COASTAL NAVIGATION & PILOTING

by

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5th Edition

Appendix Extract

Appendix A
Symbols & Abbreviations

B	**Bearing or the direction from an observer to an object; usually expressed in PSC or PC but can be in T or M.**
C	**Course that a boat was steered through the water based on the steering compass, and may be expressed as T, M or PSC.**
COG	**Course Over Ground, the course actually achieved over the ground but not necessarily through the water; expressed as T or M.**
CTS	**The necessary Course To Steer the boat, based on the steering compass, to arrive at a desired point in consideration of current and wind effects. CTS refers to the boat heading through the water as does C; the difference between them is that CTS is the course to steer in the future, and C is what was actually steered in the past. CTS may be expressed as T, M or PSC.**
D	**Distance through the water, usually in NM.**
DF	**Distance correction factor for use in calibrating distance log instrument**
DOG	**Distance Over Ground, usually in NM.**
DR	**Dead Reckoning**
Drift	**Water current speed relative to the ground expressed in knots.**
E	**East**
Ebb	**Ebb current; water is flowing out to sea**
EP	**Estimated Position based on DR plus one additional line of position, or DR plus current set, or wind leeway.**
Flood	**Flood current; water is flowing in from the sea**
GMT	**Greenwich Mean Time**
GPS	**Ground position satellite instrument for position**
H	**Heading, the momentary direction that the boat bow is pointing as read on the ship's compass. Heading may or may not be the same as course, C.**
High Tide	**High water in a tide cycle**
Knot	**Nautical miles per hour**
L	**Latitude**
Lat	**Latitude**
LD	**Log distance for use in calibrating distance log instrument**
Long	**Longitude**
LOP	**Line of position**
Loran	**Ground position instrument based on signals from shore based towers**
Low Tide	**Low water in a tide cycle**
LS	**Log speed through the water for use in calibrating speed log instrument**
LTD	**Longitude Time Difference is the number of hours between any longitude and the Greenwich meridian based on the rotational speed of the earth**
M	**Magnetic direction referenced to north magnetic pole of earth**
MTD	**Meridian Time Difference is the number of hours from a zone meridian to the Greenwich meridian based on the rotational speed of the earth.**

N	**North**
NE	**Northeast**
NM	**Nautical Mile; 1 minute of latitude or 6076 feet.**
NW	**Northwest**
PC	**Direction per compass other than ship's steering compass.**
PSC	**Direction per ship's compass, referring to the steering compass.**
RB	**Relative Bearing (±180°) referenced to the bow of the boat; expressed in degrees without any other designator such as T or M. Starboard angles are plus (+) and port angles are negative (-).**
RF	**Running Fix**
RL	**Rhumb Line, a line representing a planned route**
S	**Boat speed through the water as indicated by a speed log which measures the speed of the boat relative to the water**
S	**South**
SBE	**Slack current before ebb current begins**
SBF	**Slack current before flood current begins**
SE	**Southeast**
SET	**Direction to which a current is flowing expressed in True degrees.**
SF	**Speed correction factor for use in calibrating speed log instrument**
SOG	**Speed Over Ground can be calculated by dividing the distance traveled over ground by elapsed time, or it can be measured by GPS or Loran instruments relative to the ground beneath the sea.**
SW	**Southwest**
T	**True direction referenced to earth's polar axis**
Track	**The desired course from one known geographic point to another known geographic point usually expressed as T or M.**
VMG	**Velocity Made Good is a term used by racers to indicate the speed they are making toward a waypoint even when not sailing directly toward it.**
W	**West**
Zn	**Azimuth or direction from an observer to a celestial body expressed in True degree**
ZTD	**Zone Time Difference is the number of hours between any longitude and the zone meridian based on the rotational speed of the earth**
λ	**Longitude**
°	**Degrees**
'	**Minutes**
"	**Seconds**
	**FIX, which is an accurately known location on the chart. Also used for a running fix.**
	**Dead Reckoning point.**
	**Estimated Position (EP) based on a DR position plus estimates of water current flow, wind effects and other factors.**
	**An electronic fix based on GPS or LORAN**

Appendix B
Time Zones

Time Zones are based on the rotational speed of the earth. Since the earth rotates at 360° per 24-hour day each one-hour time zone is, by definition, 15° of longitude wide. The central meridian of each time zone is called the Zone Meridian and successive Zone Meridians are 15° apart at longitudes of 0°, 15°, 30° etc up to 180°.

