is normally flooded.

Directional light. A light illuminating a sector or very narrow angle and intended to mark a direction to be followed.

Discharge. Includes, but is not limited to, any spilling, leaking, pouring, pumping, emitting, emptying, or dumping.

Discolored water. Unnatural colored areas in the sea due to the existence of shoals. Sea water having a color other than the blues and greens normally seen. Variations of the colors red, yellow, green, and brown, as well as black and white, have been reported. Discolorations may appear in patches, streaks, or large areas and may be caused by concentrations of inorganic or organic particles or plankton.

Discontinued. To remove from operating (permanently or temporarily) a previously authorized aid.

Discrepancy. Failure of an aid to maintain its position or function as prescribed in the *Light List.*

Discrepancy buoy. An easily transportable buoy used to temporarily replace an aid to navigation not watching properly.

District Commander. The officer of the U.S. Coast Guard designated by the Commandant to command a U.S. Coast Guard District.

Diurnal. Having a period or cycle of approximately one tidal day. Thus, the tide is said to be diurnal when only one high water and one low water occur during a tidal day, and the tidal current is said to be diurnal when there is a single flood and a single ebb period in the tidal day. A rotary current is diurnal if it changes its direction through all points of the compass once each tidal day.

Divide. The line of separation between drainage systems; the summit of an interfluve. The highest summit or a pass or gap.

Dock. (1) The slip or waterway between two piers, or cut into the land for the berthing of ships. A pier is sometimes erroneously called a *dock.* Also called *slip. See also:* **Jetty; Landing; Quay; Wharf.** (2) A basin or enclosure for reception of vessels, and provided with means for controlling the water level. A wet dock is one in which water can be maintained at various levels by closing a gate when the water is at the desired level. A dry dock is a dock providing support for a ship, and means of removing the water so that the bottom of the ship or other craft can be exposed. A dry dock consisting of an artificial basin is called a *graving dock;* one consisting of a floating structure is called a *floating dock.* (3) Used in the plural, a term used to describe area of the docks, wharves, basins, quays, etc.

Dock, floating. A form of dry dock consisting of a floating structure of one or more sections which can be partly submerged by controlled flooding to receive a vessel, then raised by pumping out the water so that the vessel's bottom can be exposed.

Dock sill. The foundation at the bottom of the entrance to a dry dock or lock against which the caisson or gates close. The depth of water controlling the use of the dock or lock is measured from the sill to the surface.

Dock, wet. A dock in which water can be maintained at any level by closing a gate when the water is at the desired level.

Dog leg. A leg which does not lead directly to the destination or way point. It is followed to comply with established procedures, avoid possible dangers or bad weather, delay time of arrival, etc.

Dolphin. A mooring post or buffer placed at the entrance of a dock, alongside a wharf or in the middle of a stream. In the first and second instances it is used as a buffer. In the third it is used as a mooring post by vessels which discharge their cargoes without going alongside a dock or wharf. Each dolphin is generally composed of a series of heavy piles contiguous to each other. They are arranged in a circle, brought together and capped over the top.

Dome. A label on a nautical chart which indicates a large, rounded, hemispherical structure rising from a building or a roof of the same shape. A prominent example is that of the Capitol of the United States in Washington, DC. Also a smoothly rounded, rock-capped mountain summit, roughly resembling the dome or cupola of a building.

Doubtful sounding. Of uncertain depth. The expression, as abbreviated, is used principally on charts to indicate a position where the depth may be less than indicated, the position not being in doubt.

Draft (or draught). The vertical distance, at any section of a vessel from the surface of the water to the bottom of the keel. When measured at or near the stem, it is referred to as *draft forward* and when measured at or near the stern as *draft aft.* These drafts are more specifically described as displacement drafts as opposed to navigational drafts which are measured to the lowest appendage to the hull as opposed to the keel.

Drag. To tow a line or object below the surface, to determine the least depth in an area or to insure that a given area is free from navigational dangers to a certain depth. Drag and sweep have nearly the same meanings. Drag refers particularly to the location of obstructions or the determination that obstructions do not exist. Sweep may include, additionally, the removal of any obstructions located. *See also:* **Sweep.**

Drain. A channel; a trench; a watercourse, especially a narrow one.

Drawbridge. A bridge that can be raised, lowered, or drawn aside.

Drawing. An impression following the printing of a nautical chart of either its black or its magenta detail on matte finish transparent plastic, used in revising subsequent printings of the chart.

Dredged material. The term "dredge material" means any material excavated or dredged from navigable waters of the United States.

Dry dock. An enclosed basin into which a ship is taken for underwater cleaning and repairing. It is fitted with watertight entrance gates, which when closed permit the dock to be pumped dry. In modern dry docks the gates opening in the middle and hinged at sides having been replaced by a caisson or pontoon that fits closely into the entrance. The caisson is flooded and sunk in place, and can be pumped out, floated and warped away from the dock entrance to permit passage of vessels. Also called **Graving dock.**

Dry harbor. A small harbor which either dries at low water or has insufficient depths to keep vessels afloat during all states of the tide. Vessels using it must be prepared to take the ground on the falling tide.

Drying heights. Heights above chart sounding datum of those features which are periodically covered and exposed by the rise and fall of the tide.

Dry wash. A wash, arroyo, or coulee in the bed of which there is not water, except at infrequent intervals and for short periods.

Duck blind. For NOAA charting purposes, a duck blind is a nonfloating structure, used for concealing waterfowl hunters, usually consisting of a wooden framework covered with brush.

Dumping grounds. Although shown on nautical charts as dumping grounds in U.S. waters, the federal regulations for these areas have been revoked and their use for dumping discontinued. These areas will continue to be shown on nautical charts until such time as they are no longer considered to be a danger to navigation. *See also:* **Dump site, Spoil area.**

Dump site. An area established by federal regulation in which dumping of dredged and fill material and other nonbuoyant objects is allowed with the issuance of a permit. Dump sites are shown on nautical charts. *See also:* **Dumping grounds, Spoil area.**

Dune. A hill or ridge formed by the wind from sand or other granular material.

Ebb. Tidal current moving away from land or down a tidal stream. The opposite is **Flood.** Sometimes the terms "ebb" and "flood" are also used with reference to vertical tidal movement, but for this vertical movement the expressions falling tide and rising tide are considered preferable.

Ebb current. The tidal current associated with the decrease in the height of a tide. Ebb currents generally set seaward.

Ebb tide. The portion of the tide cycle between high water and the following low water. Also called *falling tide.*

Echo sounder. An instrument for determining the depth of water by measuring the time interval between the emission of a sonic or ultrasonic signal and the return of its echo from the bottom. Also called *echo sounding instrument* (or *apparatus), sonic depth finder,* or *ultrasonic depth finder,* as appropriate. *See also:* **Echo sounding.**

Echo sounding. A method of measuring the depth of water by determining the time required for sound waves to travel, at a known velocity, from the survey vessel to the bottom and return.

Eclipse. A phase of the characteristic of a flashing light during which the light is not exhibited.

Eddy. A current of water running contrary to the main current or moving circularly; a whirlpool.

Electronic aid to navigation. An aid to navigation using electronic equipment. If the navigational information is transmitted by radio waves, the device may be called a *radio aid to navigation.*

Electronic navigation. Navigation by means of electronic equipment. The expression electronic navigation is more inclusive than radionavigation, since it includes navigation involving any electronic device or instrument.

Elevations. Heights of natural and artificial objects above an adopted reference plane. On NOAA nautical charts, the elevations of bare rocks, bridges, landmarks, and lights are referenced to the plane of mean high water; contour and summit elevations are referenced to mean sea level, if the source for such information is referenced to this plane.

Embankment. An artificial deposit of material that is raised above the natural surface of the land and used to contain, divert, or store water; support roads or railways; or for other similar purposes.

Embayment. Any indentation of a coast regardless of width at the entrance or depth of penetration into the land.

Entrance lock. A lock between the tideway and an enclosed basin when their water levels vary. By means of the lock, which has two sets of gates, vessels can pass either way at all states of the tide. Also called **Tide lock.** *See also:* **Nontidal basin.**

Escarpment. An extended line of cliffs or bluffs; a high, steep face of rock; an elongated and comparatively steep slope of the seafloor, separating flat or gently sloping areas.

Establish. To place an authorized aid in operation for the first time.

Established direction of traffic flow. A traffic flow pattern indicating the directional movement of traffic as established within a traffic separation scheme.

Estuary. An embayment of the coast in which fresh river water entering at its head mixes with the relatively saline ocean water. When tidal action is the dominant mixing agent it is usually termed a "tidal estuary." Also, the lower reaches and mouth of a river emptying directly into the sea where tidal mixing takes place. The later is sometimes called a *river estuary.*

Everglade. A tract of swampy land covered mostly with tall grass; a swamp or inundated tract of low land. (Local in the South.)

Exclusive Economic Zone. The Exclusive Economic Zone of the United States is a zone contiguous to the territorial sea, including zones contiguous to the territorial sea of the U.S., the Commonwealth of Puerto Rico, the Commonwealth of the Northern Mariana Islands (to the extent consistent with the Covenant and the United States Trusteeship Agreement), and United States overseas territories and possessions. The Exclusive Economic Zone extends to a distance 200 nautical miles from the baseline from which the breadth of the territorial sea is measured.

Exercise area. An area shown on charts within which naval, military, or aerial exercises are carried out. Also called *military practice area.*

Extinguished. A lighted aid which has failed to show a light signal.

Extrusion (border break). The extension of chart detail outside the neatline.

Fairway. That part of a river, harbor, etc., where the main navigable channel for vessels of larger size lies. The usual course followed by vessels entering or leaving harbor. Also called *ship channel.* The word "fairway" has been generally interpreted to include any navigable water on which vessels of commerce habitually move, and, therefore, embraces the water inside channel buoys where light-draft vessels frequently navigate and not merely the ship channel itself.

Fairway buoy. A buoy marking the fairway in a channel. They are painted in black-and-white or red-and-white vertical stripes. Also called **mid-channel buoy.**

Fall (falls). A cascade, waterfall, or cataract; the flow or descent of one body of water into another. (Usually plural.)

Fan. A gently sloping, cone-shaped accumulation of material normally located at the mouth of a canyon.

Fast land. Land inshore of the inner edge of a marsh; usually at or above the plane of mean high water.

Fast shoreline. The term "fast shoreline" refers to the line appearing on a shoreline map that separates water from fast, natural uplands. This line should not be confused with the approximate back limits of marsh or marine vegetation which is normally compiled shoreward from an apparent shoreline and in lieu of the fast shoreline.

Fathom. The common unit of depth in the ocean for countries using the English system of units, equal to 6 feet (1.83 meters). It is also sometimes used in expressing horizontal distances, in which case 120 fathoms make one cable or very nearly 1/10 nautical mile.

Fault. In geology, a break or shear in the earth's crust with an observable displacement between the two sides of the break, and parallel to the plane of the break.

Federal project depth. The design dredging depth of a channel constructed by the U.S. Army Corps of Engineers; the project depth may or may not be the goal of maintenance dredging after completion of the channel. For this reason federal project depth must not be confused with **Controlling depth.**

Ferryboat. A vessel in which passengers, vehicles, and goods are conveyed over narrow waters.

Fill material. The term "fill material" means any material used for the primary purpose of replacing an aquatic area with dry land or of changing the bottom elevation of any waterbody. The term does not include any pollutant discharged into the water primarily to dispose of waste.

Filtering. This is the process of selecting specific data within a specific source document for chart application.

Finger piers. Small piers which extend from a larger main pier.

Fiord (or fjord). A long narrow arm of the sea, running up between high banks or cliffs, as on the coast of Norway. Often has a relatively shallow sill across its entrance.

Fish aggregating devices (FADs). Clusters of submerged hollow spheres tethered to a 5-foot diameter spherical surface buoy and cabled to heavy concrete blocks on the seafloor to hold them in suspension. FADs are deployed in depths of 480 to 9,000 feet and at distances from 2 to 15 miles off shore. They are primarily used in the waters off the Hawaiian Islands and to attract fish for commercial and recreational fishermen.

Fish havens. Areas established by private interests, usually sport fishermen, to simulate natural reefs and wrecks that attract fish. The reefs are constructed by dumping assorted junk in areas which may be of very small extent or may stretch a considerable distance along a depth contour. Fish havens are outlined and labeled on charts. Also called *fishery reefs.*

Fishing ground. A water area in which fishing is frequently carried on. Also called *fishing area* or **Fishing zone.**

Fishing zone. The offshore zone in which exclusive fishing rights and management are held by the coastal nation. The United States fishing zone, known as the *Fishery Conservation Zone*, is defined under P.L. 94-265. The law states, "The inner boundary of the Fishery Conservation Zone is a line conterminous with the seaward boundary of each of the coastal states, and the outer boundary of such zone is a line drawn in such manner that each point on it is 200-nautical miles from the baseline from which the territorial sea is measured."

Fish pound. A fixed fish trap of the barrier type. Also called *weir.* It generally consists of a stone wall built across the mouth of a creek and of such height that it can be covered only at high spring tide. At one point there is an opening which can be closed, thus retaining any fish that made their way into the creek on flood tide. When the opening is closed, the water can pass through a grating in the door and when the creek is dry the fish are collected.

Fish (or fishing) stakes. Poles or stakes placed in shallow water to outline fishing grounds or to catch fish.

Fishtrap areas. Areas established by the U.S. Army Corps of Engineers in which traps may be built and maintained according to established regulations. The fish stakes which may exist in these areas are obstructions to navigation and may be dangerous. The limits of fishtrap areas and a cautionary note are usually charted.

Fix. A position determined without reference to any former position. In concept, a fix is the common intersection of two or more lines of position obtained from simultaneous observations not dependent upon any former position. In normal practice, a fix is the most probable position derived from two or more intersecting lines of position obtained from observations made at nearly the same time and advanced or retired to a common time, the lines when numbering three or more not intersecting at a common point because of the errors associated with each line.

Fixed bridge. A single- or multiple-span bridge without a movable span. It has fixed vertical and horizontal clearance.

Flagpole. A label on a nautical chart which indicates a single staff from which flags are displayed. The term is used when the pole is not attached to a building. The label *flagstaff* is used for a flagpole rising from a building.

Flag tower. A label on a nautical chart which indicates a scaffoldlike tower from which flags are displayed.

Flashing light. A light in which the total duration of light in a period is shorter than the total duration of darkness, and appearances of light (flashes) are usually of equal duration. The term is commonly used for a single-flashing light, a flashing light in which a flash is regularly repeated (at a rate of less than 50 flashes per minute).

Flash tube. A discharge lamp, operated with electronic equipment, giving a high light output for a very brief period, capable of repetition.

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").

Float. A float is a floating structure, usually rectangular in shape, which generally serves as a landing or pierhead.

Floating aid. A buoy, secured in its assigned position by a mooring.

Floating breakwater. A breakwater consisting of a series of logs or timbers chained or lashed together and secured by chains or cables attached to anchors or large blocks of stone, so as to form a protected basin for the mooring or anchoring of vessels.

Floating dock. A form of dry dock consisting of a floating structure of one or more sections, which can be partly submerged by controlled flooding to receive a vessel, then raised by pumping out the water so that the vessel's bottom can be exposed. *See also:* **Graving dock.**

Flood. Tidal current moving toward land or up a tidal stream. The opposite is **Ebb.**

Flood current. The movement of a tidal current toward the shore or up a tidal river or estuary.

Floodgate. A gate for shutting out, admitting, or releasing a body of water; a sluice.

Flood plain. Belt of low flat ground bordering a stream channel that is flooded when runoff exceeds the capacity of the stream channel.

Floor. The bed or bottom of the ocean. A comparatively level valley bottom; any low-lying ground surface.

Fog detector. A device used to automatically determine conditions of visibility which warrant the turning on or off of a sound signal or additional light signals.

Fog signal. Generic term for sound and wireless signals employed aboard ship and on shore stations in fog, mist, falling snow, or heavy rainstorms.

Folio charts. These NOAA charts consist of two to four sheets, are printed front and back, folded, and are bound in a protective cardboard jacket.

Foot. (1) The bottom of a slope, grade, or declivity. A term for the lower part of any elevated land form. (2) A unit of length defined to be 1/3 of a yard and equal in the United States, since 1866, to exactly 1200/3937 of a meter.

Foothill. One of the lower subsidiary hills at the foot of a mountain, or of higher hills. (Commonly used in the plural.)

Fore and aft bridge. A series of connecting gangways between the forward and after bridges or between a bridge house and forecastle deck or poop deck. It is commonly found on tankers, where such an installation is desirable due to the slippery condition of the upper deck. Sometimes called *monkey bridge.* Also called *connecting bridge, flying bridge, catwalk.*

Foreland. A cape or promontory.

Foreshore. In legal terminology, the strip of land between the high- and low-water marks that is alternately covered and uncovered by the flow of the tide. In coastal engineering work, it is defined as the part of the shore that lies between the crest of the berm and the ordinary low-water mark, which is ordinarily traversed by the uprush and backrush of the waves as the tide rises and falls; the foreshore would thus extend farther inshore than the shore. *See also:* **Shore.**

Foreshore (according to Coastal Engineering.) That part of the shore lying between the crest of the seaward berm (or the upper limit of wave wash at high tide) and the ordinary low-water mark. *See also:* **Foreshore (according to Riparian Law).**

Foreshore (according to Riparian Law). The strip of land between the high- and low-water marks that is alternately covered and uncovered by the flow of the tide. *See also:* **Foreshore (according to Coastal Engineering).**

Fork. One of the major bifurcations of a stream; a branch.

Form line. Broken lines resembling contour lines but representing no actual elevations, which have been sketched from visual observation or from inadequate or unreliable map sources, to show collectively the shape of the terrain rather than the elevation.

Foul area. An area of numerous uncharted dangers to navigation. The area charted serves as a warning to the mariner that all dangers are not charted individually and that navigation through the area may be hazardous. The term "foul" is not applied to a soft continuum with indefinite boundaries, such as mud or sand; to areas congested with marine vegetation, such as kelp or grass in water; or to materials not likely to cause damage to a vessel.

Foul bottom. A hard, uneven, rocky, or obstructed bottom having poor holding qualities for anchors, or one having rocks or wreckage that would endanger an anchored vessel.

Foul ground. An area unsuitable for anchoring, taking the ground, or ground fishing due to being strewn with rocks, boulders, coral, or obstructions.

Fractional scale. The scale expressed as a fraction (termed the "representative fraction" or "R.F." of the chart or map) in which the numerator is unity and the denominator is the number that the unit distance must be multiplied by in order to obtain its distance on the ground in the same units, thus 1/12,000. Also used in the form 1:12,000 and 1-12,000. Sometimes referred to as natural scale. *See also:* **Scale.**

Fracture zone. A zone of unusually irregular topography of the seafloor averaging 60-nautical miles in width and normally greater than 1,000-nautical miles in length. This zone is characterized by large seamounts, steep-sided, or nonsymmetrical ridges, troughs, or escarpments.

Fringing reef. A reef closely attached to a shore, as contrasted with a barrier reef, which is separated from the shore by a lagoon.

Gap. 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.

General charts. These NOAA charts of the coast are published at scales from 1:150,000 to 1:600,000, and are intended for coastal navigation when a course is well offshore but can be fixed by landmarks, lights, buoys, and characteristic soundings.

Generalization. Selection and simplified representation of detail appropriate to the scale and/or the purpose of a map.

Generalization of detail. A term used to indicate that the least essential information is not shown on a chart. The purpose of generalization is primarily to avoid over crowding charts where space is very limited. It also serves to reduce the correctional maintenance needed and to induce navigators, at least of deeper draft vessels, to use charts of larger scales.

Geodesy. (1) The science concerned with determining the size and shape of the earth. (2) The science that locates positions on the earth and determines the earth's gravity field. The definition can be extended to other planetary bodies. (3) The branch of surveys in which the curvature of the earth must be taken into account when determining directions and distances.

Geodetic coordinates. The quantities of latitude, longitude, and height (ellipsoid), which define the position of a point on the surface of the earth with respect to the reference spheroid. Also imprecisely called *geographic coordinates.*

Geodetic datum. (Also called *horizontal* or *geodetic datum.*) The adopted position in latitude and longitude of a single point to which the charted features of a vast region are referred.

Geodetic latitude. The angle which the normal at a point on the reference spheroid makes with the plane of the geodetic equator.

Geodetic longitude. The angle between the plane of the geodetic meridian and the plane of an initial meridian, arbitrarily chosen.

Geodetic position. A position of a point on the surface of the earth expressed in terms of geodetic latitude and geodetic longitude. A geodetic position implies an adopted geodetic datum.

Geographic. Signifying basic relationship to the earth considered as a globe-shaped body. The term geographic is applied alike to data based on the geoid and on a spheroid. In geodetic surveys in this country, coordinated data consisting of latitudes, longitudes, azimuths, and lengths of lines, are recorded and published under the general title of geographic positions.

Geographic and other names. The term "geographic names" refers to localities, natural features, and artificial waterways. The names do not apply to other artificial objects or features such as roads, bridges, parks, buildings, and stadiums.

Geographical coordinates. Spherical coordinates defining a point on the surface of the earth, usually latitude and longitude. Also called *terrestrial coordinates.*

Geographic latitude. A general term applying alike to astronomic and geodetic latitudes.

Geographic longitude. A general term applying alike to astronomic and geodetic longitudes.

Geographic meridian. A general term applying alike to astronomic and geodetic meridians.

Geographic position. The position of a point on the surface of the earth expressed in terms of latitude and longitude, either geodetic or astronomic.

Geographic range. The greatest distance the curvature of the earth permits an object of a given height to be seen from a particular height of eye without regard to luminous intensity or visibility conditions.

Geyser. A spring which throws forth intermittent jets of heated water or steam.

Glacial drift. Sand, clay, or boulders transported by glaciers to their present locations.