- **Zone 0 extends from 7-1/2°E longitude to 7-1/2°W longitude and is centered at Greenwich, England, which is 0° longitude, thus half of this zone is in the western hemisphere and half in the eastern. The center longitude of each time zone is called the zone meridian, and in Zone 0 this is referred to as the Prime Meridian.**

- **Zone 1W is the next time zone west of Greenwich, its Zone Meridian is at 15°W and it extends from 7-1/2°W to 22-1/2°W.**

- **Each succeeding time zone is numbered in a similar fashion up to Zone 11W with a Zone Meridian at 165°. This zone extends from 157-1/2°W to 172-1/2°W. Similar numbering extends to the east of Greenwich and these zones are designated as 1E through 11E.**

- **Zone 12 is split similar to Zone 0 with half in the eastern and half in the western hemispheres. Zone 12W extends from 172-1/2°W to 180° and Zone 12E from 172-1/2°E to 180°.**

Western zone descriptions carry a positive math sign (+) and eastern zones carry a negative sign (-), for example: zone 4W may be designated zone +4 and zone 7E may be designated zone -7.

Meridian Time Difference (MTD) is the number of hours from a zone meridian to Greenwich based on the rotational speed of the earth. For example, the MTD of the Zone Meridian at 45°W is:

MTD = Longitude of Zone Meridian ÷ 15°
MTD = 45°W ÷ 15° per hour
= 3 hours west = + 3 hours

Longitude Time Difference (LTD) is the number of hours between any longitude and Greenwich based on the rotational speed of the earth. For example, if you were at longitude 47°18.2W, your LTD would be:

LTD = Longitude ÷ 15° per hour
= 47°18.2W ÷ 15°
= 47.30°W ÷ 15°
= 3.15 hours west
= + 3.15 hours

<u>Zone Time Difference</u> (ZTD) is the number of hours between any longitude and the zone meridian based on the rotational speed of the earth, and is calculated as:

ZTD = LTD - MTD
= 3.15 - 3.00
= 0.15 hours

<u>Greenwich Mean Time</u>: (GMT or UT1) is the reference time for all celestial data and is based on the daily rotation of the earth relative to the Sun. It is within 1 second of Coordinated Universal Time, UTC which is broadcast over SSB radio.

<u>Zone Time</u> (ZT): There are twenty-four 15º segments or Zones of Longitude around the earth and each is one hour different from the adjacent zones.

<u>Standard Time</u> (ST): May be different than ZT depending on the preferences of the various localities around the earth; most are the same as ZT, but some vary from 1/4 hour to a full hour away from ZT. Whatever the difference from ZT, it must be accounted for in calculating GMT.

<u>Local Time</u> (LT): Is a further local preference such as Daylight Time or Ship's Time, which must also be accounted for.

Zone Time and Greenwich Mean Time are related as follows:

GMT = ZT + MTD

The proper math sign must be applied to MTD as follows: West longitudes and time zones are designated positive (+) and East are designated negative (-). If you properly account for the math signs, this equation will enable you to reliably convert from any time zone to GMT or to any other time zone and to properly account for changes in date.

In most of the US,

Zone Time = Standard Time

Daylight Time = Standard Time + 1 hour

Accuracy

If you're doing Celestial Navigation, you need time accuracy to the second and therefore need a radio time standard. If you're sailing coastal, you'll be able to use an AM/FM radio time cube or a WWV radio controlled clock; if offshore, you can use an SSB radio to receive the WWV time check from Ft Collins, Colorado over 2500, 5000, 10000 or 15000 Khz or an INMARSAT time signal. Beware of using GPS clock time which may be in error by as much as 13 seconds depending on the equipment manufacturer.

HF radio refers to the High Frequency spectrum from 3 to 30 MHZ, and this is where marine band SSB and the HAM bands operate. Of the two, SSB (Single Side band) is the most prevalent on recreational boats. HF radio permits long range communications easily up to 1,000 miles and, sometimes, halfway around the world. This is achieved because HF radio waves do not penetrate the ionosphere as do higher frequencies, but are bounced back to earth a long distance away. With the right antenna and atmospheric conditions, these waves can repeatedly skip back and forth between ionosphere and earth several times and fully reach around the earth.