Glacial gorge. A deeply cut valley in U-shaped cross-section, resulting from glacial erosion.

Glacial lake. 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.

Glacier. A mass of snow and ice continuously moving from higher to lower ground or, if afloat, continuously spreading. The principal forms of glaciers are ice sheets, ice shelves, ice caps, ice piedmonts, and various types of mountain glaciers.

Glen. A secluded and small narrow valley; a dell, dale, or vale.

Gnomonic chart. A chart constructed on the gnomonic projection and often used as an adjunct for transferring a great circle to a Mercator chart. Commonly called *Great-Circle Chart.*

Gorge. A canyon, a rugged and deep ravine or gulch.

Grade. A slope of uniform inclination.

Gradient. 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.

Gradient tints. Tinted areas on a map or chart, normally in the form of bands following the contour pattern, used to indicate ranges of altitude.

Graphic scale (also called linear scale). A line or bar on a map or chart subdivided to represent distances on the earth in various units, e.g., nautical miles, statute miles, yards, feet, kilometers, etc.

Grass in water. For mapping purposes, is a nonwoody stemmed vascular plant (which may or may not be a true grass), that is attached to the bottom below the sounding datum. Grass in water is normally mapped only when the vegetation grows to the water surface.

Gravel. One of several descriptors of the "nature of the seabed" used in Chart No. 1. *See under:* **Stones.**

Graving dock. A form of dry dock consisting of an artificial basin fitted with a gate or caisson, into which vessels can be floated and the water pumped out to expose the vessels' bottoms. The term is derived from the term used to describe the process of burning barnacles and other accretions from a ship's bottom. *See also:* **Floating dock.**

Great circle. The line of intersection of the surface of a sphere and any plane which passes through the center of the sphere.

Great circle course. The direction of the great circle through the point of departure and the destination, expressed as the angular distance from a reference direction, usually north, to the direction of the great circle. The angle varies from point to point along the great circle.

Greenwich Meridian. The meridian of the Royal Observatory, Greenwich, England. Adopted in 1884 by a conference of nations as the initial, or zero, of longitudes for all nations.

Gridiron. A gridiron or careening grid is a flat frame, usually of parallel timber baulks, erected on the foreshore so that a vessel may dry out on it for painting or repair at low water.

Groin. A structure projecting from shore and designed to break the current and reduce erosion and fill out the shore by a deposition of new materials. Groins may be classified as permeable or impermeable: impermeable groins have solid or nearly solid structure, permeable groins have openings through them of sufficient size to permit passage of appreciable quantities of littoral drift.

Grotto. A small, picturesque cave, vault, or cavern.

Ground. To touch bottom or run aground. In a serious grounding the vessel is said to *strand*.

Group repetition interval. Of a particular LORAN-C chain, the specified time interval for all stations of the chain to transmit their pulse groups. For each chain a minimum *group repetition interval* (GRI) is selected of sufficient duration to provide time for each station to transmit its pulse group and additional time between each pulse group so that signals from two or more stations cannot overlap in time anywhere within the coverage area.

Group repetition interval code. The group repetition interval in microseconds divided by ten.

Gulch. A small ravine; a small, shallow canyon with smoothly inclined slopes and steep sides.

Gulf. A tract of water within an indentation or curve of the coastline, in size between a bay and a sea—the Gulf of California, for example.

Gully. Small valley cut into soft sediments on the continental shelf or continental slope. A small channel recently cut by running water; smaller than a gulch or ravine.

Gut. A narrow passage or contracted strait connecting two bodies of water.

Hachures. (1) Short lines on topographic maps or nautical charts to indicate the slope of the ground or the submarine bottom. They usually follow the direction of the slope. (2) Inward-pointing short lines or "ticks" around the circumference of a closed contour indicating a depression or a minimum.

Half-tide level. The level midway between mean high water and mean low water. It may differ slightly from mean sea level. Also called *mean tide level.*

Hammock. Variation of hummock, but usually characterized more by soil type and vegetation than by elevation. (Southern U.S., especially Florida and gulf coast.)

Harbor. A water area nearly surrounded by land or artificial dikes forming a safe anchorage for ships.

Harbor charts. NOAA charts published at scales of 1:50,000 and larger, and intended for navigating in harbors and smaller waterways and for anchorage.

Harbor line. The line beyond which wharves and other structures cannot be extended.

Harbormaster. A local official who has charge of mooring and berthing of vessels, collecting harbor fees, and other duties.

Harbor of refuge. A harbor provided as a temporary refuge on a stormy coast for the convenience of passing ships. Also called *port of refuge*. It may or may not be part of a shipping port.

Harbor reach. The reach of a winding river or estuary which leads directly to the harbor.

Hatching. The drawing or engraving of fine, parallel or crossed lines to show shading.

Head. A precipitous cape, or promontory. *See also:* **Headland.**

Heading. The horizontal direction in which a ship actually points or heads at any instant, expressed in angular units from a reference direction, usually from 000° at the reference direction clockwise through 360°.

Headland. In common usage, a land mass having a considerable elevation. In the context of the law of the sea, elevation is not an important attribute and a headland may be the apex of a salient of the coast, the point of maximum extension of a portion of the land into the water, or a point on the shore at which there is an appreciable change in direction of the general trend of the coast.

Heath. 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.)

Height. The vertical distance of an object, point, or level above the ground or other established reference plane.

Height of tide. The vertical distance from the chart datum to the level of the water at any time.

Highland(s). High or elevated land; a lofty headland or cliff. The mountainous or elevated part of any country, occasionally also in the names of geographical districts.

Hill. A natural elevation of the earth's surface, smaller than a mountain. *See also:* **Knoll.**

Hillock. A small hill.

Holding ground. An expression usually used with a modifying adjective to indicate the quality of the holding power of the material constituting the bottom of an anchorage, e.g., of good (or poor) holding ground.

Hole. A small bay, as Woods Hole, Massachusetts. (Local in New England.)

Hollow. A small ravine; a low tract of land encompassed by hills or mountains.

Hook. Something resembling a hook in shape, particularly: (a) a spit or narrow cape of sand or gravel, which turns landward at the outer end; or (b) a sharp bend or curve, as in the stream.

Hulk. The hull or portion of the hull of a derelict vessel, usually without superstructure or other appurtenance. A major portion of the hulk is usually visible at some stage of tide.

Hummock. A rounded elevation of ground, of limited size, rising out of a level surface (often swamp), frequently densely wooded.

Hydrographer. One who studies and practices the science of hydrography.

Hydrographic survey. A survey made in relation to any considerable body of water, such as a bay, harbor, lake, or river for the purposes of determination of channel depths for navigation, location of rocks, sand bars, lights, and buoys; and in the case of rivers, made for flood control, power development, navigation, water supply, and water storage.

Hydrography. (1) The science which deals with the measurements and description of the physical features of the oceans, seas, lakes, rivers, and their adjoining coastal areas, with particular reference to their use for navigational purposes. (2) That part of topography pertaining to water and drainage features.

Hyperbolic line of position. A line of position in the shape of a hyperbola, determined by measuring the difference in distance to two fixed points, e.g., LORAN-C lines of position.

IALA Maritime Buoyage System. As designed by the International Association of Lighthouse Authorities, a new uniform system of maritime buoyage, which is expected to be implemented by most maritime nations. However, within the single system are two international buoyage regions, designated as region A and region B, where lateral marks differ only in the colors of port and starboard hand marks. In region A, red is to port on entering; in region B, red is to starboard on entering. The system may be briefly described as a combined cardinal and lateral system. The system applies to all fixed and floating marks, other than lighthouses, sector lights, leading lights and marks, lightships and large navigational buoys. The system provides five types of marks which may be used in combination: lateral marks, used in conjunction with a conventional direction of buoyage, are generally used for well-defined channels. Where a channel divides, a modified lateral mark may be used to indicate the preferred route. Lateral marks may differ between buoyage regions A and B. Cardinal marks used in conjunction with the mariner's compass, indicate where the mariner may find navigable water. Isolated danger marks indicate isolated dangers of limited size that have navigable water all around them. Safe water marks to indicate that there is navigable water around their position, e.g., mid-channel marks. Special marks, not primarily intended to assist navigation, indicate an area or feature referred to in nautical documents.

Ice buoy. A lighted or unlighted buoy of sturdy construction that replaces a buoy more easily damaged during the winter ice season.

Improved channels. Dredged channels under the jurisdiction of the U.S. Army Corps of Engineers, and maintained to provide an assigned controlling depth. Symbolized on the nautical charts by black, dashed lines to represent the side limits, with the controlling depth and date of ascertainment given together with a tabulation for more detailed information.

Index contour line. A contour line accentuated by a heavier line weight to distinguish it from intermediate contours. Index contours are usually shown as every fifth contour with their assigned values, to facilitate reading elevations.

Inland rules of the road. Rules to be followed by all vessels while navigating upon certain inland waters of the United States.

Inland sea. A body of water nearly or completely surrounded by land, especially if very large or composed of salt water. If completely surrounded by land, it is usually called a *lake.* This should not be confused with closed sea, that part of the ocean enclosed by headlands, within narrow straits, etc., or within the territorial jurisdiction of a country.

Inlet. 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. A narrow body of water extending into the land from a larger body of water. A long, narrow inlet with gradually decreasing depth inward is called a *ria.* Also called *arm, tongue*.

Inner harbor. The part of a harbor more remote from the sea, as contrasted with the outer harbor. These expressions are usually used only in a harbor that is clearly divided into two parts, as by a narrow passageway or artificial structures. The inner harbor generally has additional protection and is often the principal berthing area.

Inoperative. Sound signal or radionavigation aid out of service due to a malfunction.

Inset. In cartography (1) a small area outside the neatlines of map or chart included within the neatlines or borders to avoid publishing a separate graphic of the small area alone; (2) a representation of a small area on a larger scale (e.g., town-plan inset), or of a large area at a smaller scale (e.g., orientation inset); (3) any information, not normally appearing within the geographic limits of a map, which has been enclosed by border lines and included within the map neatlines. Insets are always placed in areas where important features will not be covered.

Inshore. The zone of variable width between the shoreface and the seaward limit of the breaker zone.

Intermediate contour line. A contour line drawn between index contours. Depending on the contour interval, there are three or four intermediate contours between the index contours.

Intermittent stream. A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long-continued supply from melting snow or other sources. It is dry for a large part of the year, ordinarily more than 3 months.

International Great Lakes Datum (IGLD) (1955). Mean water level at Pointe-au-Père, Quebec, Canada, on the Gulf of St. Lawrence, over the period 1941 through 1956, from which dynamic elevations throughout the Great Lakes region are measured. The term is often used to mean the entire system of dynamic elevations rather than just the reference water level.

International Hydrographic Bureau (IHB). An organization founded in 1921 for the purpose of establishing a close and permanent association among hydrographic offices of its states members. The Bureau's main object is to encourage coordination of hydrographic work with a view to rendering navigation easier and safer throughout the world. A convention agreed by member states became effective in 1970 making the IHB the executive organ of the *International Hydrographic Organization* (IHO).

International Hydrographic Organization (IHO). Organized in 1970 by ratification of the Convention on the International Hydrographic Organization, IHO legally assumed the international intergovernmental responsibilities formerly held by the *International Hydrographic Bureau* (IHB), which now serves as the administrative or headquarters facility for IHO. IBH was founded in 1921.

International Maritime Organization (IMO). (Formerly the *Inter-governmental Maritime Consultative Organization* (IMCO).) Established in 1959 (as the UN-sponsored international agency for the promotion of maritime safety and marine pollution prevention), IMO is mainly concerned with maritime safety and coordinates work relating to atomic propulsion, aviation, health, labor, meteorology, oceanography, and telecommunications.

International rules. The rules of the road established by agreement between maritime nations, governing the navigation of the high seas.

International rules of the road. The rules of navigation that are applicable to the water areas seaward of the lines established by the U.S. Coast Guard.

Interrupted quick-flashing light. A quick light in which the sequence of flashes is interrupted by regularly repeated eclipses of constant and long duration.

Intracoastal waterway. An inside protected route extending through New Jersey; from Norfolk, VA, to Key West, FL; across Florida, from St. Lucie Inlet to Fort Myers, Charlotte Harbor, Tampa Bay, and Tarpon Springs; and from Carabelle, FL, to Brownsville, TX.

Island. A land area (smaller than a continent) extending above and completely surrounded by water at mean high water; an area of dry land entirely surrounded by water or a swamp; an area of swamp entirely surrounded by open water.

Island shelf. 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.

Island slope. A declivity from the outer edge of an island shelf into greater depths.

Islet. A small island.

Isogonic. A line connecting points of equal magnetic variation. Also called *isogonic line, isogonal.*

Isogonic chart. A chart showing magnetic variation with isogonic lines and the annual rate of change in variation with isoporic lines.

Isoporic line. A line connecting points of equal annual rate of change of any magnetic element. Also called *isopor*.

Isthmus. A narrow strip of land connecting two larger bodies of land.

Jetty. A structure built out into the water to restrain or direct currents, usually to protect a river mouth or harbor entrance from silting. On open seacoasts, a structure extending into a body of water, and designed to prevent shoaling of a channel by littoral materials, and to direct and confine the stream or tidal flow. Jetties are built at the mouth of a river or tidal inlet to help deepen and stabilize a channel.

Junction. (1) A place of joining of two channels, as that of tributary with a main river. (2) In levelling, the place where two or more lines of levels are connected together. (3) In hydrographic survey, the joining of two adjacent survey sheets.

Junction buoy. A buoy which, when viewed from a vessel approaching from the open sea or in the same direction as the main stream of flood current, or in the direction established by appropriate authority, indicates the place at which two channels meet. *See also:* **Bifurcation buoy**.

Kelp. One of an order of unusually large, blade-shaped, or vinelike brown algae. Kelp is so frequently associated with rocky bottoms, and therefore possible dangers to navigation, that it should not be confused with, or compiled as, other marine vegetation. Kelp of one species or another is widely found in the cold oceans of the world.

Key. A low island or reef; a cay.

Kill. A channel, creek, or stream, as the kills between Staten Island, NY, and Bergen Neck, NJ.

Knob. A rounded hill or mountain, especially an isolated one.

Knoll. A small round hill; a mound; a seamount rising less than 500 fathoms from the seafloor and having a pointed or rounded top.

Knot. A unit of speed defined as *1 international nautical mile per hour.*

Lagoon. (1) A shallow sound, pond, or lake generally separated from the open sea. (2) A body of water enclosed by the reefs and islands of an atoll.

Lake. (1) A standing body of open water that occurs in a natural depression fed by one or more streams from which a stream may flow, that occurs due to the widening or natural blockage or cutoff of a river or stream, or that occurs in an isolated natural depression that is not a part of a surface river or stream. (2) A standing body of open water created by artificially blocking or restricting the flow of a river, stream, or tidal area. (3) Any standing body of inland water, generally of considerable size. There are exceptions such as the lakes in Louisiana, which are open to or connect with the Gulf of Mexico. Occasionally a lake is called a sea, especially if very large and composed of salt water.

Landfall. The first sighting of land when approached from seaward. By extension, the term is sometimes used to refer to the first contact with land by other means, e.g., by radar.

Landing. A place where boats receive or discharge passengers, freight, etc. *See also:* **Wharf.**

Landmark. In marine terminology, a landmark is an object or feature of known position that is conspicuous to the mariner and so located that it can be used for navigation. A landmark should be readily identifiable by the mariner and located where it will be visible through a useful range of travel. An object that is conspicuous at one point, but quickly becomes lost in background clutter or hidden from view by obstructions as the mariner progresses is of limited value.

Landslide. Earth and rock which becomes loosened from a hillside by moisture or snow, and slides or falls down the slope.

Lane. An established route as an air lane or shipping lane. In an electronic radiolocation lattice, the zone between two lines on which measured values, expressed in terms of the system's electronic unit (wavelength or microsecond), are whole numbers and are one unit apart.

Large navigational buoy (LNB or LANBY). (1) A large buoy designed to take the place of a lightship where construction of an offshore light station is not feasible. These 40-foot diameter buoys may show secondary lights from heights of about 36 feet above the water. In addition to the light, these buoys may mount a radiobeacon and provide sound signals. A station buoy may be moored nearby. Called *lighthouse buoy* in British terminology. (2) A 40-foot diameter, automated discus-shaped buoy used to replace light vessels.

Lateral system. (1) A system of aids to navigation in which buoys, daybeacons, and minor lights are assigned colors and shapes in accordance with their respective location in relation to safe water. (2) A system of aids to navigation in which the shape, color, and number distinction are assigned in accordance with their location in respect to navigable waters. When used to mark a channel, they are assigned colors to indicate the side they mark and numbers to indicate their sequence along the channel. The lateral system is used in the United States In the cardinal system, the aids are assigned shape, color, and number distinction in accordance with location relative to the nearest obstruction.

Latitude. Angular distance from a primary great circle or plane. *Terrestrial latitude* is angular distance from the equator, measured northward or southward through 90° and labeled "N" or "S" to indicate the distance between the plumb line and the plane of the celestial equator. *Geodetic* or *topographical latitude* at a station is angular distance between the plane of the geodetic equator and a normal to the ellipsoid. *Geocentric latitude* is the angle at the center of the reference ellipsoid between the celestial equator and a radius vector to a point on the ellipsoid. Geodetic and sometimes *astronomical latitude* are also called *geographic latitude.* Geodetic latitude is used for charts.

Latitude scale. The subdivided east and west borders of a Mercator chart into degrees and minutes; a variant of the graphic scale, since a minute of latitude is very nearly equal to a nautical mile.

Lava. The fluid or semifluid matter flowing from a volcano. The substance that results from the cooling of the molten rock. Part of the ocean bed is composed of lava.

Lead. The weight attached to a line. A *sounding lead* is used for determining depth of water. A *hand lead* is a light sounding (7 lbs to 14 lbs), usually having a line of not more than 25 fathoms. A *deep-sea lead* is a heavy sounding lead (about 30 lbs to 100 lbs), usually having a line 100 fathoms or more in length. A *light deep-sea lead* (30 lbs to 50 lbs), used for sounding depths of 20 to 60 fathoms is called a *coasting lead.* A type of sounding lead used without removal from the water between soundings is called a *fish lead.* A *drift lead* is one placed on the bottom to indicate movement of a vessel. To *heave the lead* is to take a sounding with a lead.

Leadline. A line, graduated with attached marks and fastened to a sounding lead, used for determining the depth of water when making soundings by hand. The leadline is usually used in depths of less than 25 fathoms. Also called *sounding line.*

Leading light. A light so located that vessels may steer directly for it until close aboard, when a new course is taken.

Ledge. (1) A rocky formation connected with and fringing the shore and generally uncovered at the sounding datum. (2) A rocky formation continuous with and fringing the shore. The area that uncovers is usually represented on charts by symbols.

Left bank. That bank of a stream or river on the left of an observer facing in the direction of flow, or downstream. *See also:* **Right bank.**

Leg. (1) Each straight section of a traverse. (2) One part of a craft's track consisting of a single course line.

Legend. (1) A description, explanation, table of symbols, and other information printed on a map or chart to provide a better understanding and interpretation of it. The title of a map or chart formerly was considered part of the legend, but this usage is obsolete. (2) An artificial bank confining a stream channel or limiting adjacent areas subject to flooding. (3) On the seafloor, an embankment bordering a canyon, valley, or sea channel.

Levee. (1) An artificial bank confining a stream channel or limiting adjacent areas subject to flooding. (2) On the seafloor, an embankment bordering a canyon, valley, or seachannel.

Light. The signal emitted by a lighted aid to navigation; a piece of illuminating apparatus; a lighted aid to navigation on a fixed structure.

Lighthouse. A building on some conspicuous point of the coast, a pier or jetty, an island or rock, from which a light is exhibited at night as an aid to navigation. All maritime nations have government departments responsible for the establishment and maintenance of lighthouses.

Light List. (1) A publication giving detailed information regarding lighted navigational aids and fog signals. The name and location of the lighted aids, their characteristics, heights, range, structure description, and other pertinent remarks are given. (2) *Light List,* published by the U.S. Coast Guard in five volumes, covers the waters of the United States and its possessions including the Intracoastal Waterway, the Great Lakes (both U.S. and certain aids on the Canadian shores), and the Mississippi River and its navigable tributaries. In addition to the information on lighted aids, the *Light List* gives information on unlighted buoys, radiobeacons, radio direction finder calibration stations, daybeacons, RACONs, etc. (3) *List of Lights,* published by the *NIMA* in seven volumes, covers waters other than the United States and its possessions. In addition to the information on lighted aids, the *List of Lists* provides information on storm signals, signal stations, radio direction finder stations, radiobeacons, etc.

Light List Number (LLNR). The number used to identify a navigational light in the *Light List.* This number should not be confused with "International Number," which is an identifying number assigned by the *International Hydrographic Organization*. The international number is in *italic* type and is located under the *Light List* number in the *Light List.* Sometimes called *list of lights number.*

Light sector. (1) As defined by bearings from seaward, the sector in which a navigational light is visible or in which it has a distinctive color different from that of adjoining sectors, or in which it is obscured. (2) The arc over which a light is visible described in degrees true as observed from a vessel toward the light.

Lightship. A distinctively marked vessel providing aids to navigation services similar to a light station, i.e., a light of high intensity and reliability, sound signal, and radiobeacon, and moored at a station where erection of a fixed structure is not feasible. The chart symbol represents the approximate location of the anchor. Also called *light vessel.* Lightships are no longer used in the United States.

Light station. A manned station providing a light usually of high intensity and reliability. It may also provide sound signal and radiobeacon services. In many instances, sound signals, radiobeacon equipment, and operating personnel are housed in separate buildings near the light structure.

Line feature. A cartographic feature with the geometry of a line, i.e., defined by a sequence of connected points. Represented on a map by a line of certain width or type, e.g., dashed, dotted, double, a sequence of symbols.

Line of soundings. A series of soundings obtained by a vessel underway, usually at regular intervals. In piloting, this information may be used to determine an estimated position, by recording the soundings at appropriate intervals (to the scale of the chart) along a line drawn on transparent paper or plastic, to represent the track, and then fitting the plot to the chart, by trial and error. A vessel obtaining soundings along a course line, for use in making or improving a chart, is said to run a line of soundings.

Littoral. Pertaining to the shore, especially of the sea; a coastal region. Used coextensively with “riparian.” *See also:* **Riparian lands.**

Littoral current. A current in the littoral zone such as a longshore or rip current.

Littoral state. One that borders on the sea or Great Lakes. Corresponds to Riparian State, which borders on a river. *See also:* **Riparian lands.**

Littoral zone. In coastal engineering, the area from the shoreline to just beyond the breaker zone. In biological oceanography, it is that part of the benthic division extending from the high-water line out to a depth of about 200 meters. The littoral system is divided into a eulittoral and sublittoral zone, separated at a depth of about 50 meters. Also, frequently used interchangeably with “intertidal zone.”

Local magnetic disturbance. An anomaly of the magnetic field of the earth, extending over a relatively small area, due to local magnetic influences. Also called: *local attraction, magnetic anomaly.*

Lock. A basin in a waterway with caissons or gates at each end by means of which vessels are passed from one water level to another without materially affecting the higher level. To lock a vessel means to pass a vessel through a lock.

Local Notice to Mariners (LNM). (1) A written document providing information pertaining to the condition of aids of navigation and the waterways within each U.S. Coast Guard District that is of interest to the mariner. (2) A notice issued by each U.S. Coast Guard District to disseminate important information affecting navigational safety within the District. The *Local Notice to Mariners* reports changes to and deficiencies in aids to navigation maintained by and under the authority of the U.S. Coast Guard. Other information includes channel depths, new charts, naval operations, regattas, etc. Since temporary information, known or expected to be of short duration, is not included in the weekly *Notice to Mariners* published by National Imagery and Mapping Agency, the appropriate *Local Notice to Mariners* may be the only source of such information. Much of the information contained in the *Local Notice to Mariners* is included in the weekly *Notice to Mariners.* The *Local Notice to Mariners* is published as often as required; usually weekly. It may be obtained by making application to the appropriate U.S. Coast Guard District Commander.

Log booms. Heavy logs chained or lashed together and moored or anchored so as to enclose and contain rafted logs.

Longitude. Angular distance, along a primary great circle, from the adopted reference point; the angle between a reference plane through the polar axis and a second plane through that axis. *Terrestrial longitude* is the arc of a parallel, or the angle at the pole, between the prime meridian and the meridian of a point on the earth, measured eastward or westward from the Prime meridian through 180°, and labeled “E” or “W” to indicate the direction of measurement. *Astronomical longitude* is the angle between the plane of the prime meridian and the plane of the celestial meridian at a station and the plane of the geodetic meridian at Greenwich. *Geodetic* and sometimes *astronomical longitude* are also called *geographic longitude. Geodetic longitude* is used in charting.

Longshore bar. A bar running roughly parallel to the shoreline.

Lookout station. A distinctive structure or place on shore from which personnel keep watch upon events at sea or along the coast.

Lookout tower. Any tower surmounted by a small house in which a watch is habitually kept, as distinguished from an observation tower in which no watch is kept.

Loran. (1) The designation of a family of electronic navigational systems by which hyperbolic lines of position are determined by measuring the differences in the time of reception of synchronized pulse signals from two fixed transmitters. The name "LORAN" is derived from the words **Lo***ng* **Ra***nge* **N***avigation.* (2) A long-range, low-frequency (90 to 110 kHz) radionavigation system by which a hyperbolic line of position of high accuracy is obtained by measuring the difference in the times of arrival of pulse signals radiated by a pair of synchronized transmitters (master station and secondary station), which are separated by several hundred miles.

Lower lowwater datum (LLWD). An approximation of mean lower low water that has been adopted as a standard reference for a limited area and is retained for an indefinite period regardless of the fact that it may differ slightly from a better determination of mean lower low water from a subsequent series of observations. Used primarily for river and harbor engineering purposes. Columbia River lower low water datum is an example.

Lowland. Low and relatively level land at a lower elevation than adjoining districts.

Low-water datum (LWD). The dynamic elevation for each of the Great Lakes and Lake St. Clair and the corresponding sloping surfaces of the St. Marys, St. Clair, Detroit, Niagara, and St. Lawrence Rivers to which are referred the depths shown on the navigational charts and the authorized depths for navigation improvement projects.

Low-water line. 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.

Loxodrome. A curve, on the surface of a sphere, intersecting all great circles of the sphere at a constant oblique angle, theoretically never reaching the pole while closely approaching it.

Luminous range. The greatest distance a light can be seen given its nominal range (luminous intensity) and the existing meteorological visibility.

Magnetic annual change. The amount of magnetic secular change undergone in 1 year. Also called *annual change, annual magnetic change, annual rate, annual rate of change.*

Magnetic disturbance. An irregular, large-amplitude, rapid change of the earth's magnetic field, which occurs at approximately the same time worldwide. A magnetic disturbance is usually associated with the occurrence of solar flares or other strong solar activity. Also called a *magnetic storm.* Sometimes, the daily magnetic variation is called a *magnetic disturbance.*

Magnetic meridian. The line having the direction of the magnetic needle at a given place; a vertical plane fixed by the direction taken by a perfect compass needle.

Magnetic north. The direction indicated by the north-seeking pole of a freely suspended magnetic needle, influenced only by the earth's magnetic field.

Magnetic variation. A regular or irregular change, with time, of magnetic declination, dip, or intensity. In nautical and aeronautical navigation, and sometimes in surveying, the term *magnetic variation* is used for magnetic declination. The regular magnetic variations are: *secular,* the change from year to year in the same direction (which usually persists for many decades); *annual,* the change over a period of 1 year; and *diurnal,* the change over a period of 1 day (24 hours). Irregular variations, when sudden, worldwide, and severe, are known as *magnetic storms.*

Mainland. The principal portion of a large land area. The term is used loosely to contrast a principal land mass from outlying islands and sometimes peninsulas.

Major aid to navigation. An aid of considerable intensity, reliability, and range exhibited from fixed structures or marine sites. Major aids are classified as primary or secondary and are usually manned or remotely monitored.

Major light. A light of high intensity and reliability exhibited from a fixed structure or on a marine site (except range light). Major lights include primary seacoast lights and secondary lights. *See also:* **Minor light.**

Mangrove. This type includes the mangroves and stands of tree like plants that are predominantly mangrove. These plants are perennials that frequently create an apparent shoreline. Much of this vegetation grows in the vicinity of the high waterline with overhanging and tangled growth that obscures the shoreline from the mariner.

Manmade (artificial) shoreline. This is the line of contact between the surface of a body of water and artificial land or features provided the artificial waterline is continuous with the natural shoreline. This is intended to include as artificial shoreline the water along breakwaters, bulkheads, fill areas, jetties, and other features built out from the land.

Map. A representation, usually on a plane surface, of all or part of the surface of the earth, celestial sphere, or other area; showing relative size and position, according to a given projection, of the physical features represented and such other information as may be applicable to the purpose intended. Such a representation intended primarily for navigational use is called a *chart.* A method of representing all or part of the surface of a sphere or spheroid, such as the earth, upon a plane surface is called a *map projection.* A *planimetric map* indicates only the horizontal positions of features; a *topographic map* indicates both horizontal and vertical position. A topographic map showing relief by means of contour lines drawn at regular height intervals is called a *contour map.* A *relief map* emphasizes relative elevations or relief; a three-dimensional relief map is called a *relief model.* The pattern on the underside of extensive cloud areas, created by the varying amounts of light reflected from the earth's surface, is called a *sky map.* A chart which shows the distribution of meteorological conditions over an area at a given moment may be called a *weather map.*

Map bathymetric. Map delineating the form of the bottom of a body of water, or a portion thereof, by the use of depth contours (isobaths).

Map digitization. Conversion of map data from graphic to digital form.

Map editing. The process of checking a map or chart, in its various stages of preparation, to ensure accuracy, completeness, correct preparation, and interpretation of sources used, and legible and precise reproduction.

Map, isogonic. A map showing lines of constant magnetic inclination for a particular base data (shown on the map). Lines of equal annual change in declination are generally also shown. If the map is designed for use in navigation, it is called an *isogonic chart.*

Map, planimetric. A map which shows only the horizontal positions of the features represented. Unlike a topographic map, a planimetric map does not show relief in measurable form. Natural features usually shown include rivers, lakes, and seas; mountains, valleys, and plains; forests, prairies, marshes, and deserts. Cultural features shown include cities, farms, transportation routes, and public utility facilities; and political and private boundary lines.

Map projection. An orderly system of lines on a plane representing a corresponding system of imaginary lines on an adopted terrestrial or celestial datum surface. Also the mathematical concept of such a system.

Map projection, Mercator. A conformal map projection of the so-called cylindrical type. The equator is represented by a straight line true to scale; the geographic meridians are represented by parallel straight lines perpendicular to the line representing the equator; they are spaced according to their distance apart at the equator. The geographic parallels are represented by a second system of straight lines perpendicular to the family of lines representing the meridians, and therefore, parallel with the equator. Conformality is achieved by mathematical analysis, the spacing of the parallels being increased with increasing distance from the equator to conform with the expanding scale along the parallels resulting from the meridians being represented by parallel lines. The Mercator map projection is considered one of the most valuable of all map projections, its most useful feature being that a line of constant bearing (azimuth) on a sphere is represented on the projection by a straight line.

Map relief. A map whose surface is shaped to represent topography in a region. The most common kind is the plastic relief map. This is made by printing an ordinary topographic map on a plastic sheet, which is then placed on a plaster mold that has been carved to represent the topography. Heat and pressure are applied to fix the plastic sheet permanently into the shape of the mold. Another kind, less common and more costly but showing more detail in greater accuracy, is the solid relief-map, made by carving the topography, etc., in a suitable substance, such as plaster, and then painting or drawing further detail on the model. Also called a *terrain model* or *relief model.*

Map scale, equivalent. An equivalent scale is the relationship which a small distance on the map bears to the corresponding distance on the earth, expressed as an equivalence. Usually, but not necessarily, the equivalence is expressed in different specified units; for example, 1 inch (on the map) equals 1 mile (on the ground).

Map scale, fractional. A fractional scale is the ratio which any small distance on the map bears to the corresponding distance on the earth. It may be written in the form of a fraction: 1/10,000; or as a proportion 1:10,000.

Map scale, graphic (or bar). A line on a map subdivided and marked with the distance which each of its parts represents on the earth.

Map, topographic. (1) A map showing the horizontal and vertical locations of natural and artificial features. It is distinguished from a planimetric map by the presence of quantitative symbols showing the relief. A topographic map usually shows the same features as a planimetric map, but uses numbered contour lines or comparable symbols to indicate elevations of mountains, valleys, and plains; in the case of hydrographic charts, symbols and numbers are used to show depths in bodies of water. (2) A map whose principal purpose is to portray and identify the natural or artificial features of the earth's surface as faithfully as possible within the limitations imposed by scale.

Margin data. All explanatory information given in the margin of a map or chart which clarifies, defines, illustrates, and/or supplements the graphic portion of the sheet. Also called *border data, border information, margin information.*

Marginal sea. The water area bordering a nation over which has exclusive jurisdiction, except for the right of innocent passage of foreign vessels. It is a creation of international law, although no agreement has thus far been reached by the international community regarding its width. It extends seaward from the low-water mark along a straight coast and from the seaward limits of inland waters where there are embayments. The United States has traditionally claimed 3 nautical miles as its width and has not recognized the claims of other countries to a wider belt. Also called *territorial sea, adjacent sea, marine belt, maritime belt, and 3-mile limit.*

Marginal wharf. A wharf flush with the general adjacent shoreline and normally of concrete or asphalt decking atop open-pile supports. This is the predominant type of modern general cargo wharf.

Marina. A harbor facility for small boats, yachts, etc., where supplies, repairs, and various services are available.

Marine. An adjective meaning relating to navigation or shipping; relating to or connected with the sea; used, or adopted for use at sea. Sometimes called *maritime,* but maritime more frequently applies to that which borders on the sea.

Marine railway. A marine railway is a track, cradle, and winding mechanism for hauling vessels out of the water so that the hull can be exposed as in a dry dock. This is also called a *patent slip* in British terminology.

Marine vegetation. For NOAA charting purposes, marine vegetation refers to permanent or semipermanent vegetation or areas of vegetation growing at or seaward from the shoreline and presenting some significance to the mariner.

Marker. (1) A small automatic radiobeacon with a range of 4 to 6 miles located on a buoy, pierhead, or piling structure. It is not intended for long-range accurate bearings but serves as a local mark indicating a channel entrance, turning point, pierhead, etc., in or near a harbor. The use of two or more beacons provides a "fix." (2) That which marks something; a marker beacon. *See also:* **Radiobeacon.** (3) A term used to describe an aid intended as a guide for normal surface navigation. It is generally used to refer to any private unlighted or lighted fixed aid to navigation not established or maintained by the U.S. Coast Guard and not listed in the *Light List,* which is erected to make minor channels. The term may also refer to markers for other specific purposes (e.g., measured mile markers or dredging range).

Marker buoy. A temporary buoy used in surveying to make a location of particular interest, such as a shoal or reef. *See also:* **Station buoy.**

Marl. One of several descriptors of the "nature of the seabed" used in Chart No. 1. A crumbling, earthy deposit, particularly one of clay mixed with sand, lime, decomposed shells, etc. Sometimes a layer of marl becomes quite compact. Part of the ocean bed is composed of marl. Marl is generally not a suitable holding material for anchors. Anchoring in marl requires an anchor with a pointed bill to penetrate the bottom.

Marsh. (1) An area of wet, often spongy ground that is subject to frequent flooding or tidal inundations, but not considered to be continually underwater. It is characterized by the growth of nonwoody stemmed, vascular plants, such as the bulrushes, cordgrasses, reeds, and other wetland species, and by the lack of trees. Marsh often forms a transition between the open water and the dry uplands and is frequently associated with an apparent shoreline. (2) 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.

Matching. The act by which detail or information on the edge, or overlap area, of a map or chart is compared, adjusted, and corrected to agree with the existing overlapping chart.

Mattress. A mass of interwoven brush, poles, etc., used to protect a bank from erosion.

Mean higher high water (MHHW). A tidal datum. The average of the higher high water height of each tidal day observed over the National Tidal Datum Epoch. For stations with shorter series, simultaneous observational comparisons are made with a control tide station in order to derive the equivalent datum of the National Tidal Datum Epoch.

Mean high water (MHW). A tidal datum. The average of all the high-water heights observed over the National Tidal Datum Epoch. For stations with shorter series, simultaneous observational comparisons are made with a control tide station in order to derive the equivalent datum of the National Tidal Datum Epoch.

Mean high water line (MHWL). The line on a chart or map, which represents the intersection of the land with the water surface at the elevation of mean high water. *See also:* **Shoreline.**

Mean lower low water (MLLW). A tidal datum. The average of the lower low-water height of each tidal day observed over the National Tidal Datum Epoch. For stations with shorter series, simultaneous observational comparisons are made with a control tide station in order to derive the equivalent datum of the National Tidal Datum Epoch.

Mean low water (MLW). A tidal datum. The average of all the low-water heights observed over the National Tidal Datum Epoch. For stations with shorter series, simultaneous observational comparisons are made with a control tide station in order to derive the equivalent datum of the National Tidal Datum Epoch.

Mean low water line (MLWL). The line on a chart or map which represents the intersection of the land with the water surface at the elevation of mean low water.

Mean range of tide. The difference in height between mean high water and mean low water.

Mean sea level (MSL). (1) A tidal datum. The arithmetic mean of hourly heights observed over the National Tidal Datum Epoch. Shorter series are specified in the name; e.g., monthly mean sea level and yearly mean sea level. (2) The average height of the surface of the sea for all stages of the tide over a 19-year period, usually determined from hourly height readings. A determination of mean sea level that has been adopted as a standard for heights is called a *sea level datum.*

Measured mile. A length of 1-nautical mile, the limits of which have been accurately measured and are indicated by ranges ashore. It is used by vessels to calibrate logs, engine revolution counters, etc., and to determine speed.

Mercator projection. A conformal map projection upon a plane, in which the latitude and longitude lines are straight parallel lines intersecting each other at right angles, and in which the meridians of longitude are spaced equally throughout the map, based on their distance apart at the equator, and the distances between parallels are derived by a mathematical analysis, their spacing bearing an exact relationship to the spreading of the meridians along a corresponding parallel.

Meridian. A north-south reference line, particularly a great circle through the geographical poles of the earth. The term usually refers to the upper branch, the half, from pole to pole, which passes through a given place; the other half being called the lower branch.

Meridians. Imaginary planes passing through the poles and measure longitudes east or west of the principal meridian of Greenwich. *See also:* **Longitude.**

Mesa. A flat-topped, rocky hill with steep sides. (Southwestern United States.)

Meter. The base unit of length in the International System of Units, equal to 39.37008 inches, approximately.

Metonic cycle. A period of almost 19 years or 235 lunations. Devised by Meton, an Athenian astronomer who lived in the fifth century B.C., for the purpose of obtaining a period in which new and full moon would recur on the same day of the year.

Metric system. Decimal system of weights and measures based on the meter as a unit length and the kilogram as a unit mass.

Microwave. A very short electromagnetic wave, usually considered to be about 30 centimeters to 1 millimeter in length. While the limits are not clearly defined, it is generally considered as the wavelength of a radar operation.

Microwave tower. A tower which carries microwave broadcasters and receivers used in the transmission of communications signals.

Mid-channel buoy. See **Fairway buoy.**

Middle latitude. Half the arithmetical sum of the latitudes of two places on the same side of the equator.

Mile. (1) A unit of distance. The nautical mile, or sea mile, is used primarily in navigation. Nearly all maritime nations have adopted the International Nautical Mile of 1,852 meters proposed in 1929 by the International Hydrographic Bureau. The U.S. Departments of Defense and Commerce adopted this value on July 1, 1954. Using the yard-meter conversion factor effective July 1, 1959 (1 yard = 0.9144 meter, exactly), the International Nautical Mile is equivalent to 6076.11549 feet, approximately. The geographical mile is the length of one minute of arc of the equator, considered to be 6,087.08 feet. The statute mile or land mile (5,280 feet in the United States) is commonly used for navigation on rivers and lakes, notably in the Great Lakes of North America. (2) A unit of distance, variously defined. *See also:* **Mile, nautical; Mile, statute.**

Mile, international nautical. The nautical mile defined as exactly 1,852 meters length. It was proposed in 1929 by the International Hydrographic Bureau because of the variety of nautical miles then in use. It has since been adopted by most maritime nations, and, on July 1, 1954, by the U.S. Department of Commerce and the U.S. Department of Defense.

Mile, nautical. The U.S. nautical mile is defined as equal to the length of 1/60 of a degree of a great circle on a sphere having an area equal to the area of an ellipsoid representing the earth's surface. Its value, calculated for the Clarke spheroid of 1866, is 1,853.248 m (6,080.2 feet); (compare with the international nautical mile of 1,852 m (6,076.1 feet)). The U.S. nautical mile is also called a *sea mile,* a *geographical mile,* and a *geographic mile.* It may be taken as equal to the length of a minute of arc along the equator or a minute of latitude anywhere on a map. The nautical mile is used principally for stating distances over water. It is the unit of length used for defining the **knot,** a unit of speed defined as 1-nautical mile per hour.

Mile, statute. A unit of length defined to be exactly 5,280 feet. It is used principally in stating distances on land.

Minor aid to navigation. An unmanned, unmonitored light on a fixed structure showing usually low to moderate intensity; generally fitted with light characteristics and dayboards in accordance with its lateral significance in the waterway.

Minor light. An automatic unmanned light on a fixed structure usually showing low to moderate intensity. Minor lights are established in harbors, along channels, along rivers, and in isolated locations. *See also:* **Major light.**

Moat. An annual depression that may not be continuous, located at the base of a seamount or an island.

Mobile hoist. A device for hauling out small craft and moving them over land to cradles or to the place at which their hulls and underwater appendages are cleaned, painted, or repaired. It consists of a self-powered steel frame on rubber tires, with two slings suspended from electric hoists. The lift is run out onto a trackway extending over the water, the slings are lowered beneath the water, and the boat is positioned over the slings; the hoists then raise the slings (and the boat) above the trackway and ground, and the lift backs off the trackway.

Mole. A form of breakwater alongside which vessels may lie on the sheltered side only; in some cases it may lie entirely within an artificial harbor, permitting vessels to lie along both sides. A structure, usually massive, on the seaward side of a harbor for its protection against current and wave action, drift ice, sanding up, wind, etc. Sometimes it may be suitable for the berthing of ships. *See also:* **Jetty; Quay.**

Mooring. A place where a vessel may be secured. (Usually in pl.) The equipment used to secure a vessel. The process of securing a vessel, other than anchoring with a single anchor.

Mooring buoy. A buoy secured to the bottom by permanent moorings and provided with means for mooring a vessel by use of its anchor chain or mooring lines.

Morse code light. A light in which the appearances of light of two clearly different durations are grouped to represent a character or characters in the Morse code.

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 large hill or mountain, usually a detached, characteristically conical mass of earth.

Mountain. A natural elevation of the earth's surface rising more or less abruptly from the surrounding level, and attaining an altitude which, relatively to adjacent elevations, is impressive or notable.

Mountain range. A series of connected and aligned mountains or mountain ridges.

Mouth. The place of discharge of a stream into the ocean or entrance to a bay from the ocean.