These radios require Ship Station licenses and Operators Licenses, which can be obtained with a simple application to the FCC plus fee with no testing required. The HAM requires considerable study, practice and testing before licensing. For further information or download of forms check the FCC website by linking to it through the American Sailing Association's website at http://www.american-sailing.com/ Sailing Resources.

Practice Exercises

1. **Using the procedures discussed above determine what time zones the following longitudes located in:**

    a. **Longitude 146°16.2'W**

    b. **Longitude 97°29.9'E**

    c. **Longitude 97°30.1'E**

2. **Determine the zone meridian longitudes for the following longitudes:**

    a. **Longitude 8°27.3'W**

    b. **Longitude 167°45.9'E**

    c. **Longitude 52°31.6'W**

3. **Determine the distance in nautical miles from:**

a. The equator to 12°N latitude

b. The equator to 36°14.3'S latitude

c. 63°32.8'N latitude to 16°52.6'S latitude

4. If the time is 1425ZT on June 16 at Longitude 128°27.3'W, what is the time and date at:

a. Greenwich, England.

b. Longitude 100°00.0'E

c. Longitude 170°13.0'W

d. And, in which time zone is it noon time?

Appendix C
USCG Light List for US Waters

Light lists are discussed in Chapters 2 and 8. Following is an example of four of the Nav Aides on training chart 1210Tr which were downloaded from the NGA website which can be reached through http://www.american-sailing.com/ Sailing Resources link.

(1) No.	(2) Name	(3) Position	(4) Characteristic	(5) Height	(6) Range	(7) Structure	(8) Remarks
SEACOAST (Massachusetts) - First District							
	APPROACHES TO NEW YORK - NANTUCKET SHOALS TO FIVE FATHOM BANK (Chart 12300)						
620 15610	**Gay Head Light**	41 20 54N 70 50 06W	**Al W R** 15s 0.2s W fl 7.3s ec 0.2s R fl 7.3s ec	170	W 24 R 20	Red brick tower. 51	Obscured from 342° to 359° by Nomans Land; light occasionally visible through notches in hilltop. Emergency light (Fl W 6s) of reduced intensity when main light is extinguished. Lighted throughout 24 hours.
SEACOAST (Massachusetts) - First District							
630 15985	**Buzzards Bay Entrance Light**	41 23 48N 71 02 01W	**Fl W** 2.5s	67	17	Tower on red square on 3 red piles with large tube in center, worded BUZZARDS on sides.	Emergency light of reduced intensity when main light is extinguished. RACON: B(- • • •). HORN: 2 blasts ev 30s (2s bl-2s si-2s bl-24s si).

(1) No	(2) Name	(3) Position	(4) Characteristic	(5) Height	(6) Range	(7) Structure	(8) Remarks
SEACOAST (Rhode Island) - First District							
640	**Block Island Southeast Light**	41 09 10N 71 33 04W	**Fl G** 5s	261	20	Red-brick octagon-pyramid tower attached to dwelling. 67	Lighted throughout 24 hours. Emergency light of reduced intensity when main light is extinguished. Emergency light is offset from main light. HORN: 1 blast ev 30s (3s bl).
RHODE ISLAND - First District							
19450	**Point Judith Light**	41 21 42N 71 28 54W	**Oc (3) W** 15s 5s fl 2s ec 2s fl 2s ec 2s fl 2s ec	65	16	Octagon tower, lower half white, upper half brown. 51	HORN: 1 blast ev 15s (2s bl

The following 39 pages are the descriptive material of the USCG Light List downloaded from the NGA website, which can be linked through http://www.american-sailing.com/ Sailing Resources link.

DEPARTMENT OF TRANSPORTATION, U.S. COAST GUARD

LIGHT LIST

Volume I

ATLANTIC COAST

St. Croix River, Maine to
Shrewsbury River, New Jersey

2001 Edition

This publication contains a list of lights, sound signals, buoys, daybeacons, and other aids to navigation.