Mud. One of several descriptors of the "nature of the seabed" used in Chart No. 1. A general term applied to mixtures of sediments in water. Where the grains are less than 0.002 mm in diameter, the mixture is called *clay.* Where the grains are between 0.002 mm and 0.0625 mm in diameter the mixture is called *silt.*

Muskeg. A bog or marsh. (Local in north central United States, Canada, and Alaska.)

Narrows. A navigable narrow part of a bay, strait, river, etc.

National boundary. The seaward boundary of the United States within which it exercises exclusive sovereignty except for the right of innocent passage of foreign vessels; the three-mile limit. *See:* **Marginal sea.**

National Oceanic and Atmospheric Administration (NOAA). NOAA was formed on October 3, 1970, by Reorganization Plan 4 of 1970. Its principal functions are authorized by Title 15, Chapter 9, United States Code (National Weather Service); Title 33, Chapter 17, United States Code (National Ocean Survey); and Title 16, Chapter 9, United States Code (National Marine Fisheries Service). NOAA's mission was further defined by the Coastal Zone Management Act of 1972, the Marine Mammals Protection Act of 1972, the Marine Protection, Research, and Sanctuaries Act of 1972, the Weather Modification Reporting Act of 1972, the Endangered Species Act of 1973, the Offshore Shrimp Fisheries Act of 1973, and the Fishery Conservation and Management Act of 1976. The mission of NOAA is to explore, map, and chart the global ocean and its living resources, to manage, use, and conserve those resources and to describe, monitor, and predict conditions in the atmosphere, ocean, sun and space environment, issue warnings against impending destructive natural events, develop beneficial methods of environmental modification, and assess the consequences of inadvertent environmental modification over several scales of time.

Natural harbor. A harbor possessing natural shelter in a large degree. Natural harbors require only the provision of such facilities as quays or piers and sometimes deepening by artificial means to make them serviceable as shipping ports.

Natural shoreline. This is the line of contact between the surface of a body of water and natural land, including islands. It does not include the water line along floating or artificial features, or along rocks smaller than those considered to be islands.

Nautical. Of or pertaining to ships, navigation (chiefly marine), or seamen. In contrast, *navigational* refers to navigation only, *marine* refers to the sea, *maritime* indicates relationship or proximity to the sea, and *naval* refers to the Navy.

Nautical chart. A representation of a portion of the navigable waters of the earth and adjacent coastal areas on a specified map projection, and designed specifically to meet requirements of marine navigation. Included on most nautical charts are: depths of water, characteristics of the bottom, elevations of selected topographic features, general configuration and characteristics of the coast, the shoreline (usually the mean high water line), dangers, obstructions, aids to navigation, limited tidal data, and information about magnetic variation in the charted area.

Nautical Chart Manual. A manual, published by NOAA, for the cartographer engaged in the construction and revision of nautical charts.

Navigability. The actual navigable capacity of a waterway and not the extent of tidal influence.

Navigable. Affording passage to a craft; capable of being navigated.

Navigable waters of the United States. Navigable waters of the United States are those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. A determination of navigability, once made, applies laterally over the entire surface of the waterbody, and is not extinguished by later actions or events which impede or destroy navigable capacity. See 33 CFR Part 329 for a more complete definition of this term.

Navigation. The process of planning, recording, and controlling the movement of a craft or vehicle from one place to another. The word "navigate" is from the Latin *navigatus,* the past participle of the verb navigere, which is derived from the word navis, meaning "ship," and agere, meaning "to move," or "to direct."

Navigational aid. An instrument, device, chart, method, etc., intended to assist in the navigation of a craft. This expression should not be confused with *aids to navigation,* which refers only to devices external to a craft. In British usage, the terms *navigational aid* and *aid to navigation* are used without distinction.

Navigation, coastwise. Navigation in the vicinity of a coast, in contrast with offshore navigation.

Navigation, electronic. Navigation by means of electronic equipment. The expression *electronic navigation* is more inclusive than radio navigation, since it includes navigation involving any electronic device or instrument.

Navigation, offshore. Navigation at distance from a coast, in contrast with coastwise navigation.

Navigation, radio. Any method of navigation in which location or velocity is inferred from measurements on radio waves. The term is generally applied only to one of the following methods of navigation: (a) measuring direction or distance to two or more radio transmitters, (b) measuring differences of distance to two or more pairs of radio transmitters, (c) measuring the Doppler shift in frequency of a signal from an orbiting beacon or beacons.

Navigation system. A set of equipment and techniques by which the location of a moving vehicle, vessel, or aircraft can be determined and made known sufficiently quickly so the information can be used for navigation.

Navigation system, hyperbolic. A navigation system using the differences in distance (measured in wavelengths) of a mobile unit from three or more fixed stations to determine location. The locus of points all of which have the same difference of distance is a "hyperbola." If the difference in distance from two pairs of fixed points (one point of which may be common to the two) is determined, two intersecting hyperbolas result and the mobile unit is located at one of those intersections.

Neatline. Line, usually grid or graticule, bounding the detail of a map. Also referred to as "inner neatline" to differentiate from border drawn outside of neatline.

Neck. (1) A narrow isthmus, cape, or promontory. (2) The land areas between streams flowing into a sound or bay. (3) A narrow strip of land, which connects a peninsula with the mainland. (4) A narrow body of water between two larger bodies; a strait.

Net under keel clearance. The distance between the ocean bottom and the portion of a tanker's hull closest to the ocean bottom when the tanker is underway, moored, or anchored, considering ship motion in responding to the combination of actual wind, wave, tide, and current conditions.

New chart. A new chart is usually constructed to satisfy the needs of navigation in a particular area; e.g., the area had no prior adequate chart coverage of the same scale, or limits are radically changed. The new chart may cancel an existing chart.

New editions. A chart issue that cancels a previous issue. If the new information renders that existing chart obsolete, the new printing is designated a new edition. A new edition reflects one or more changes of such importance to navigation that all previous printings are obsolete. Changes may be based on corrections from the *Notice to Mariners* (NM), in addition to other sources. The date of a new edition is the date of the latest *NIMA* NM from which the chart has been corrected. The edition number and date are printed in the lower left corner of the chart.

Nineteen-Year Tidal Cycle. The period of time generally reckoned as constituting a full tidal cycle because the more important of the periodic tidal variations due to astronomic causes will have passed through complete cycles. The longest cycle to which the tide is subject is due to a slow change in the declination of the moon, which covers 18.6 years.

Nominal range. The maximum distance a light may be seen in clear weather (meteorological visibility of 10-nautical miles) without regard to the curvature of the earth, height of eye, or height of light. Listed for all federal lighted aids except range lights and directional lights.

Nontidal basin. An enclosed basin separated from tidal waters by a caisson or flood gates. Ships are moved into the dock near high tide. The dock is closed when the tide begins to fall. If necessary, ships are kept afloat by pumping water into the dock to maintain the desired level. Also called *wet dock.*

Nontidal waters. Waters not subject to tidal influence.

Normal pool elevation. The level at which a controlled body of water is generally maintained.

North. The primary reference direction relative to the earth; the direction indicated by 000° in any system other than relative. True north is the direction of the north geographic pole; magnetic north the direction north as determined by the earth's magnetic compass; grid north an arbitrary reference direction used with grid navigation.

Notch. A short defile through a hill, ridge, or mountain. A deep, close pass; a defile; gap. (Local in New England.)

Notice to Mariners (NM). A weekly publication of the *National Imagery and Mapping Agency (NIMA)* prepared jointly with NOAA and the U.S. Coast Guard giving information on changes in aids to navigation (lights, buoys, daymarks, ranges), dangers to navigation (rocks, shoals, reefs, wrecks), selected items from the *Local Notice to Mariners,* important new soundings, changes in channels, harbor construction, radionavigation information, new and revised charts and publications, special warnings and notices, pertinent Hydrolant, Hydropac, Navarea IV and XII messages and in general, all such information as affects the mariner's charts, manuals, catalogs, sailing directions (pilots), etc. The *Notice to Mariners* should be used routinely for updating the latest editions of nautical charts and related publications.

Nun buoy. An unlighted buoy of which the upperpart of the body (above the water line), or the larger part of the superstructure, has approximately the shape of a cone with vertex upwards. Called *conical buoy* in British terminology.

Obscured. Said of the arc of a light sector designated by its limiting bearings in which the light is not visible from seaward.

Obsolete chart. A chart which is not considered safe to use for navigation because it does not contain the latest important navigational information.

Obstruction. Anything that hinders or prevents movement, particularly anything that endangers or prevents passage of a vessel or aircraft. The term is usually used to refer to an isolated danger to navigation, such as a submerged rock or pinnacle in the case of marine navigation, and a tower, tall building, mountain peak, etc., in the case of air navigation.

Obstruction buoy. A buoy used alone to indicate a dangerous reef or shoal. The buoy may be passed on either side.

Obstruction light. A light indicating a radio tower or other obstruction to aircraft.

Obstruction mark. A navigation mark used alone to indicate a dangerous reef or shoal. The mark may be passed on either hand.

Occasional light. A light put into service only on demand.

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.

Offshore. Away from the shore. The comparatively flat zone of variable width which extends from the outermark of the rather steeply sloping shoreface to the edge of the continental shelf.

Offshore light stations. Manned light stations built on exposed marine sites to replace lightships.

Offshore navigation. Navigation at a distance from a coast, in contrast with coastwise navigation in the vicinity of a coast.

Offshore tower. Manned or monitored light stations built on exposed marine sites to replace light vessels.

Offshore water. Water adjacent to land in which the physical properties are slightly influenced by continental conditions.

Off soundings. Said of a vessel navigating beyond the 100-fathom curve. In earlier times, said of a vessel in water deeper than could be sounded with the sounding lead.

Off station. A floating aid not on its assigned position.

Omega Navigation System. A worldwide, continuous, radionavigation system of medium accuracy, which provides hyperbolic lines of position through phase comparisons of VLF (10 kHz to 14 kHz) continuous wave signals transmitted on a common frequency on a time-shared basis. The system is comprised of eight transmitting stations.

Omnirange. A radio aid to navigation providing direct indication of a magnetic bearing (omnibearing) of that station from any direction. Also called *omnidirectional range* or *omnidirectional beacon.*

One-way traffic lane. A lane within which all ships are advised to proceed in approximately the same direction.

On soundings. Said of a vessel navigating within the 100-fathom curve. In earlier times, said of a vessel in water sufficiently shallow for sounding by sounding lead.

Ooze. One of several descriptors of the “nature of the seabed” used in Chart No. 1. A soft, slimy, organic sediment covering part of the ocean bottom composed principally of shells or other hard parts of minute organisms. Generally, ooze offers poor purchase for anchors.

Open coast. The coast that fringes the marginal sea as distinguished from the coast that fringes inland water. A coast that is not sheltered from the sea.

Open harbor. An unsheltered harbor exposed to the sea.

Open sea. The water area of the open coast seaward of the ordinary low-water mark, or seaward of inland water.

Outer Continental Shelf (OCS). Means all submerged lands lying seaward and outside of the area of “lands beneath navigable waters” as defined in Section 2(a) of the Submerged Lands Act (43 U.S.C. 1301(a)) and of which the subsoil and seabed appertain to the United States and are subject to its jurisdiction and control. “OCS activity” means any offshore activity associated with exploration for, or development or production of, the miners of the OCS.

Outer Continental Shelf (OCS) Facility. “OCS facility” means any artificial island, installation, or other device permanently or temporarily attached to the subsoil or seabed of the OCS, erected for the purpose of exploring for, developing, or producing resources therefrom, or any such installation or other device (other than a ship or vessel) for the purpose of transporting such resources. The term includes mobile offshore drilling units when in contact with the seabed of the OCS for exploration or exploitation of subsea resources.

Outlet. The opening by or through which any body of water discharges its content.

Overfalls. Short, breaking waves, occurring when a strong current passes over a shoal or other submarine obstruction or meets a contrary current or wind. *See:* **Rips.**

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 plural).

Parallels. Imaginary planes passing through the earth parallel to the equator and measure latitudes north or south of the equator.

Pass. (1) A navigable channel leading to a harbor or river. Sometimes called **Passage.** (2) A break in a mountain range, permitting earlier passage from one side of the range to the other; also called *Col.* (3) A narrow opening through a barrier reef, atoll, or sand bar.

Passage. A narrow navigable channel, especially one through reefs or islands. Sometimes called a **pass,** or in New England waters, a *hole.*

Passing light. A term applies to a lower candlepower light mounted on a light structure. Used where a mariner passes out of the main light beam (such as a range light) but still needs to keep the structure in sight during transit.

Peak. A pointed mountain summit; the topmost point; summit; a seamount rising more than 500 fathoms from the seafloor, and having a pointed or rounded top.

Pebble. One of several descriptors of the “nature of the seabed” used in Chart No. 1. *See under:* **Stones.**

Pecked line. In cartography, a symbol consisting of a line broken at regular intervals.

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.

Perch. A staff placed on top of a buoy, rock, or shoal as a mark for navigators. A ball or cage is sometimes placed at the top of the perch, as an identifying mark.

Period. The interval of time between the commencement of the identical aspect in two successive cycles of a rhythmic light.

Permafrost. A layer of soil or bedrock at a variable depth beneath the surface of the earth in which the temperature has been below freezing continuously from a few to several thousands of years.

Photogrammetry. (1) The science or art of obtaining reliable measurements from photographic images. (2) The science of preparing charts and maps from aerial photographs using stereoscopic equipment and methods.

Pictorial symbol. A symbol whose form is a simplified portrayal of the feature or phenomenon it represents.

Pier. (1) A structure extending into the water approximately perpendicular to a shore or a bank and providing berthing for ships, and which may also provide cargo-handling facilities. *See also:* **Wharf.** (2) A structure extending into the water approximately perpendicular to a shore or bank and providing a promenade or place for other use, as a fishing pier. (3) A support for the spans of a bridge.

Pierhead. That part of a pier or jetty projecting farthest into the water.

Pile. A long, heavy timber or section of steel, concrete, etc., forced into the earth to serve as a support, as for a pier, or to resist lateral pressure.

Pile, sheet. A pile with a generally slender flat cross-section to be driven into the ground or seabed and meshed or interlocked with like members to form a diaphragm, wall, or bulkhead.

Piling. A group of piles set in a row.

Pillar buoy. A buoy composed of a tall central structure mounted on a broad flat base. Also called *beacon buoy.*

Pilot. One who directs the movements of a vessel through pilot waters; usually, one who has demonstrated extensive knowledge of channels, aids to navigation, dangers to navigation, etc., in a particular area and is licensed for that area.

Pilot area. A pilot area represents a meeting or boarding place where vessels pick up or disembark pilots. A pilot vessel may either cruise in the area continuously or come out on request.

Pilot station. The office or headquarters of pilots; the place where the services of a pilot may be obtained.

Pinnacle. On the seafloor, a high tower or spire-shaped pillar of rock or coral, along or cresting a summit. It may or may not be a hazard to surface navigation. Due to the sheer rise from the seafloor, no warning is given by sounding.

Pipe. A hollow metal tube, of varying diameters and lengths, imbedded in the bottom in a manner similar to a pile. Pipes are often used as privately maintained aids to navigation and in the determination of beach or bottom sand migration (deposition or erosion).

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); and extent of level or nearly level land; a flat, gently sloping or nearly level region of the seafloor.

Plan position indicator (PPI). A cathode ray scope on which signals appear in correct relation to each other, so that the scope face presents a maplike representation of the area about the transmitter, the director of a target being represented by the direction of its echo from a center and range by its distance from that center.

Plateau. An elevated plain, tableland, or flat-topped region of considerable extent; a comparatively flat-topped elevation of the seafloor greater than 60-nautical miles across the summit and normally rising more than 100 fathoms on all sides.

Platform. (1) In geographical literature, a natural or artificial terrace; a flat elevated piece of ground; a tableland, a plateau. (2) In oceanographic terminology, any artificial structure (aircraft, ship, buoy, or tower) from or on which oceanographic instruments are suspended or installed. (3) Structures which are erected on or over the seabed and subsoil of the Outer Continental Shelf and in the waters under the jurisdiction of the United States, for the purpose of exploring for, developing, removing, and transporting resources there from. This includes all fixed structures, temporary or permanent, for which a U.S Army Corps of Engineers' permit is issued. It includes, but is not necessarily limited to, all drilling platforms, production platforms, quarters platforms, pipeline riser platforms, manifold platforms, loading platforms, boat landings, caissons, oil well protective structures, tank battery barges submerged on station, drilling barges submerged on location, breakwater barges submerged on location, and all other piles, pile clusters, pipes, or structures erected in the waters.

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).

Polyconic map projection. A map projection having the central geographic meridian represented by a straight line, along which the spacing for lines representing the geographic parallels is proportional to the distances between the parallels; the parallels are represented by arcs of circles which are not concentric, but whose centers lie on the line representing the central meridian, and whose radii are determined by the lengths of the elements of cones, which are tangent along the parallels. All meridians except the central ones are curved.

Pond. A small body of still water of artificial formation, its bed being either hollowed out of the soil or formed by embanking and damming up a natural hollow. A small fresh-water lake.

Pontoon. A flat-bottomed boat, or a number of flat-bottomed boats, or other floating objects, such as hollow cylinders, used as supports for a bridge.

Pontoon bridge. A bridge supported on pontoons.

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.

Port. A place for the loading and unloading of vessels recognized and supervised for maritime purposes by the public authorities. The term includes a city or borough for the reception of mariners and merchants and therefore denotes something more than a harbor or hare. A port may possess a harbor, but a harbor is not necessarily a port. Any natural creek or inlet on the seashore with adequate depth of water and sufficient shelter for ships fulfills the essential conditions of a harbor. To make it a port, in the accepted sense of the word, there must be in addition accommodation and facilities for landing passengers and goods and some amount of overseas trade.

Port hand buoy. A buoy which is to be left to the port hand when approaching from the open sea or in general proceeding in the direction of the main stream of flood current, or in the direction established by appropriate authority.

Position. A point defined by stated or implied coordinates, particularly one on the surface of the earth. A fix is a relatively accurate position determined without reference to any former position. A running fix is a position determined by crossing lines of position obtained at different times and advanced or retired to a common time. An estimated position is determined from incomplete data or data of questionable accuracy. A dead reckoning position is determined by advancing a previous position for courses and distances. A most probable position is that position of a craft judged to be most accurate when an element of doubt exists as to the true position. It may be a fix, running fix, estimated position, or dead reckoning position depending upon the information which it is based. An assumed position is a point at which a craft is assumed to be located. A geographical position is that point on the earth at which a given celestial body is in the zenith at a specified time, or any position defined by means of its geographical coordinates. A geodetic position is a point on the earth the coordinates of which have been determined by triangulation from an accurately known initial station or one defined in terms of geodetic latitude and longitude. An astronomical position is a point on the earth whose coordinates have been determined as a result of observation of celestial bodies, or one defined in terms of astronomical latitude and longitude. A maritime position is the location of a seaport or other point along a coast. A relative position is one defined with reference to another position, either fixed or moving.

Position approximate. Of inexact position. The expression is used principally on charts to indicate that the position of a wreck, shoal, etc., has not been accurately determined or does not remain fixed. Usually shown by the abbreviation 'PA'.

Position doubtful. Of uncertain position. The expression is used principally on charts to indicate that a wreck, shoal, etc., has been reported in various positions and not definitely determined in any. Usually shown by the abbreviation 'PD'.

Position, estimated. The most probable position of a craft determined from incomplete data or data of questionable accuracy. Such a position might be determined by applying a correction to the dead reckoning position.

Positioning system, hyperbolic. A positioning system in which the observer measures the difference in time of reception of signals from two stations whose coordinates are known. The difference in time is converted to a difference in distance. The locus of all points lying at a fixed difference in distance from two points are the two branches of a hyperbola.

Positioning system, inertial. A positioning system consisting of a computer and an assemblage of three accelerometers and two or three gyroscopes. The gyroscopes are fastened together in such a way that they define the orientation of the accelerometers with respect to nonrotating coordinates and the accelerometers measure the components of acceleration of the positioning system along the directions defined by the gyroscopes. The computer and associated equipment integrate the components of acceleration to give the three components of displacement of the positioning system.

Positioning system, radio. A positioning system in which the travel time or phase shift of radio waves is measured. The most common radio positioning systems at present measure the difference in time of travel of radio pulses from three or more known points.

Positioning system, satellite. A positioning system consisting of a radio receiver, or receiver and transmitter, at the point whose location is to be determined, one or more beacons or transponders in orbit about the earth, and a computing system for determining and predicting the orbits. The satellites can be considered points of known location. The radio receiver may measure times of travel of radio pulses, directions to the satellites or the Doppler shift in the frequency of the radio waves emitted by the satellites.

Post. A small beacon, more substantial than a perch, used for marking channels. *See also:* **Pile.**

Potable water. Water suitable for drinking or cooking, from both health and aesthetics considerations.

Potable water intake (PWI). A structure designed for the intake of drinking water. The intake is usually elevated above the bottom, supported and protected by a debris-screening structure (crib), a separately charted feature.

Pound net. A set net composed of vertical netting supported and held in place by stakes. It consists of three essential parts. The pot (pound, pocket, bowl), the wings or hearts and the leader or lead. The pound consists of a bag of stout netting with 1-inch meshes the margin of which is supported by upright stakes. The bottom of the pound is spread and secured by ropes which pass through loops near the lower end of the stakes. The wings or heart are vertical fences of netting diverging from the entrance of the net. The mesh is 1/2-inch and they are supported by stakes. The leader, which may vary in length from about 150 feet to 1,000 or more, extends from shore or shallow water into deeper water and deflects the fish toward the heart or wings.

Prairie. A treeless and grassy plain; an extensive tract of grassland; a low, sandy, grassy tract in the Florida pine woods.

Pratique. Permission granted by the quarantine authorities (U.S. Public Health Service) to a vessel, which has arrived from a foreign port, to communicate with the shore; pratique is normally granted only after inspection and release. Pratique may be granted by radio without inspection to some of the larger passenger vessels entering certain specified U.S. ports; a request for such radio pratique must be made by radio, giving all particulars regarding sanitary conditions aboard, from 12 to 24 hours before the time of arrival at the port.

Precautionary area. A routing measure comprising an area within defined limits where ships must navigate with particular caution and within which the direction of traffic flow may be recommended.

Precipice. The brink or edge of a high and very steep cliff; an abrupt declivity.

Preliminary chart. A chart for which there is a strong requirement, but of a region where some or all of the survey data do not meet modern standards. The deficiencies in surveys may be due to small-scale, outmoded, or nonstandard survey techniques, obsolete age, unprocessed or unapproved data, or other factors which cause the survey data to be below customary standards for the scale of the chart.

Primary light. A major aid to navigation established for the purpose of making landfalls and coastwise passages from headland to headland or for marking areas dangerous to mariners.

Prime meridian. The meridian of longitude 0°, used as the origin for measurement of longitude. The meridian of Greenwich, England, is almost universally used for this purpose.

Private aids to navigation. In U.S. waters, those aids to navigation not established and maintained by the U.S. Coast Guard. Private aids include those established by other federal agencies with prior U.S. Coast Guard approval, those aids to navigation on marine structures or other works which the owners are legally obligated to establish, maintain, and operate as prescribed by the U.S. Coast Guard, and those aids which are merely desired, for one reason or another, by the individual corporation, state or local government, or other body that has established the aid with U.S. Coast Guard approval. Although private aids to navigation are inspected periodically by the U.S. Coast Guard, the mariner should exercise special caution when using them for general navigation.

Prohibited area. An area shown on nautical charts within which navigation and/or anchoring is prohibited except as authorized by appropriate authority. *See also:* **Danger area, Restricted area.**

Projection. (1) The lines representing the parallels of latitude and meridians of longitude drawn on a survey sheet, map, or chart. (2) The representation of a figure on a surface, either plane or curved, according to a definite plan. In a perspective projection this is done by means of projecting lines emanating from a single point, which may be infinity.

Projection, lambert conformal conic. A conformal projection of the conical type, on which all geographic meridians are represented by straight lines, which meet in a common point outside the limits of the map, and the geographic parallels are represented by a series of arcs of circles having this common point for a center. Meridians and parallels intersect at right angles, and angles on the earth are correctly represented on the projection.

Projection, mercator. A conformal projection of the cylindrical type. The equator is represented by a straight line true to scale; the geographic meridians are represented by parallel straight lines perpendicular to the line representing the equator; they are spaced according to their distance apart at the equator. The geographic parallels are represented by a second system of straight lines perpendicular to the family of lines representing the meridians, and therefore, parallel with the equator. Conformality is achieved by mathematical analysis, the spacing of the parallels being increased with the increasing distance from the equator to conform with the expanding scale along the parallels resulting from the meridians being represented by parallel lines. Since rhumb lines appear as straight lines and directions can be measured directly, this projection is widely used in navigation.

Projection, skewed. Any standard projection used in map or chart construction, which does not conform to a general north-south format with relation to the neatlines of the map or chart.

Promontory. High land extending into a large body of water beyond the line of the coast. Called *headland* when the promontory is comparatively high and has a steep face. Also called *foreland.*

Proportional dividers. An instrument consisting in its simple form of two legs pointed at both ends and provided with an adjustable pivot, so that for any given pivot setting, the distance between one set of pointed ends always bears the same ratio to the distance between the other set. A change in the pivot changes the ratio. The dividers are used in transferring measurements between charts or other drawings which are not at the same scale.

Protractor, three-arm. An instrument consisting essentially of a circle graduated in degrees, to which is attached one fixed arm and two arms pivoted at the center and provided with clamps so that they can be set at any angle to the fixed arm, within the limits of the instrument. It is used for finding a ship's position, when the angles between three-fixed and known points are measured.

Province. A region composed of a group of similar bathymetric features whose characteristics are markedly in contrast with those of surrounding areas.

Publisher's note. A marginal note which indicates the publisher and usually place of publication.

Pumping platform complex (PPC). A single platform of a series of interconnected platforms that have one or more of the following capabilities: (1) pumping oil between a vessel and the shore; (2) berthing and messing facilities for assigned personnel; (3) landing area for helicopters; and (4) mooring and loading for small vessels.

Quartz. One of several descriptors of the "nature of the seabed" used in Chart No. 1. Quartz is crystalline silica. In its most common form it is colorless and transparent, but it takes a large variety of forms of varying degrees of opaqueness and color. It is the most common solid mineral. Part of the ocean bed is composed of quartz.

Quay. A structure of solid construction along a shore or bank which provides berthing for ships and which generally provides cargo-handling facilities. A similar facility of open construction is called a *wharf. See also:* **Mole.**

Quicksand. Loose, yielding, wet sand which offers no support to heavy objects. The upward flow of the water has a velocity that eliminates contact pressures between the sand grains and causes the sand-water mass to behave like a fluid.

Race. Swiftly flowing water in a narrow channel or river; also the channel itself which may be artificial as in a mill-race. Also a swift rush of water through a narrow channel in tidal waters and caused by the tidal movement of the waters. *See:* **Tide race.**

RACON (Radar Transponder Beacon). A radio–navigation system that transmits a coded signal which is displayed on the user's radar screen allowing him to identify the aid and determine the aid's range and bearing.

Radar. An electronic system designed to transmit radio signals and receive reflected images of those signals from a "target" in order to determine the bearing and distance of the "target."

Radar beacon. A radar transmitter whose emissions enable a ship to determine its direction and frequent position relative to the transmitter by means of the ship's radar equipment. There are two general types of radar beacons. One type, the RACON, must be triggered by the ship's radar emissions; the other type, the RAMARK, transmits continuously and provides bearings only.

Radar buoy. A buoy having corner reflectors designed into the superstructure, the characteristic shape of the buoy being maintained. This is to differentiate from a buoy on which a corner reflector is mounted.

Radar dome. A dome-shaped structure used to protect the antenna of a radar installation.

Radar reflector. A special fixture fitted to or incorporated into the design of certain aids to navigation to enhance their ability to reflect radar energy. In general, these fixtures will materially improve the aids for use by vessels equipped with radar.

Radiobeacon. Electronic apparatus which transmits a radio signal for use in providing a mariner a line of position.

Radiobeacon characteristic. The description of the complete cycle of transmission of a radiobeacon in a given period of time, inclusive of any silent period.

Radio direction finder (RDF). Radio receiving equipment which determines the direction of arrival of a signal by measuring the orientation of the wave front or of the magnetic or electric vector. Radio direction finders may be either manual or automatic. Also called *direction finder.* Formerly called *radio compass.*

Radio frequency. Any electromagnetic wave occurring within that segment of the spectrum normally associated with some form of radio propagation. Radio frequencies are usually classified as very low, 3 to 30 *kilohertz* (kHz); low, 30 to 300 kHz; medium, 300 to 3,000 kHz; high, 30 to 30 megahertz; very high, 30 to 300 megahertz; ultra high, 300 to 3,000 megahertz; super high, 3 to 30 gigahertz; extremely high, 30 to 300 gigahertz.

Radio mast. A radio mast is a tall structure held vertical by guylines.

Radionavigation. (1) The determination of position, or the obtaining of information relating to position, for the purposes of navigation by means of the propagation properties of radio waves. (2) As defined by the *International Telecommunication Union* (ITU), radiodetermination used for the purposes of navigation, including obstruction warning.

Radio station. A place equipped with one or more transmitters or receivers, or a combination of transmitters and receivers, including the accessory equipment necessary at one location, for carrying on a radiocommunication service. Each station is classified by the service in which it operates permanently or temporarily.

Radio tower. A radio tower is a latticed structure, which is self-supporting.

Ramp. A sloping structure that can either be used as a landing place, at variable water levels, for small vessels, landing ships, or a ferry boat, or for hauling a cradle carrying a vessel.

Range. (1) Two or more objects in line. Such objects are said to be "in range." An observer having them in range is said to be "on the range." Two beacons are frequently located for the specific purpose of forming a range to indicate a safe route or the centerline of a channel. Called *leading marks* in British terminology. (2) Distance in a single direction or along a great circle. (3) The extreme distance at which an object or light can be seen is called *visual range.* (4) The extreme distance at which a signal can be detected or used. The maximum distance at which reliable service is provided is called *operating range.* The spread of ranges in which there is an element of uncertainty of interpretation is called *critical range.* (5) The distance a craft can travel at cruising speed without refueling is called *cruising radius.* (6) The difference in extreme values of variable quantity. *See also:* **Range of tide.** (7) A series of mountains or mountain ridges is called *mountain range.* (8) A predetermined line along which a craft moves while certain data are recorded by instruments usually placed below the line, or the entire station at which such information is determined. *See also:* **Degaussing range.** (9) An area where practice firing of ordnance equipment is authorized. (10) On the seafloor, a series of ridges or seamounts.

Range, geographic(al). The greatest distance at which a light can be seen as a function of the curvature of the earth and heights of the light source and the observer.

Range, luminous. The greatest distance at which a light can be seen merely as a function of its luminous intensity, the meteorological visibility, and the sensitivity of the observer's eye.

Range, nominal. The luminous range of a light in a homogeneous atmosphere in which the meteorological visibility is 10-sea miles.

Range of tide. The difference in height between consecutive high- and low-tide waters. The mean range is the difference in the height between mean high water and mean low water.

Rapid(s). Portions of a stream with accelerated current where it descends rapidly but without a break in the slope of the bed sufficient to form a waterfall. Usually used in the plural.

Ravine. A gulch; a small gorge or canyon, the sides of which have comparatively uniform slopes.

Reach. The comparatively straight segment of a river or channel between two bends. That part of a winding river between the last bend and the sea is called a *sea reach;* that part between the harbor and the first bend is called a *harbor reach.*

Rebuilt. A fixed aid, previously destroyed, which has been restored as an aid to navigation.

Reciprocal bearing. A bearing differing by 180° or one measured in the opposite direction, from a given bearing.

Recommended direction of traffic flow. A traffic flow pattern indicating a recommended directional movement of traffic where it is impractical or unnecessary to adopt an established direction of traffic flow.

Recommended track. A route which has been specially examined to ensure so far as possible that it is free of dangers and along which ships are advised to navigate.

Reduction of soundings. Recorded soundings on hydrographic surveys are corrected for any departure from true depths attributable to the method of sounding or to a fault in the measuring apparatus and for the elevation of the tide or water level above or below the chart datum (tidal or stage correction).

Reef. A rocky or coral elevation dangerous to surface navigation which may or may not uncover at the sounding datum. A rocky reef is always detached from shore; a coral reef may or may not be connected with the shore.

Reference datum. A general term applied to any datum, plane, or surface used as a reference or base from which other quantities can be measured.

Reference station. A tide or current station for which independent daily predictions are given in the *Tide Tables* and *Tidal Current Tables,* and from which corresponding predictions are obtained for subordinate stations by means of differences and ratios. *See:* **Subordinate current station.**

Register marks. Designated marks, such as small crosses, circles, or other patterns applied to original copy prior to reproduction to facilitate registration of plates and to indicate the relative positions of successive impressions. Also called: *corner marks; corner ticks; register ticks; registration ticks; ticks.*

Registration. Correct positioning of one component of a composite map image in relation to the other components. Achieved, for example, by punching sets of holes, having a fixed horizontal relationship to each other, in each component sheet and then attaching the components together using specially designed fasteners.

Relief. (1) The elevations or the inequalities, collectively of a land surface; represented on graphics by contours, hypsometric tints, shading, spot elevations, hachures, etc. Similar inequalities of the ocean bed or their representation are called *submarine relief.* (2) The removal of a buoy from a station and the providing of another buoy having the operating characteristics authorized for that station.

Relighted. An extinguished aid returned to its advertised light characteristics.

Relocated. Authorized movement of an aid from one position to another in the immediate vicinity.

Removable span bridge. A bridge with a portable or pontoon span that can be removed or drawn aside.

Repeatability. (1) A measure of the variation in the accuracy of an instrument when identical tests are made under fixed conditions. (2) In a navigation system, the measure of the accuracy with which the system permits the user to return to a specified point as defined only in terms of the coordinates peculiar to that system.

Repeatable accuracy. In a navigation system, the measure of the accuracy with which the system permits the user to return to a position as defined only in terms of the coordinates peculiar to that system. For example, the distance specified for the repeatable accuracy of the system, such as LORAN-C is the distance between two LORAN-C positions established using the same stations and time-difference readings at different times. The correlation between the geographical coordinates and the system coordinates may or may not be known.

Replaced. An aid previously off station, adrifts, or missing restored by another aid of the same type and characteristics.

Replaced (temporarily). An aid previously off station, adrift, or missing restored by another aid of different type and/or characteristic.

Representative fraction. The scale of a map or chart expressed as a fraction or ratio that relates unit distance on the map to distance measured in the same unit on the ground. Also called *natural scale, fractional scale.*

Reprint. A reprinting of a chart without revision, necessitated by the depletion of stock. The issue is an exact duplicate of the current issue with no changes in printing or publication dates.

Reset. A floating aid previously off station, adrift, or missing returned to its assigned position (station).

Restricted area. A specified area designated by appropriate authority and shown on charts, within which navigation is restricted in accordance with certain specified conditions. *See:* **Danger area; Prohibited area.**

Restricted waters. Areas which for navigational reasons such as the presence of shoals or other dangers confine the movements of shipping within narrow limits.

Retractable bridge. A bridge with a movable span that can be withdrawn horizontally or within the remaining structure of the bridge.

Reversing current. A tidal current which flows alternately in approximately opposite direction with a slack water at each reversal of direction. Currents of this type usually occur in rivers and straits where the direction of flow is more or less restricted to certain channels.

Revetment. Facing of stone or other material, either permanent or temporary, placed along the edge of a stream to stabilize the bank and to protect it from the erosive action of the stream.

Revised print. A chart issue that does not cancel a current edition; the revisions are minor, the edition number remains the same but the print date is changed, and the chart is designated a revised print of that chart. The date of a revised print is shown to the right of the edition date.

Revision. The process of bringing the information on a map up to date. Continuous revision: a system designed to keep the information on a map up to date at all times.

Revision cycle. The proposed time interval between successive revisions of a chart or map.

Rhythmic light. A light showing intermittently with a regular periodicity.

Ridge. A long and narrow elevation with steep sides; a long, narrow elevation of the seafloor, with steep sides and more irregular topography than a rise.

Right bank. That bank of a stream or river on the right of the observer when he is facing in the direction of flow, or downstream. *See also:* **Left bank.**

Rincon. Corner or cove; an angular recess or hollow bend in a mountain, riverbank, cliff, or the like. (Local in Southwest) (Sp. origin)

Riparian boundaries. Water boundaries, or boundaries formed by the sea or a river.

Riparian lands. Lands bordering on a river. The term "riparian" is also used as relating to the shore of the sea or other tidal water, or of a lake or other considerable body of water not having the character of a watercourse.

Rip current. A strong surface current flowing seaward from the shore. It usually appears as a visible band of agitated water and is the return movement of water piled up on the shore by incoming waves and wind. With the seaward movement concentrated in a limited band, its velocity is somewhat accentuated.

Riprap. A layer of broken rock, cobbles, boulders, or fragments of sufficient size and thickness to resist the erosive forces of flowing water or wave action. Such structures usually are used to protect channels with relatively high velocity flow, shores, slopes, slopes on dams, or outlets of structures.

Riprap mounds. Mounds of riprap maintained at certain light structures to protect the structures against ice damage and scouring action. Uncharted submerged portions present hazard to vessels attempting to pass extremely close aboard.

Rips. Agitation of water caused by the meeting of currents or by a rapid current setting over an irregular bottom. Called *tide rips* when a tidal current is involved.

Rise. A long, broad elevation that rises gently and generally smoothly from the seafloor.

River. A natural stream of water, or greater volume than a creek or rivulet, flowing in a more or less permanent bed or channel, between defined banks or walls, with a current which may either be continuous in one direction or affected by the ebb and flow of the tidal current.

Road. An open anchorage affording less protection than a harbor. Some protection may be afforded by reefs, shoals, etc. Often used in the plural.

Rock. (1) An isolated rocky formation on a single large stone, usually one constituting a danger to navigation. It may be always submerged, always uncovered, or alternately covered and uncovered by the tide. A pinnacle is a sharp-pointed rock rising from the bottom. (2) The naturally occurring material that forms the firm, hard, and solid masses of the ocean floor. Also, *rock* is a collective term for masses of hard material generally not smaller than 256 millimeters.

Rock awash. In NOAA terminology, a rock exposed at any stage of the tide between the datum of mean high water and the sounding datum, or one just bare at these datums. For cartographic purposes, in order that the charted symbols may reflect the most probable condition of the rock as seen by the mariner, rocks the summits of which are in the zone between 1 foot above mean high water and 1 foot below the sounding datum on the Atlantic and gulf coasts and 2 feet on the Pacific coast are shown as rocks awash.

A rock that becomes exposed, or nearly so, between chart sounding datum and mean high water. In the Great Lakes, the rock awash symbol is used on charts for rocks that are awash, or nearly so, at low-water datum.

Rotary current. A tidal current that flows continually with the direction of flow changing through all points of the compass during the tidal period.

Roundabout. A routing measure comprising a separation point or circular separation zone and a circular traffic lane within defined limits. Traffic within the roundabout is separated by moving in a counterclockwise direction around the separation point or zone. A circular area within definite limits in which traffic moves in a counterclockwise direction around a specified point or zone.

Route charts. These NOAA charts are published in a single long, narrow sheet, printed front and back and folded. They are designed for river and narrow waterway coverage, and for much of the Intracoastal Waterways. Most are issued in a protective cardboard jacket.

Routing. A complex of measures concerning routes aimed at reducing the risk of casualties; it includes traffic separation schemes, two-way routes, tracks, areas to be avoided, inshore traffic zones, and deep-water routes.

Routing system. Any system of one or more routes and/or routing measures aimed at reducing the risk of casualties; it includes traffic separation schemes, two-way routes, recommended tracks, areas to be avoided, inshore traffic zones, roundabouts, precautionary areas, and deep-water routes.

Ruin. A structure in decayed or deteriorated condition resulting from neglect or disuse, or a damaged structure in need of repair. A ruin is considered hazardous if it extends over or into navigable waters and thus represents a danger to surface navigation.

Rules of the road. The International Regulations for Preventing Collisions at Sea, commonly called *Inland Rules of the Road,* and *Inland Rules of the Road* to be followed by all vessels while navigating upon certain inland waters of the United States. Also called *Rules of Navigation.*

Saddle. A low point on a ridge or crestline; a ridge connecting two higher elevations; a low point on a ridge or between seamounts.

Safety lanes. Specified sea lanes designated for use in transit by submarines and surface ships to prevent attack by friendly forces.

Safety zones. Established around *Outer Continental Shelf* (OCS) facilities being constructed, maintained, or operated on the OCS to promote the safety of life and property on the facilities, their appurtenances and attending vessels, and on the adjacent waters within the safety zones.

Sailing charts. These NOAA charts are published at a scale smaller than 1:600,000, and are intended for planning and for fixing the mariner's position as the coast is approached from the open ocean or for sailing along the coast between distant ports. The shoreline and topography are generalized and only offshore soundings, principal navigational lights and buoys, and landmarks visible at considerable distances are shown.

Salt marsh. Flat, poorly drained coastal swamps which are flooded by most high tides.

Salt pans. Shallow pools of brackish water used for the natural evaporation of sea water to obtain salt.

Sanctuary, marine. Area established under provisions of the Marine Protection, Research, and Sanctuaries Act of 1972, Public law 92-532 (86 Stat. 1052), for the preservation and restoration of its conservation, recreational, ecological, or esthetic values. Such an area may lie in ocean waters as far seaward as the outer edge of the Continental Shelf, in coastal waters where the tide ebbs and flows, or in the Great Lakes and connecting waters, and may be classified as a habitat, species research, recreations and esthetic, or unique area.

Sand. One of several descriptors of the "nature of the seabed" used in Chart No. 1. Sediment consisting of small but easily distinguishable separate grains between 0.0625 and 2 mm in diameter. It is called *very fine sand* if the grains are between 0.0625 mm and 0.125 mm in diameter, *fine sand* if between 0.125 mm and 0.25 mm in diameter, *medium sand* if between 0.25 mm and 0.5 mm in diameter, *coarse sand* if between 0.50 mm and 1.0 mm in diameter, and *very coarse sand* if between 1.0 mm and 2.0 mm in diameter. *See also:* **Mud, Stones, Rock, Boulder.**

Sandwave. A large wavelike sediment feature in very shallow water and composed of sand. The wavelength may reach 100 meters; the amplitude is about 0.5 meter. Also called *megaripple.*

Scale. The relationship between a linear dimension on a chart and the actual dimension represented is expressed, usually, as a ratio. Thus, the ratio 1:10,000 or 1/10,000 means that one unit of measure on the chart represents 10,000 of the same unit on the surface of the earth. Just as 1:4 or 1/4 is larger than 1:8 or 1/8, a 1:40,000 scale chart is larger than 1:80,000-scale chart. Consequently, a large-scale chart will show chart features in more detail but will cover a smaller area; a smaller scale chart will be more generalized but will cover a larger area.

Scale, bar. A graduated line on a map, plan, photograph, or mosaic, by means of which actual ground distances may be determined. Also called *graphic scale* or *linear scale.*

Scale, border. A scale drawn along the border of a chart.

Scale, large. A scale involving a relatively small reduction in size. A large-scale chart is one covering a small area. The opposite is small scale.

Scale, logarithmic. A scale graduated in the logarithms of uniformly spaced consecutive numbers.

Scale, small. A scale involving a relatively large reduction in size. A small-scale chart is one covering a large area. The opposite is large scale.

Scarp. A steep slope extending over a considerable distance and marking the edge of a terrace, plateau, bench, etc.

Scarp, beach. An almost vertical slope along the beach caused by erosion of wave action. It may vary in height from a few inches to several feet, depending on wave action and the nature and composition of the beach.

Schist. One of several descriptors of the "nature of the seabed" used in Chart No. 1. Schist is a foliated crystalline metamorphic rock composed of layers of different minerals that splits into thin irregular plates. Schist offers variable holding quality.

Scouring basin. A basin in which a quantity of water is impounded during the flood tide and the contents retained until a suitable time, about low water, when the gates are opened again and a volume of water is let out to maintain desired depth of the entrance channel by scouring the bottom. Also called *sluicing pond.*

Sea. (1) A body of salt water more or less confined by continuous land or chains of islands and forming a region distinct from the great masses of water. (2) A body of water nearly or completely surrounded by land, especially if very large or composed of salt water. Sometimes called *inland sea.* (3) Ocean areas in general, including major indentations in the coastline, such as gulfs. (4) Waves generated or sustained by winds within their fetch as opposed to swell. (5) The character of a water surface, particularly the height, length (period), and direction of travel of waves generated locally.

Seaboard. The region of land bordering the sea. The terms *seaboard, coast,* and *littoral* have nearly the same meanings. Seaboard is a general term used somewhat loosely to indicate a rather extensive region bordering the sea. Coast is the region of indefinite width that extends from the sea inland to the first major change in terrain features. Littoral applies more specifically to the various parts of a region bordering the sea, including the coast, foreshore, backshore, beach, etc.

Sea buoy. The outermost buoy marking the entrance to a channel or harbor. Called *landfall buoy* in British terminology.

Sea gate. (1) A way giving access to the sea such as a gate, channel, or beach. (2) A gate which serves to protect a harbor or tidal basin from the sea, such as one of a pair of supplementary gates at the entrance to a tidal basin exposed to the sea.

Sea mile. An approximate mean value of the nautical mile equal to 6,080 feet, or the length of a minute of arc along the meridian at latitude 48°. (British terminology: The length of one minute of arc, measured along the meridian in the latitude of the position; its length varies both with the latitude and with the figure of the earth in use.)

Sea wall. A structure separating land and water areas, primarily designed to prevent erosion and other damage due to wave action. *See also:* **Bulkhead.**

Seaward. Away from the land; toward the sea.

Seaward boundary. Limits of any area or zone offshore from the mean low, or mean lower low water line and established by an act of the U.S. Congress, or agreed to by treaty. *See:* **Mean low water line.**

Seaweed. One of several descriptors of the "nature of the seabed" used in Chart No. 1. Seaweed includes any of a large variety of weeds generally found in shallow waters. Seaweed has no holding power; anchors must pass through the weed to grip the underlying seabed. Anchors suitable for seaweed require a long, narrow fluke that penetrates deeply to reach the bottom. Care must be taken in anchoring in seaweed to ensure that the anchor penetrates to the bottom. Searching for an alternative location is often preferable to attempting to anchor in seaweed.

Secondary light. A major light, other than a primary seacoast light, established at harbor entrances and other locations where high intensity and reliability are required.

Security zone. All areas of land, water, or land and water, which are so designated by the Captain of the Port for such time as he deems necessary to prevent damage or injury to any vessel or waterfront facility, to safeguard ports, harbors, territories, or waters of the United States or to secure the observance of the rights and obligations of the U.S.

Sediment(s), bottom. In general all sedimentary material regardless of origin found on or in the submarine bottom, including ballast or other material dumped into the sea by man. More specifically it is limited to unconsolidated mineral and organic material forming the sea bottom, not including coral reefs or bedrocks.

Seiche. A stationary wave usually caused by strong winds and/or changes in barometric pressure. It is found in lakes, semienclosed bodies of water, and in areas of the open ocean.

Semidiurnal. Having a period or cycle of approximately one-half of a tidal day. The predominant type of tide throughout the world is semidiurnal, with two high waters and two low waters each tidal day. The tidal current is said to be semidiurnal when there are two flood and two ebb periods each day.

Separation zone or line. A zone or line separating traffic proceeding in one direction from traffic proceeding in another direction. A separation zone may also be used to separate a traffic lane from the adjacent inshore traffic zone.

Setting a buoy. The act of placing a buoy on assigned position in the water.

Sewage. Human body wastes and the wastes from toilets and other receptacles intended to receive or retain body waste.

Shallow water. Commonly, water of such a depth that surface waves are noticeably affected by bottom topography. It is customary to consider water of depths less than half the surface wavelength as shallow water.

Shelf: Continental; Insular; Island. A zone adjacent to a continent (or around an island) and extending from the low-water line to a depth at which there is usually a marked increase of slope toward oceanic depths.

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.)

Shingle. One of several descriptors of the "nature of the seabed" used in Chart No. 1. *See under:* **Stones.**

Shipping lane. A term used to indicate the general flow of merchant shipping between two departure/terminal areas.

Ships' Routing. A publication of the *International Maritime Organization* (IMO), which describes the general provisions of ships' routing, traffic separation schemes, deep-water routes, and areas to be avoided, which have been adopted by IMO. All details of routing systems are promulgated through *Notices to Mariners,* together with their dates of implementation. Also details of routing system are depicted on charts and are given in *Sailing Directions.*

Shoal. (1) Shallow. (2) An offshore hazard to navigation on which there is a depth of 10 fathoms or 20 meters or less, composed of unsolidated material, except coral or rock. *See:* **Reef.**

Shoaling. A bottom effect, which describes the height of the waves, but not the direction. It can be divided into parts which occur simultaneously. The one part has to do with the fact that waves become less dispersive close to shore; therefore, since the same energy can be carried by high waves of lesser height, this effect causes a gradual decrease in the wave height. In the other part, the waves slow down, the crests move closer together, and since the energy between crests remain relatively fixed, the waves can become higher near shore. These effects are evidenced in the initial decrease in height of the incoming wave, then an increase in height as the wave comes into shore.

Shore. That part of the land in immediate contact with a body of water including the area between high- and low-water lines. The term *shore* is usually used with reference to the body of water and coast with reference to the land, as the east coast of the United States is part of the western shore of the Atlantic Ocean. The term *shore* usually refers to a narrow strip of land in immediate contact with any body of water, while coast refers to a general region in proximity to the sea. A shore bordering the sea may be called a *seashore. See also:* **Foreshore; Backshore.**

Shoreface. The narrow zone seaward from the low tide shoreline, permanently covered by water, over which the beach sands and gravels actively oscillate with changing wave conditions.

Shoreline. The line of contact between the land and a body of water. On NOAA nautical charts and surveys, the shoreline approximates the mean highwater line. In NOAA usage, the term is considered synonymous with "coastline." *See:* **Mean high water line.**

Short-range systems. Those radionavigation systems limited in their positioning capability to coastal regions, or those systems limited to making landfalls. Radar and radio direction finder are examples.

Significant. A condition or situation that could have a material consequence for the chart user A significant error, for example, could lead to an erroneous, even dangerous use of the chart.

Sill. On the seafloor the low part of a gap or saddle separating basins. *See also:* **Dock sill.**

Sill depth. The greatest depth over a sill.

Silt. One of several descriptors of the "nature of the seabed" used in Chart No. 1. *See under:* **Stones.**

Single station range light. A direction light bounded by other sectors of different characteristics which define its margins with small angles of uncertainty. Most commonly the bounding sectors are of different colors (red and green).

Sink, sinkhole. A depression which has subsurface drainage only, through natural holes and caverns in limestone or by seepage into a lower lying water table.

Skeleton tower. A tower, usually of steel, constructed of heavy corner members and various horizontal and diagonal bracing members.

Slack water (slack). The state of a tidal current when its speed is near zero, especially the moment when a reversing current changes direction and its speed is zero.

Slip. A berthing space between two piers. Also called *dock.*

Slipway. A structure in a shipyard on which vessels are constructed so that when finished they may be slid into the water.

Slope. On the seafloor, the slope seaward from the shelf edge to the beginning of a continental or insular rise or the point where there is a general reduction in slope.

Slough. A minor marshland or tidal waterway which usually connects other tidal areas; often more or less equivalent to a bayou.

Sluice. Sliding gate or other contrivance for changing the level of a body of water by controlling flow into or out of it.

Small-craft nautical charts. These charts are published by NOAA at scales from 1:10,000 to 1:80,000 and are designed for easy reference and plotting in limited spaces. In some areas these charts represent the only chart coverage for all marine users. They portray regular nautical chart detail and other specific details of special interest to small-craft operators, such as enlargements of harbors; tide, current, and weather data; rules-of-the-road information; locations of marine facilities; anchorages; courses; and distances.

Snag. A tree or branch embedded in a river or lake bottom and not visible on the surface, forming thereby a hazard to boats.

Sound. A relative long arm of the sea or ocean forming a channel between an island and a mainland or connecting two larger bodies of water, as a sea and the ocean, or two parts of the same body but usually wider and more extensive than strait. The term has been applied to many features which do not fit the accepted definition. Many are very large bodies of water, such as Mississippi Sound and Prince William Sound, others are mere salt water ponds or small passages between islands.

Sound buoy. A buoy equipped with either a gong, bell, whistle, or electronic horn. Bells and gongs on buoys are sounded by tappers that hang from the tower and swing as the buoys roll in the sea. Bell buoys produce a sound of only one tone; gong buoys produce several tones. Whistle buoys make a loud moaning sound caused by the rising and falling motions of the buoy in the sea. A buoy equipped with an electronic horn, a horn buoy, will produce a pure tone at regular intervals and will operate continuously regardless of the sea state.

Sounding. Measured or charted depth of water, or the measurement of such depth. A no-bottom sounding is one in which the bottom is not reached. A vessel is said to be on soundings when it is navigating primarily by means of the information obtained by successive measurements of the depth of the water, or is in an area where this can be done. In other areas a vessel is said to be "off soundings."

Sounding, danger. A minimum sounding chosen for a vessel of specific draft in a given area to indicate the limit of safe navigation.

Sounding, doubtful. A depth shown on a chart over a shoal, a rock, etc., that may be less than that indicated.

Sound signal. A sound transmitted in order to convey information as a fog signal. The term *sound signal* is sometimes used to describe the apparatus generating the sound.

Special-purpose buoy. A buoy having no lateral significance used to indicate a special meaning to the mariner which must be determined from appropriate nautical documents.

Spheroid. An ellipsoid; a figure resembling a sphere. Also called *ellipsoid* or *ellipsoid of revolution,* from the fact that it can be formed by revolving an ellipse about one of its axes. If the shorter axis is used as the axis of revolution, an oblate spheroid results, and if the longer axis is used, a prolate spheroid results. The earth is approximately an oblate spheroid.

Spire. A label on a nautical chart which indicates a pointed structure extending above a building. The spire is seldom less than two-thirds of the entire height and its lines are rarely broken by stages or other features. The term is not applied to a short pyramid-shaped structure rising from a tower or belfry.

Spit. A small tongue of land or a narrow shoal (usually sand) extending from the shore into a body of water. Generally the tongue of land continues in a long narrow shoal for some distance from the shore.

Spoil. Mud, sand, silt or other deposits obtained from the bottom of a channel of harbor by dredging.

Spoil area. Area for the purpose of depositing dredged material, usually near and parallel to dredged channels. Spoil areas are usually a hazard to navigation and navigators of even the smallest craft should avoid crossing these areas. Spoil areas are shown on nautical charts. *See also:* **Dumping ground; Dump site.** Also called *spoil ground.*

Spoil banks. Submerged accumulations of dumped material dredged from channels or harbors.

Spoil ground. *See:* **Spoil area.**

Spot elevation. A point on a map or chart whose height above a specified datum is noted, usually by a dot or a small sawbuck and elevation value.

Spring. A place where water issues naturally from the rock or soil upon the land or into a body of surface water.

Spring tides or tidal currents. Tides of increased range or tidal currents of increased speed occurring semimonthly as the result of the moon being new or full.

Spur. A subordinate elevation, ridge, or rise projecting outward from a larger feature.

Stack. A label on a nautical chart which indicates a tall smokestack or chimney. The term is used when the stack is more prominent as a landmark than the accompanying buildings.

Stake. An elongated wood or metal pole embedded in the bottom to serve as a marker or support for fish nets.

Stand of tide. Sometimes called a *platform tide.* An interval at high or low water when there is no sensible change in the height of the tide.

Standpipe. A label on a nautical chart which indicates a tall cylindrical structure, in a waterworks system, the height of which is several times the diameter.

Starboard. The right side of a craft, facing forward. The opposite is port.

Station buoy. An unlighted buoy set near a lightship or an important buoy as a reference point should the primary aid be moved from its assigned position.

Station, reference. A place where tide or tidal current constants have been determined from observations, and which is used as a standard for the comparison of simultaneous observations at a subordinate station. It is also a place for which independent daily predictions are given in the tide or tidal current tables, from which corresponding predictions are obtained for other locations by means of differences or factors. Also called *standard station* and *standard port* (British terminology).

Stones. One of several descriptors of the "nature of the seabed" used in Chart No. 1. A general term for rock fragments ranging in size from 2 mm to 256 mm. An individual stone is called a *cobble* if between 64 mm and 256 mm, a *pebble* if between 4 mm and 64 mm, and *gravel* if between 2 mm and 4 mm. An aggregate of stones ranging from 16 mm to 256 mm is called *shingle.*

Strait. A relatively narrow waterway, usually narrower and less extensive than a sound, connecting two larger bodies of water.

Stranded and sunken. These terms apply exclusively to items that once possessed the ability to float but which are now resting on the bottom. Stranded items project above the sounding datum. Sunken items do not project above the sounding datum. These terms apply most often to wrecks. Masts, funnels, and other extensions of wreck superstructure should be disregarded when applying the above definitions; these features may be above the sounding datum and still have the wreck classified as "sunken."

Stranding. The destruction or loss of a vessel by its being sunk or broken up by the violence of the sea or by its striking or stranding upon a rock, shoal, or the like. The term "stranding" refers most particularly to the driving or running aground of a vessel. It may be either accidental or voluntary. Voluntary stranding takes place where the ship is run aground either to avoid a more serious fate, or for some fraudulent purpose. In marine insurance, a "touch-and-go" is not considered a stranding. In order to constitute a stranding, the ship must be stationary for a certain length of time.

Stream. Any river, brook, rivulet, or course of running water. A steady current in the sea or in a river, especially the middle or most rapid part of a tide or current.

Stream channel. 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.

Strobe light. Many charted features marked with ultrabright flashing lights of extremely short duration. These bright flashes are produced by a strobe light device usually a xenon gas condenser-discharge flash lamp or flash tube. Xenon flash tubes are unique light sources capable of firing extremely power flash. The flash is almost similar to the spectral distribution of light of the sun, which ranges from ultraviolet to infrared regions. The duration of the flash is controlled from some microseconds up to scores of milliseconds. Strobe lights are used on certain U.S. Coast Guard maintained aids to navigation and on potential aero hazards such as stacks, towers, and builds. The terms "Flick" and "Flash Tube" as used in U.S. Coast Guard *Notice to Mariners* are considered to have strobe light characteristics for the purpose of nautical chart labeling. Aids published in *Notice to Mariners* and *Light Lists* as well as landmarks with the above characteristics are identified on nautical charts with the label "Strobe" incorporated within the label of the particular feature.

Structure. The term "structure" includes, without limitation, any pier, wharf, dolphin, weir, boom, breakwater, bulkhead, revetment, riprap, jetty, permanent mooring structure, power transmission line, permanently moored floating vessel, piling, aid to navigation, or any other obstacle or obstruction.

Submarine cable. An insulated, waterproofed wire or bundle of wires for carrying an electric current under water. Such a cable is placed on or near the bottom.

Submarine valley (also called Seavalley). A depression in the sea bottom of broad valley form without the steep side slopes which characterize a canyon.

Submerged. Under water; not showing above water. The opposite is "uncovered."

Submerged lands. Lands covered by water at any stage of the tide, as distinguished from tidelands which are attached to the mainland or an island and cover and uncover with the tide. Tidelands presuppose a high-water line as the upper boundary, submerged lands do not.

Submerged production well. An oil or gas well that is a seabed installation only, i.e., the installation does not include a permanent production platform.

Submerged rock. A rock covered at the chart sounding datum and considered to be potentially dangerous to navigate. *See also:* **Bare rock; Rock awash.**

Subordinate current station. (1) A current station from which a relatively short series of observations is reduced by comparison with simultaneous observations from a control current station. (2) A station listed in the *Tidal Current Tables* for which predictions are to be obtained by means of differences and ratios applied to the full predictions at a reference station. *See:* **Reference station.**

Summit. The highest point, part of elevation; top or apex.

Sunken rock. A rock potentially dangerous to surface navigation, the summit of which is below the lower limit of the zone for a rock awash.

Super-buoy. A very large buoy, generally more than 5 meters in diameter. Its large size renders a super-buoy a potential hazard even to large vessels. The three principal types of super-buoy are: large navigational buoy, offshore tanker loading/discharge buoy (or single-point mooring), and the *oceanographic data acquisition system* (ODAS) buoy.

Survey, wire-drag. A hydrographic survey made utilizing a wire drag. In areas of rocky bottom or where submerged obstacles such as wrecks are present, a wire-drag survey represents the most practical way of making sure that all obstructions or dangers have been found and least depths over them obtained. Also called *wire-drag sweep.*

Suspension bridge. A bridge suspended from chains or cables which are anchored at either end and supported by towers at regular intervals.

Swamp. A track of stillwater abounding in certain species of trees and course grass or boggy protuberances; a track of wet, spongy land, saturated, but not usually covered with water; a boggy marshland and stream; a slough.

Swash. A narrow channel or sound within a sand bank, or between a sand bank and the shore. Also called *swashway.* A bar over which the sea washes. The rush of water up onto a beach following the breaking of a wave.

Swash channel. (1) On the open shore, a channel cut by flowing water in its return to the parent body (e.g., a rip channel). (2) A secondary channel passing through or shoreward of an inlet or river bar.

Sweep. To drag. Drag and sweep have nearly the same meanings. *Drag* refers particularly to the location of obstructions, or the making sure that obstructions do not exist. *Sweep* may include, additionally, the removal of any obstruction located.

Sweeping. The process of towing a line or object below the surface, to determine whether an area is free from isolated submerged dangers to vessels and to determine the position of any such dangers that exist, or to determine the least depth of an area. The process of clearing an area or channel of mines or other dangers to navigation.

Swing bridge. A bridge that can be swung in a horizontal plane to allow tall vessels to pass.

Tableknoll. A seamount rising less than 500 fathoms from the seafloor and having a comparatively smooth, flat top with minor irregularities.

Tablemount. A seamount rising more than 500 fathoms from seafloor and having a comparatively smooth, flat top with minor irregularities.

Terrace. On the seafloor, a relatively flat, horizontal or gently inclined surface, sometimes long and narrow, which is bounded by a steeper ascending slope on one side and by a steeper descending slope on the opposite side.

Territorial sea (also called Marginal sea, *[Adjacent sea,] Marine belt, Maritime belt, and Three-mile limit).* The water area bordering a nation over which it has exclusive jurisdiction, except for the right of innocent passage of foreign vessels. It is a creation of international law, although no agreement has thus far been reached by the international community regarding its width. It extends seaward from the low-water mark along a straight coast and from the seaward limits of inland waters where there are embayments. The United States has traditionally claimed 3-nautical miles as its width and has not recognized the claims of other countries to a wider belt.

Territorial waters. Includes the territorial sea (marginal sea) and the inland waters of a country (lakes, rivers, bays, etc.). Sometimes used as synonymous with **Territorial sea.**

Thorofare. This shortened form of thoroughfare has become standard for a natural waterway in marshy areas. It is the same type of feature as a slough or bayou.

Three-arm protractor. An instrument consisting essentially of a circle graduated in degrees, to which is attached one fixed arm and two arms pivoted at the center and provided with clamps so that they can be set at any angle to the fixed arm, within the limits of the instrument. It is used for finding a ship's position when the angles between three fixed and known points are measured. Also called *station pointer.*

Tidal basin. A basin without a caisson or gate in which the level of water rises and falls with the tides. Also called *open basin. See also:* **Tidal harbor; Nontidal basin.**

Tidal current. A horizontal movement of the water caused by gravitational interactions between the sun, moon, and earth.

Tidal current chart diagrams. A series of 12 monthly diagrams to be used with the Tidal Current Charts. Each diagram contains lines that indicate the specific tidal current chart of each series to use, and speed factor to apply to that chart.

Tidal current charts. (1) Charts on which tidal current data are depicted graphically. (2) Tidal current chart; as published by NOAA, part of a set of 12 charts which depict, by means of arrows and figures, the direction and velocity of the tidal current for each hour of the tidal cycle.

Tidal Current Tables. (1) Tables which give the predicted times of slack water and the predicted times and velocities of maximum current flood and ebb for each day of the year at a number of reference stations, together with time differences and velocity ratios for obtaining predictions at subordinate stations. (2) Tidal Current Tables; published annually in two volumes; Atlantic Coast of North America; Pacific coast of North America and Asia.

Tidal cycle. A complete set of tidal conditions as those occurring during a tidal day, lunar month, or Metonic cycle.

Tidal datum. Specific tide levels which are used as surfaces of reference for depth measurements in the sea and as a base for the determination of elevation on land. Many different datums have been used, particularly for leveling operations. Also called *tidal datum plane.*

Tidal flat. A marsh or sandy or muddy coastal flatland which is covered and uncovered by the rise and fall of the tide.

Tidal harbor. A harbor affected by the tides, in distinction from a harbor in which the water level is maintained by caissons or gates. *See also:* **Nontidal basin.**

Tidal waters. All waters which flow and reflow under the influence of the tides. Arms of the sea, bays, creeks, coves, or rivers in which the tide ebbs and flows are properly denominated tidal waters. The term tidal water is not limited to water which is salt, but embraces also so much of the water of fresh rivers as is propelled backward by the ingress and pressure of the tide. Also called *tide waters.*

Tide. The periodic rise and fall of the water resulting from gravitational interactions between the sun, moon, and earth. The vertical component of the particulate motion of a tidal wave.

Tide lock. A lock situated between a basin or canal and tidewater to maintain the water at a desired level as the height of the tide changes. Also called *guard lock.*

Tide race. A very rapid tidal current through a comparatively narrow channel. Also called *race.*

Tide rips. Small waves formed on the surface of water by the meeting of opposing tidal currents or by a tidal current crossing an irregular bottom. Vertical oscillation, rather than progressive waves, is characteristic of tide rips. *See also:* **Rips.**

Tide station. (1) The geographic location at which tidal observations are made. (2) The equipment used to make tidal observations and its housing.

Tide tables. Tables which give the predicted times and heights of high and low water for every day in the year for a number of reference stations, and tidal differences and ratios by which additional predictions can be obtained for subordinate stations. From these values it is possible to interpolate by a simple procedure the height of the tide at any hour of the day. *See also:* **Tidal Current Tables.**

Toe (engineering). Terminal edge or edges of a structure.

Tongue. 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.

Topographic map. A map which presents the vertical position of features in measurable form as well as their horizontal positions.

Topography. (1) The configuration of the surface of the earth, including its relief, the position of its stream, roads, cities, etc. The earth's natural and physical features collectively. A single feature, such as a mountain or valley, is termed a *topographic feature.* Topography is subdivided into hypsography (the relief features), hydrography (the water and drainage features), culture (artificial features), and vegetation. (2) The science of delineation of natural and artificial features of a place or region especially in a way to show their positions and elevations.

Track. (1) The intended or desired horizontal direction of travel with respect to the earth. The track as expressed in degrees of the compass may be different from the course due to such factors as making allowance for current sea or steering to resume the track. (2) The path of intended travel with respect to the earth as drawn on the chart. Also called *intended track, trackline.* (3) The actual path of a vessel over the ground.

Traffic lane. An area within defined limits in which one-way traffic is established. Natural obstacles, including those forming separation zones, may constitute a boundary.

Traffic separation scheme. A scheme which separates traffic proceeding in opposite or nearly opposite directions by the use of a separation zone or line, traffic lanes or by other means. Shipping corridors marked by buoys, which separate incoming from outgoing vessels. Improperly called "sea lanes."

Trench. A long, narrow, characteristically very deep and asymmetrical depression of the seafloor, with relatively steep sides. *See also:* **Trough.**

Trough. (1) A long depression of the seafloor, characteristically flat bottomed and steep sided, and normally shallower than a trench. (2) The lowest part of a wave, between two crests is called *wave trough.*

True north. The direction from any observer's position to the geographical North Pole. The north direction of any geographic meridian.

Tule. Reed. Bulrush. A place where reeds grow. Corruption of Spanish *Tulares.*

Tundra. One of the level or undulating treeless plains characteristic of arctic regions, having a black muck soil with a permanently frozen subsoil.

Turning basin. A water area used for turning vessels.

Two-way route. A route within defined limits, inside which two-way traffic is established, aimed at providing safe passage of ships through waters where navigation is difficult or dangerous.

Under construction. The term used to indicate that the feature on the map is not completed but that construction has started. It is distinguished from "proposed," which means that the feature has been planned but construction has not been started.

Uniform state waterway marking system. A system developed jointly by the U.S. Coast Guard and state boating administrators to assist the small-craft operator in those state waters marked by participating states. It consists of two categories of aids to navigation. One is a system of aids to navigation, generally compatible with the federal lateral system of buoyage, to supplement the federal system in state waters. The other is a system of regulatory markers to warn the small-craft operator of dangers or to provide general information and directions.

United States Army Corps of Engineers (USACE). The *Commanding General, United States Army Corps of Engineers* (CGUSACE) serves as the Army's Real Property Manager, performing the full-cycle of real property activities (requirements, programming, acquisition, operation, maintenance, and disposal); manages and executes engineering, construction, and real estate programs for the Army and the United States Air Force; and performs research and development in support of these programs. CGUSACE manages and executes Civil Works Programs. These programs include research and development, planning, design, construction, operation and maintenance, and real estate activities related to rivers, harbors and waterways; administration of laws for protection and preservation of navigable waters and related resources such as wetlands. CGUSACE assists in recovery from natural disasters.

United States Coast Guard (USCG). The U.S. Coast Guard, established by the Act of January 28, 1915 (14 U.S.C. 1), became a component of the U.S. Department of Transportation on April 1, 1967, pursuant to the U.S. Department of Transportation Act of October 15, 1966 (80 Stat. 931). The Coast Guard is a branch of the Armed Forces of the Untied States at all times and is a service within the U.S. Department of Transportation except when operating as part of the Navy in time of war or when the President of the United States directs.

U. S. Coast Pilot. A descriptive book for the use of mariners, containing detailed information of coastal waters, harbor facilities, etc., of an area. Such books are prepared by NOAA for waters of the United States and its possessions.

Unsurveyed area. Areas on a map or chart where both relief and planimetric data are unavailable. These areas are usually labeled "unsurveyed." Or an area on a map or chart which shows little or no charted data because accurate information is limited or not available.

Upland. A highland; ground elevated above the lowlands along a river or between hills.

Upper limit of navigability. The character of a river will, at some point along its length, change from navigable to nonnavigable. Very often that point will be at a major fall or rapids, or other place where there is a marked decrease in the navigable capacity of the river. The upper limit will therefore often be the same point traditionally recognized as the head of navigation, but may, under some of the tests described above, be at some point yet farther upstream.

Upwelling. An upward flow of subsurface water due to such cases as divergences, offshore winds, and wind drift transports away from shore.

Urban area. An area predominantly occupied by artificial structures used for residential, commercial, and industrial purposes.

Valley. On the seafloor, a relatively shallow, wide depression, the bottom of which usually has a continuous gradient. This term is generally not used for features that have canyonlike characteristics for a significant portion of their extent.

Variation. (1) The angle between the magnetic and geographic meridians at any place, expressed in degrees and minutes east or west to indicate the direction of magnetic north from true north. The angle between magnetic and grid meridians is called *grid magnetic angle, grid variation,* or *grivation.* Called *magnetic variation* when a distinction is needed to prevent possible ambiguity. Also called *magnetic declination.* (2) Change or difference from a given value.

Vertical lift bridge. A bridge with a movable span between two lift towers such as the entire span can be raised uniformly in the vertical direction.

Vessel. Includes every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on the waters of the United States.

Vessel traffic service (VTS) area. Prescribe rules for vessel operation in order to prevent collisions and groundings and to protect the navigable waters of the VTS area from environmental harm from collisions and grounds.

Viaduct. A structure consisting of a series of arches or towers supporting a roadway, waterway, etc., across a depression, etc. *See also:* **Causeway.**

Visibility. That property of the atmosphere which determines the ability of an observer to see and identify prominent objects by day, or lights or lighted objects by night. A measure of this property is expressed in units of distance. This term should not be confused with *visual range.*

Visual range (of a light). The predicted range at which a light can be observed.

Volcano. An opening in the earth from which hot gases, smoke, and molten material issue, or a hill or mountain composed of volcanic material. A volcano is characteristically conical in shape with a crater in the top.

Warp. To move, as a vessel, from one place to another by means of lines fastened to an object, such as a buoy, wharf, etc., secured to the ground.

Warping buoy. A buoy so located that lines to it can be used for the movement of ships.

Wash. The dry channel of an intermittent stream.

Watching properly. An aid on its assigned position exhibiting the advertised characteristics in all respects.

Waterfront. Land at the end of a stream harbor, etc. The part of a city or town on such land; wharf or dock area.

Waterfront facility. All piers, wharves, docks, and similar structures to which a vessel may be secured; areas of land, water, or land and water under and in immediate proximity to them; buildings on such structures or contiguous to them and equipment and materials on such structures or in such buildings.

Water line. The line marking the junction of water and land.

Watershed. The area drained by a stream.

Waterway. A water area providing a means of transportation from one place to another, principally a water area providing a regular route for water traffic, such as a bay, channel, passage, or the regularly traveled parts of the open sea. The terms waterway, fairway, and thoroughfare have nearly the same meanings.

Way point. A mark or place at which a vessel is required to report to establish its position. (Also known as "reporting point" or "calling-in-point.")

Weir. A sort of fence set in a stream or along a shore line to catch fish. It differs from a pound because it is mainly constructed of brush hedging or narrow boards with or without nettings. The terms weir and pound are, to a great extent, used interchangeably in the United States. Also called *brush weir, fish weir.* Fish wiers are fixed solid structures made of stones or stakes and wattlings, or a combination of both. The simple form is a "Y" with the end toward high-water mark and the apex toward low water. In the apex there is very often a special cage or trap for the concentration or retention of the catch. Coastal weirs are generally built where there is a large expanse of ground left uncovered at low water. Weirs are usually kept in position all year round.

Weir jetty. An updrift jetty with a low section or weir over which littoral drift moves into a predredged deposition basin which is dredged periodically.

Wellhead. A submarine structure projecting some distance above the seabed and capping a temporarily abandoned or suspended oil or gas well. *See also:* **Submerged production well.**

Wetlands. Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Wharf. A structure of open, rather than solid construction, along a shore or bank which provides berthing for ships and which generally provides cargo-handling facilities. A similar facility of solid construction is called quay.

Winter light. A light which is maintained during those winter months when the regular light is extinguished. It is of lower candlepower than the regular light but usually of the same characteristic.

Winter marker. A lighted or unlighted buoy without sound signal, which is established as a replacement during the winter months when other aids are closed or withdrawn.

Wire drag. An apparatus for surveying rock areas where the normal sounding methods are insufficient to insure the discovery of all existing obstructions, pinnacles, rocks, etc., above a given depth or for determining the least depth of an area. It consists essentially of a buoyed wire towed at the desired depth by two launches. Often shortened to drag.

Withdrawn. The discontinuing of a floating aid during severe ice conditions or for the winter season.

World Geodetic System 1972 (WGS 72) A system comprised of a consistent set of parameters describing the size and shape of the earth, the positions of a network of points with respect to the center of mass of the earth, transformations from major geodetic datums, and the potential of the earth (usually in terms of harmonic coefficients). WGS 72 represents the *Defense Mapping Agency's* (DMA's) modeling of the earth from a geometric, geodetic, and gravitational standpoint using data available in 1972.

World Geodetic System 1984 (WGS 84). A system comprised of a consistent set of parameters describing the size and shape of the earth, the positions of a network of points with respect to the center of mass of the earth, transformations from major geodetic datums, and the potential of the earth (usually in terms of harmonic coefficients). WGS 84 represents the U.S. *Defense Mapping Agency's* (DMA's) modeling of the earth from a geometric, geodetic, and gravitational standpoint using data, techniques, and technology available in 1984.

Wreck. The ruined remains of a vessel which has been rendered useless, usually by violent action, as by the action of the sea and weather on a stranded or sunken vessel. In hydrography the term is limited to a wrecked vessel, either submerged or visible, which is attached to or foul of the bottom or cast up on the shore.

Wreck buoy. A buoy marking the position of a wreck. It is usually placed on the seaward or channel side of the wreck and as near to the wreck as conditions will permit. To avoid confusion in some situations, two buoys may be used to mark the wreck. The possibility of the wreck having shifted position due to sea action between the times the buoy was established and later checked or serviced should not be overlooked.

Wrecks. Charted wrecks are of two kinds: stranded wreck, where any portion of the hull is above the chart datum; and sunken wreck, where the hull is below the chart datum or where the masts only are visible.

X-axis. A horizontal axis in a system of rectangular coordinates; that line on which distances to the right or left (east or west) of the reference line are marked, especially on a map, chart, or graph.

Yard. A fundamental unit of length in the English system of measurement. The metric equivalent prior to July 1, 1959, was 1 year = 0.91440183 meter. On that date the value was changed to 1 yard = 0.9144 meter. This change will not apply to any data expressed in feet derived from and published as a result of geodetic surveys within the United States until such time as the basic geodetic survey networks are readjusted. *See:* **Mile, nautical.**

Y-Axis. A vertical axis in a system of rectangular coordinates; that line on which distances above or below (north or south of) a reference line are marked, especially on a map, chart, or graph. The line which is perpendicular to the X-axis and passes through the origin.

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APPENDIX B

PART I. INDEX OF ABBREVIATIONS (Section V of Chart No. 1)

Abbreviation	Meaning	Symbol (if applicable)
A		
AERO, Aero	Aero light	P 60
AERO RBn	Aeronautical radiobeacon	S 16
Aero RC	Aeronautical radiobeacon	S 16
Al	Alternating	P 10.11
ALP	Articulated Loading Platform	L 12
Alt	Alternating	P 10.11
Am	Amber	P 11.8
anc	Ancient	O 84
ANCH, Anch	Anchorage	N 20, O 21
approx	Approximate	O 90
Apprs	Approaches	O 22
B		
B	Bay, bayou	O 4
Bdy Mon	Boundary monument	B 24
bk	Broken	J 33
Bkw	Breakwater	F 4.1
Bl	Blue	P 11.4
BM	Bench mark	B 23
Bn	Beacon	O 4
Bn Tr	Beacon tower	O 3
Br	Breakers	K 17
brg	Bearing	B 62
brk	Broken	J 33
Bu	Blue	P 11.4
C		
c	Course	J 32
C	Can, cylindrical	Q 21
C	Cove	O 9
CALM	Centenary Anchor Leg Mooring	L 16
Cas	Castle	E 34.2
Cb	Cobbles	J 8
Cbl	Cable	B 46
Cd	Candela	B 54
CD	Chart datum	H 1
Cem	Cemetery	E 19
CG	Coast Guard station	T 10
Chan	Channel	O 14
Ch.	Church	E10.1
Chy	Chimney	E 22
Cl	Clay	J 3
CL	Clearance	D 20, D 21
cm	Centimeter(s)	B 43
Co	Coral	J 10
Co rf	Coral reef	O 26
Cr	Creek	O 7

PART I. INDEX OF ABBREVIATIONS (Section V of Chart No. 1)

Abbreviation	Meaning	Symbol (if applicable)
crs	Course	J 32
Cup, Cup.	Cupola	E 10.4
Cus Ho	Customs House	F 61
Cy	Clay	J 3

D

Abbreviation	Meaning	Symbol (if applicable)
D	Destroyed	O 94
Destr	Destroyed	O 94
dev	Deviation	B 67
DIA, Dia	Diaphone	R 11
Dir	Direction	P 30, P 31
dist	Distant	O 85
dm	Decimeter(s)	B 42
Dn.	Dolphin	F 20
Dol.	Dolphin	F 20
DW	Deep Water route	M 27.1, N 12.4
DZ	Danger Zone	Q 50

E

Abbreviation	Meaning	Symbol (if applicable)
E	East, eastern	B 10
ED	Existence doubtful	I 1
EEZ	Exclusive Economic Zone	N 47
E Int	Equal interval, isophase	P 10.3
Entr	Entrance	O 16
Est	Estuary	O 17
exper	Experimental	O 93
Explos	Explosive	R 10
Exting, exting	Extinguished	P 55

F

Abbreviation	Meaning	Symbol (if applicable)
f	Fine	J 30
F	Fixed	P 10.1
Fd	Fjord	O 5
F Fl	Fixed and flashing	P 10.10
FISH	Fishing	N 21
Fl	Flashing	P 10.4
Fla	Flare stack	L 11
fm	Fathom	B 48
fms	Fathoms	B 48
fne	Fine	J 30
Fog Det Lt	Fog detector light	P 62
Fog Sig	Fog signal	R 1
FP	Flagpole	E 27
FS, FS.	Flagstaff	E 27
ft	Foot, feet	B 47

G

Abbreviation	Meaning	Symbol (if applicable)
G	Gravel	J 6
G	Green	P 11.3
G	Gulf	O 3
Gp Fl	Group flashing	P 10.4
GP Occ	Group occulting	P 10.2

H

Abbreviation	Meaning	Symbol (if applicable)
h	Hard	J 39
h	Hour	B 49
H	Pilot transferred by helicopter	T 1.4
HAT	Highest astronomical tide	H 3
Hbr Mr	Harbormaster	F 60
Historic Wk	Historic wreck	N 26
Hk	Hulk	F 34
Hor	Horizontally disposed	P 15
Hor Cl	Horizontal clearance	D 21
Hosp	Hospital	F 62.2
hr	Hour	B 49
hrd	Hard	J 39

I

Abbreviation	Meaning	Symbol (if applicable)
IALA	International Association of Lighthouse Authorities	Q 130
in	Inlet	O10
Intens	Intensified	P 45
Int Qk Fl	Interrupted quick flashing	P 10.6
IQ	Interrupted quick flashing	P 10.6

PART I. INDEX OF ABBREVIATIONS (Section V of Chart No. 1)

Abbreviation	Meaning	Symbol (if applicable)
I Qk Fl	Interrupted quick flashing	P 10.6
Iso	Isophase	P 10.3
IUQ	Interrupted ultra quick	P 10.8

K

Abbreviation	Meaning	Symbol (if applicable)
km	Kilometer(s)	B 40
kn	Knot(s)	B 52

L

Abbreviation	Meaning	Symbol (if applicable)
L	Loch, lough, lake	O 6
Lag	Lagoon	O 8
LANBY	Large Automatic Navigational Buoy	P 8
Lat, lat	Latitude	B 1
LASH	Lighter aboard ship	G 184
LAT	Lowest astronomical tide	H 2
Ldg	Landing	F 17
Ldg	Leading	P 21
Le	Ledge	O 28
L Fl	Long flashing	P 10.5
Lndg	Landing	F 17
LNG	Liquified natural gas	G 185
Long, long	Longitude	B 2
LOP	Line of position	S 21, S 31, S 41
LPG	Liquified petroleum gas	G 186
LSS	Life saving station	T 12
Lt	Light	P 1
Lt Ho	Lighthouse	P 1
Lt V	Light vessel	O 6

M

Abbreviation	Meaning	Symbol (if applicable)
m	Meter(s)	B 41
m	Minute(s) of time	B 50
m	Medium (in relation to sand)	J 31
M	Mud, muddy	J 2
M	Nautical mile(s)	B 45
mag	Magnetic	B 61
MHHW	Mean higher high water	H 13
MHLW	Mean higher low water	H 14
MHW	Mean high water	H 5
MHWN	Mean high water neaps	H 11
MHWS	Mean high water springs	H 9
Mi	Nautical mile(s)	B 45
mn	Minute of time	B 50
Mk	Mark	Q 101
MLHW	Mean lower high water	H 15
MLLW	Mean lower low water	H 12
MLW	Mean low water	H 4
MLWN	Mean low water neaps	H 10
MLWS	Mean low water springs	H 8
mm	Millimeter(s)	B 44
Mo	Morse	P 10.9
MON, Mon, Mon.	Monument	B 24, E 24
MSL	Mean sea level	H 6
Mt	Mountain	O 32
Mth	Mouth	O 19

N

Abbreviation	Meaning	Symbol (if applicable)
N	North, northern	B 9
N	Nun	Q 20
NE	Northeast	B 13
NM	Nautical mile(s)	B 45
N Mi	Nautical mile(s)	B 45
No	Number	N 12.2
NP	Neap tide	H 17
NW	Northwest	B 15
NWS SIG STA	Weather signal station	T 29

O

Abbreviation	Meaning	Symbol (if applicable)
Obsc	Obscured	P 43
Obscd	Obscured	P 43
Obs spot	Observation spot	B 21
Obstn	Obstruction	K 40, K 41, K 42

PART I. INDEX OF ABBREVIATIONS (Section V of Chart No. 1)

Abbreviation	Meaning	Symbol (if applicable)
Obstr	Obstruction	K 41
Oc	Occulting	P 10.2
Occ	Occulting	P 10.2
Occas	Occasional	P 50
ODAS	Ocean Data Acquisition System	Q 58
Or	Orange	P 11.7

P

Abbreviation	Meaning	Symbol (if applicable)
P	Pebbles	J 7
P	Pillar	Q 23
PA	Position approximate	B 7
Pass	Passage, pass	O 13
PD	Position doubtful	B 8
PTL STA	Pilot station	T 3
Pk	Peak	O 35
Post Off	Post office	F 63
Priv, priv	Private	P 65, Q 70
Prod. well	Production well	L 20
PROHIB	Prohibited	N 2.2, N 20, N 21
Pyl	Pylon	D 26

Q

Abbreviation	Meaning	Symbol (if applicable)
Q	Quick	P 10.6
Qk Fl	Quick flashing	P 10.6

R

Abbreviation	Meaning	Symbol (if applicable)
R	Coast radio station providing QTG services	S 15
R	Red	P 11.2
R	Rocky	J 9
Ra	Radar reference line	M 32
Ra (conspic)	Radar conspicuous object	S 5
Ra Antenna	Dish aerial	E 31
Racon	Radar transponder beacon	S 3
Radar Sc.	Radar scanner	E 30.3
Radar Tr.	Radar tower	E 30.2
Radome, Ra Dome	Radar dome	E 30.4
Ra Ref	Radar reflector	S 4
RBn	Circular radiobeacon	S 10
RC	Circular radiobeacon	S 10
Rd	Roads, roadstead	O 22
RD	Directional radiobeacon	S 11
RDF	Radio direction finding station	S 14
Ref.	Refuge	Q 124
Rep	Reported	I 3
Rf	Reef	O 26
RG	Radio direction finding station	S 14
Rk	Rocky	J 9
Rky	Rocky	J 9
R Mast	Radio mast	E 28
Ro Ro	Roll on Roll off	F 50
R Sta	Coast radio station providing QTG services	S 15
R Tower	Radio tower	E 29
Ru	Ruins	D 8, F 33.1
RW	Rotating radiobeacon	S 12

S

Abbreviation	Meaning	Symbol (if applicable)
S	Sand	J 1
S	South, southern	B 11
S	Spar, spindle	Q 24
s	Second of time	B 51
SALM	Single Anchor leg Mooring	L 12
SBM	Single Buoy Mooring	L 16
Sc	Scanner	E 30.3
Sd	Sound	O 12
SD	Sounding doubtful	I 2
SE	Southeast	B 14
sec	Second of time	B 51
sf	Stiff	J 36
sft	Soft	J 35
SH	Shells	J 12
Shl	Shoal	O 25
Si	Silt	J 4
so	Soft	J 35

PART I. INDEX OF ABBREVIATIONS (Section V of Chart No. 1)

Abbreviation	Meaning	Symbol (if applicable)
Sp	Spring tide	H 16
S P	Spherical	Q 22
Sp.	Spire	E 10.3
Spipe	Standpipe	E 21
SPM	Single point mooring	L 12
S S	Signal station	T 20
st	Stones	J 5
stf	Stiff	J 36
stk	Sticky	J 34
Str	Strait	O 11
Subm	Submerged	O 93
Subm piles	Submerged piles	K 43.1
Subm ruins	Submerged ruins	F 33.2
sy	Sticky	J 34
SW	Southwest	B 16

T

Abbreviation	Meaning	Symbol (if applicable)
T	True	B 63
t	Metric ton(s)	B 53
Tel	Telephone, telegraph	D 27
Temp, temp	Temporary	P 54
Tk	Tank	E 32
Tr, Tr., TR	Tower	E 10.2, E 20
T T	Tree tops	C 14
TV Mast	Television mast	E 28
TV Tower	Television tower	E 29

U

Abbreviation	Meaning	Symbol (if applicable)
Uncov	Uncovers	K 11
UQ	Ultra quick	P 10.8

V

Abbreviation	Meaning	Symbol (if applicable)
v	Volcanic	J 37
var	Variation	B 60
Vert	Vertically disposed	P 15
Vert Cl	Vertical clearance	D 20
Vi	Violet	P 11.5
Vil	Village	D 4
VLCC	Very large crude carrier	G 187
vol	Volcanic	J 37
VQ	Very quick	P 10.7
V Qk Fl	Very quick flash	P 10.7

W

Abbreviation	Meaning	Symbol (if applicable)
W	West, western	B 12
W	White	P 11.1
Wd	Weed	J 13.1
WGS	World Geodetic System	S 50
Whf	Wharf	F 13
WHIS, Whis	Whistle	R 15
Wk	Wreck	K 20–23, K 26–27, K 30

Y

Abbreviation	Meaning	Symbol (if applicable)
Y	Yellow	P 11.6

PART II. INDEX OF ABBREVIATIONS— Supplementary National Abbreviations (Section V of Chart No. 1)

Abbreviation	Meaning	Symbol (if applicable)

A

Abbreviation	Meaning	Symbol
Apt	Apartment	Es

B

Abbreviation	Meaning	Symbol
B	Black	Qq
bk	Black	Jas
bl	Black	Jas
Blds	Boulders	Je
br	Brown	Jaz
Bu	Blue	Jau

C

Abbreviation	Meaning	Symbol
Cap	Capitol	Et
Ch	Chocolate	Jba
Chec	Checkered	Qo
ck	Chalk	Jf
Cn	Cinders	Jp
Co	Company	Eu
Co Hd	Coral head	Ji
COLREGS	Collision regulations	Na
Corp	Corporation	Ev
cps	Cycles per second	Bj
CRD	Columbia River Datum	Hj
c/s	Cycles per second	Bj
Ct Ho	Court house	Eo

D

Abbreviation	Meaning	Symbol
dec	Decayed	Jan
deg	Degree(s)	Bn
Di	Diatoms	Jaa
Diag	Diagonal bands	Qp
Discol water	Discolored water	Ke
dk	Dark	Jbd

E

Abbreviation	Meaning	Symbol
Explos Anch	Explosives anchorage	Qk

F

Abbreviation	Meaning	Symbol
Facty	Factory	Ed
F Gp Fl	Fixed and group flashing	Pd
fl	Flood	Hq
fly	Flinty	Jao
Fr	Foraminifera	Jy
Fu	Fucus	Jaf

G

Abbreviation	Meaning	Symbol
GAB, Gab	Gable	Ei
GCLWD	Gulf Coast Low Water Datum	Hk
Gl	Globigerina	Jz
glac	Glacial	Jap
gn	Green	Jav
Govt Ho	Government house	Em
Grd	Ground	Ja
Grs	Grass	Jv
gty	Gritty	Jam
GUN	Fog gun	Rd
gy	Gray	Jbb

H

Abbreviation	Meaning	Symbol
HECP	Harbor entrance control point	Tb

PART II. INDEX OF ABBREVIATIONS—Supplementary National Abbreviations (Section V of Chart No. 1)

Abbreviation	Meaning	Symbol (if applicable)
HHW	Higher high water	Hb
H S	High school	Eg
ht	Height	Hp
HW	High water	Hq
HWF & C	High water full and change	Hh
Hz	Hertz	Bg

I

Abbreviation	Meaning	Symbol (if applicable)
in	Inch	Bc
ins	inches	Bc
Inst	Institute	En
ISLW	Indian springs low water	Hg

K

Abbreviation	Meaning	Symbol (if applicable)
K	Kelp	Ju
kc	Kilocycle	Bk
kHz	Kilohertz	Bh
kn	Knot(s)	Ho

L

Abbreviation	Meaning	Symbol (if applicable)
La	Lava	Jl
LLW	Lower low water	He
LOOK TR	Lookout tower	Tf
lrg	Large	Jai
lt	Light	Jbc
Ltd	Limited	Er
LW	Low water	Hc
LWD	Low water datum	Hd
LWF & C	Low water full and change	Hi

M

Abbreviation	Meaning	Symbol (if applicable)
m^2	Square meter(s)	Ba
m^3	Cubic meter(s)	Bb
Ma	Mattes	Jag
Magz	Magazine	El
Mc	Megacycle(s)	Bl
Mds	Madrepores	Jj
MHz	Megahertz	Bi
Ml	Marl	Jc
Mn	Manganese	Jq
Mo	Morse code	Rf
Ms	Mussels	Js
MTL	Mean Tide Level	Hf

N

Abbreviation	Meaning	Symbol (if applicable)
NAUTO	Nautophone	Rc

O

Abbreviation	Meaning	Symbol (if applicable)
or	Orange	Jax
Oys	Oysters	Jr
Oz	Ooze	Jb

P

Abbreviation	Meaning	Symbol (if applicable)
Pav	Pavillion	Ep
Pm	Pumice	Jm
Po	Polyzoa	Jad
Pt	Pteropods	Jac

Q

Abbreviation	Meaning	Symbol (if applicable)
Quar	Quarantine	Fd
Qz	Quartz	Jg

R

Abbreviation	Meaning	Symbol (if applicable)
Rd	Radiolaria	Jab
rd	Red	Jay
rt	Rotten	Jaj
Ry	Railway, railroad	Db

S

Abbreviation	Meaning	Symbol (if applicable)
Sc	Scoriae	Jo
Sch	Schist	Jh
Sch	School	Ef
Sem	Semaphore	Tg
Sh	Shingle	Jd

PART II. INDEX OF ABBREVIATIONS—Supplementary National Abbreviations (Section V of Chart No. 1)

Abbreviation	Meaning	Symbol (if applicable)
S-LFl	Short-long flashing	Pb
sml	Small	Jah
Spg	Sponge	Jt
Spi	Spicules	Jx
spk	Speckled	Jal
Stg	Seatangle	Jw
St M	Statute mile(s)	Be
St Mi	Statute mile(s)	Be
Str	Stream	Hl
str	Streaky	Jak
SUB-BELL	Submarine fog bell	Ra
Subm crib	Submerged crib	Ki
SUB-OSC	Submarine oscillator	Rb
Sub vol	Submarine volcano	Kd

T

Abbreviation	Meaning	Symbol (if applicable)
T	Telephone	Eq,Qt
T	Short ton(s)	Bm
T	Tufa	Jn
Tel	Telegraph	Qs
Tel off	Telegraph office	Ek
ten	Tenacious	Jaq

U

Abbreviation	Meaning	Symbol (if applicable)
unev	Uneven	Jbf
Univ	University	Eh
us	Microsecond(s)	Bf
usec	Microsecond(s)	Bf

V

Abbreviation	Meaning	Symbol (if applicable)
vard	Varied	Jbe
vel	Velocity	Hn
vi	Violet	Jat
Vol Ash	Volcanic ash	Jk

W

Abbreviation	Meaning	Symbol (if applicable)
wh	White	Jar
WHIS	Whistle	Qc

Y

Abbreviation	Meaning	Symbol (if applicable)
yd	Yard	Bd
yds	Yards	Bd
yl	Yellow	Jaw

PART III. INTERNATIONAL ABBREVIATIONS (Section W of Chart No. 1)

Abbreviation	Meaning	Symbol (if applicable)

B Positions, Distances, Directions, Compass

PA	Position approximate	B 7
PD	Position doubtful	B 8
N	North	B 9
E	East	B 10
S	South	B 11
W	West	B 12
NE	Northeast	B 13
SE	Southeast	B 14
NW	Northwest	B 15
SW	Southwest	B 16
km	Kilometer(s)	B 40
m	Meter(s)	B 41
dm	Decimeter(s)	B 42
cm	Centimeter(s)	B 43
mm	Millimeter(s)	B 44
M	Nautical mile(s), Sea mile(s)	B 45
ft	Foot/feet	B 47
h	Hour	B 49
m, min	Minute(s) of time	B 50
s, sec	Second(s) of time	B 51
kn	Knot(s)	B 52
t	Ton(s)	B 53
cd	Candela (new candela)	B 54

D Cultural Features

Ru	Ruin	D 8

F Ports

Lndg	Landing for boats	F 17
RoRo	Roll-on, Roll-off Ferry	F 50

I Depths

ED	Existence doubtful	I 1
SD	Sounding doubtful	I 2

K Rocks, Wrecks, Obstructions

Br	Breakers	K 17
WK	Wreck	K 20
Obstn	Obstruction	K 40

L Offshore Installations, Submarine Cables, Submarine Pipelines

Fla	Flare stack	L 11
Pro	Submerged Production	L 20
Well	Well	

M Tracks, Routes

Ra	Radar	M 31
DW	Deep Water	M 27.2

N Areas, Limits

No	Number	N 12.2
DW	Deep Water	N 12.4

O Hydrographic Terms

SMt	Seamount	O 33

P Lights

Lt	Light	P 1

PART III. INTERNATIONAL ABBREVIATIONS (Section W of Chart 1)

Abbreviation	Meaning	Symbol (if applicable)
F	Fixed	P 10.1
Oc	Occulting	P 10.2
Iso	Isophase	P 10.3
Fl	Flashing	P 10.4
LFl	Long-flashing	P 10.5
Q	Quick	P 10.6
IQ	Interrupted quick	P 10.6
VQ	Very quick	P 10.7
IVQ	Interrupted very quick	P 10.7
UQ	Ultra quick	P 10.8
IUQ	Interrupted ultra quick	P 10.8
Mo	Morse Code	P 10.9
W	white	P 11.1
R	red	P 11.2
G	green	P 11.3
Bu	blue	P 11.4
Vi	violet	P 11.5
Y	yellow/orange/Amber	P 11.6
Or	Orange	P 11.7
Am	Amber	P 11.8
Ldg	Leading light	P 20.3
Dir	Direction light	P 30
occas	occasional	P 50
R lts	Air obstruction lights	P 61.2
priv	private	P 65
Fog Det Lt	Fog detector light	P 62
Aero	Aeronautical	P 60/61.1

Q Buoys, Beacons

Abbreviation	Meaning	Symbol (if applicable)
DZ	Danger Zone	Q 50
ODAS	Ocean Data Acquisition System	Q 58
Mk	mark	Q 101
IALA	International Association of Lighthouse Authorities	Q 130

R Fog Signals

Abbreviation	Meaning	Symbol (if applicable)
Explos	Explosive	R 10
Dia	Diaphone	R 11
Whis	Whistle	R 15

S Radar, Radio, Electronic Position-Fixing Systems

Abbreviation	Meaning	Symbol (if applicable)
Ra	Coast Radar Station	S 1
Racon	Radar transponder beacon	S 3
FRacon	Radar transponder beacon, responding on a fixed frequency outside the marine band	S 3.4
RC	Circular (non-directional) marine radiobeacon	S 10
RD	Directional radiobeacon	S 11
RW	Rotating-pattern radiobeacon	S 12
RG	Radio direction-finding stations	S 14
R	QTG service, Coast radio stations	S 15
Aero RC	Aeronautical radiobeacon	S 16
WGS	World Geodetic System	S 50

T Services

Abbreviation	Meaning	Symbol (if applicable)
SS	Signal station	T 20
INT	international	T 21

PART IV. ABBREVIATIONS USED THIS MANUAL, NM, LNM, *LIGHT LIST, BROADCAST NOTICE TO MARINERS, NAUTICAL CHART CATALOG,* OR DATES OF LATEST EDITIONS

Abbreviation .... Meaning

A

ABAND .... Abandoned
A/C .... Aircraft
AERO RBN .... Aeronauticalradiobeacon
ANCH .... Anchorage
ANCH PROHIB ...... Anchorage prohibited
ANMS .... Automated Notice to Mariners
APPROX .... Approximate
ART DBN .... Articulated daybeacon
ART LT .... Articulated light
ATLC .... Atlantic
ATON .... Aids to Navigation
AUTH .... Authorized
AUTH CL .... Authorized Clearance
AVG .... Average

B

BKW .... Breakwater
BLDG .... Building
BNM .... *Broadcast Notice to Mariners*
BRG .... Bearing

C

C .... Can
(C) .... Indicates chart has Loran-C TDs overprinted
CFR .... *Code of Federal Regulations*
CGUSACE .... Commanding General, U.S. Army Corps of Engineers
CHAN .... Channel
COE .... Corps of Engineers
COLREGS .... Collision Regulations
COMDTINST .... *Commandant Instruction*
COMDTPUB .... *Commandant Publication*
CONT .... Continue
COTP .... Captain of the Port
CUP .... Cupola

D

D .... Indicates NAD 1983 added
DEG .... Degrees (Temperature; geo pos)
DESTR .... Destroyed
DGPS .... Differential Global Positioning System
DIA .... Diameter
DISCONTD .... Discontinued
DMA .... Defense Mapping Agency
DOD .... Department of Defense
DR .... Dead Reckoning
DW .... Deep Water Route

E

E .... New Edition
ECDIS .... Electronic Chart Display and Information Systems
ED .... Edition
ED .... Existence Doubtful
EEZ .... Exclusive Economic Zone
EFF .... Effect/Effective
ELB .... Exposed Location Buoy
ENTR .... Entrance
EPA .... United States *Environmental Protection Agency*
ESTAB .... Established
EXPLOS ANCH ...... Explosive Anchorage

PART IV. ABBREVIATIONS USED THIS MANUAL, NM, LNM, LIGHT LIST, BROADCAST NOTICE TO MARINERS, NAUTICAL CHART CATALOG, OR DATES OF LATEST EDITIONS

Abbreviation .... Meaning

F

FAD .... Fish Aggregating Device
FCC .... Federal Communications Commission
FCZ .... Fishery Conservation Zone
FM(S) .... Fathom(s)
FOG SIG .... Fog Signal Station
F P .... Flag Pole
F R .... *Federal Register*
F S .... Flag Staff
F T .... Foot/Feet
F TR .... Flag tower
F/V .... Fishing Vessel

G

G .... Green
GPS .... Global Positioning System
GRI .... Group Repetition Interval

H

HBR .... Harbor
HO .... House
HOR CL .... Horizontal Clearance
HR .... Hour
HT .... Height
HZ .... Hertz

I

IALA .... International Association of Lighthouse Authorities
ICW .... Intracoastal Waterway
IGLD .... International Great Lakes Datum
IHB .... International Hydrographic Bureau
IHO .... International Hydrographic Organization
IMCO .... Inter-governmental Maritime Consultantive Organization
IMO .... International Maritime Organization
ITU .... International Telecommunications Union

K

KHZ .... Kilohertz
KM .... Kilometer
KT(S) .... Knot(s)

L

LANBY .... Large Automated Navigation Buoy
LAT .... Latitude
L B .... Lighted Buoy
L B B .... Lighted Bell Buoy
LGB .... Lighted Gong Buoy
LHB .... Lighted Horn Buoy
LLNR .... Light List Number
LLWD .... Lower Low Water Datum
LNB .... Large Navigation Buoy
LNG .... Liquidifed Natural Gas
LNM .... *Local Notice to Mariners*
LONG .... Longitude
Look TR .... Lookout Tower
LOOP .... Louisiana Offshore Oil Port
LOP .... Line of Position
Loran .... Long-Range Navigation
LT .... Light
LT HO .... Light House
LT OBSC .... Light Obscured
LWB .... Lighted Whistle Buoy
LWD .... Low Water Datum

PART IV. ABBREVIATIONS USED THIS MANUAL, NM, LNM, LIGHT LIST, BROADCAST NOTICE TO MARINERS, NAUTICAL CHART CATALOG, OR DATES OF LATEST EDITIONS

Abbreviation .... Meaning

M

M .... Metric Chart
MAINTD .... Maintained
MAX .... Maximum
MB .... Millibar
MDT .... Moderate
MF .... Marine Facility Chart
MHHW .... Mean Higher High Water
MHW .... Mean High Water
MHWL .... Mean High Water Line
MHZ .... Megahertz
MICRO TR .... Microwave Tower
MIN .... Minute (time; geo pos)
MLLW .... Mean Lower Low Water
MLW .... Mean Low Water
MLWL .... Mean Low Water line
MM .... Millimeter
Mo (A) .... Morse Alpha
MSL .... Mean Sea Level
MT .... Mountain, Mount
M/V .... Motor Vessel
MWLL .... Mean Water Level Line

N

N .... New Chart
N .... Nun
NAD .... North American Datum
NAE .... National Academy of Engineering
NAS .... National Academy of Sciences
NIMA .... National Imagery and Mapping Agency
NM .... Nautical Mile(s)
NM .... *Notice to Mariners*
NOAA .... National Oceanographic & Atmospheric Administration
NOS .... National Ocean Service
NRC .... National Research Council

Abbreviation .... Meaning

NWS .... National Weather Service

O

O .... Omega Chart
OBSTR .... Obstruction
OCCASION .... Occasion/Occasionally
OCS .... Outer continental shelf
ODAS .... Oceanographic (or Ocean) Data Acquisition System
OPAREA .... Operating Area
OVHD PWR CAB ... Overhead Power Cable

P

PA .... Position Approximate
PAC .... Pacific
P/C .... Pleasure Craft
PD .... Position Doubtful
PPC .... Pumping Platform Complex
PPI .... Plan Position Indicator
PRES .... Pressure
PRIV .... Private, Privately
PRIV MAINTD .... Privately Maintained
PROHIB .... Prohibited
PSN .... Position
PT(S) .... Point(s)
PUB .... Publication
PWI .... Potable Water Intake

R

R .... Red
R .... Revised Print
RACON .... Radar Transponder Beacon
RAMARK .... Radar Marker
RA Ref .... Radar Reflector
RBN .... Radio Beacon
RDF .... Radio Direction Finder

PART IV. ABBREVIATIONS USED THIS MANUAL, NM, LNM, LIGHT LIST, BROADCAST NOTICE TO MARINERS, NAUTICAL CHART CATALOG, OR DATES OF LATEST EDITIONS

Abbreviation .... Meaning	
REP	Reported
RESTR	Restricted
RF	Representative Fraction
RGE	Range
RK	Rock
R/V	Research Vessel

S

Abbreviation	Meaning
SAR	Search and Rescue
SC	Small Craft
SD	Sounding Doubtful
SEC	Second (time; geo pos)
SIG STA	Signal station
SM	Statute Mile(s)
SOLAS	Safety of Life at Sea
SPOR	Shoreline Plane of Reference
S SIG STA	Storm Signal Station
ST	Saint
STA	Station
S'PIPE	Standpipe
S/V	Sailing Vessel

T

Abbreviation	Meaning
TD	Time Difference
TEMP	Temporary
THRU	Through
TR	Tower
TR	True
TRLB	Temporarily Replaced by Lighted Buoy
TRUB	Temporarily Replaced by Unlighted Buoy
TSD	Time-Speed-Distance
TSS	Traffic Separation Scheme
TSTM	Thunderstorm

U

Abbreviation	Meaning
UMIB	Urgent Marine Information Broadcast
UNCOV	Uncovers; Dries
US	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	United States Coast Guard
USCGAUX	United States Coast Guard Auxiliary
USCP	*United States Coast Pilot*
USDOT	United States Department of Transportation
USPHS	U.S. Public Health Service
USPS	United States Power Squadrons
UTC	Universal Coordinated Time

V

Abbreviation	Meaning
VERT CI	Vertical Clearance
VHF–FM	Very High Frequency – Frequency Modulated
VLCTY	Velocity
VSBY	Visibility
VTC	Vessel Traffic Center
VTS	Vessel Traffic Services

W

Abbreviation	Meaning
WEA	Weather
WGS	World Geodetic System
WHIS	Whistle
WK	Wreck
W/P	Watching Properly
WRNG	Warning

X

Abbreviation	Meaning
X	Discontinued Chart

Y

Abbreviation	Meaning
YD	Yard(s)