Includes corrections through:
First Coast Guard District Local Notice to Mariners No. 13/01, March 28, 2001
and
National Imagery and Mapping Agency Notice to Mariners No. 16/01, April 21, 2001

IMPORTANT

THIS PUBLICATION SHOULD BE CORRECTED EACH WEEK FROM THE LOCAL NOTICES TO MARINERS OR NOTICES TO MARINERS AS APPROPRIATE.

COMDTPUB P16502.1

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CONTENTS

Geographic Sections

PREFACE

Lights and other marine aids to navigation, maintained by or under authority of the U.S. Coast Guard and located on waters used by general navigation, are described in the Light List. This volume includes aids to navigation located between St. Croix River, Maine to Shrewsbury River, New Jersey.

Included are all Coast Guard aids to navigation used for general navigation. Not included are Coast Guard mooring buoys and some buoys having no lateral significance, such as special purpose, anchorage, fish net, and dredging.

PRIVATE AIDS TO NAVIGATION

Included: Class I aids to navigation on marine structures or other works which the owners are legally obligated to establish, maintain, and operate as prescribed by the Coast Guard.

Included: Class II aids to navigation exclusive of Class I, located in waters used by general navigation.

Not included: Class III aids to navigation exclusive of Class I and Class II, located in waters not ordinarily used by general navigation.

This Light List is published annually and is intended to furnish more complete information concerning aids to navigation than can be conveniently shown on charts. It is not intended to be used during navigation in place of charts or Coast Pilots. Charts should be consulted for the location of all aids to navigation. It may be dangerous to use aids to navigation without reference to charts.

This list is corrected to the date of the notices to mariners shown on the title page. Changes made to aids to navigation during the year are published in U.S. Coast Guard Local Notices to Mariners and National Imagery and Mapping Agency (NIMA) Notices to Mariners. Important changes to aids to navigation are also broadcast through Coast Guard or Naval radio stations. Mariners should keep their Light Lists, charts and other nautical publications corrected from these notices and should consult all notices issued after the date of publication of this Light List.

IMPORTANT: A summary of corrections for this publication, which includes corrections from the dates shown on the title page to the date of availability, is published in the Local Notice to Mariners and the Notice to Mariners. These corrections must be applied, in order to bring the Light List up-to-date. Additionally, this publication should be corrected weekly from the Local Notices to Mariners or the Notices to Mariners, as appropriate.

Mariners and others are requested to bring to the attention of the District Commander (see pg. v) or Commandant (G-OPN-2), U.S. Coast Guard, 2100 Second St., S.W., Washington, DC 20593-0001, any apparent errors or omissions in these lists.

The 2001 edition supersedes the 2000 edition.

RECORD OF CORRECTIONS PUBLISHED IN LOCAL/NOTICES TO MARINERS

YEAR 20___

1	12	23	33	43 .....
2	13	24	34	44 .....
3	14	25	35	45 .....
4	15	26	36	46 .....
5	16	27	37	47 .....
6	17	28	38	48 .....
7	18	29	39	49 .....
8	19	30	40	50 .....
9	20	31	41	51 .....
10	21	32	42	52 .....
11	22			

YEAR 20___

1	12	23	33	43 .....
2	13	24	34	44 .....
3	14	25	35	45 .....
4	15	26	36	46 .....
5	16	27	37	47 .....
6	17	28	38	48 .....
7	18	29	39	49 .....
8	19	30	40	50 .....
9	20	31	41	51 .....
10	21	32	42	52 .....
11	22			

COAST GUARD DISTRICT COMMANDERS

DISTRICT	ADDRESS	WATERS OF JURISDICTION
FIRST	408 Atlantic Avenue Boston, MA 02110-3350 PHONE: DAY 617-223-8338 PHONE: NIGHT 617-223-8558	Maine, New Hampshire, Massachusetts, Vermont (Lake Champlain), Rhode Island, Connecticut, New York, to Shrewsbury River, New Jersey.
FIFTH	Federal Building; 431Crawford Street; Portsmouth, VA 23704-5004 PHONE: DAY 757-398-6486 PHONE: NIGHT 757-398-6231	Shrewsbury River, New Jersey to Delaware, Maryland, Virginia, District of Columbia and North Carolina.
SEVENTH	Brickell Plaza Federal Building 909 SE 1st Avenue; Rm: 406 Miami, FL 33131-3050 PHONE: DAY 305-415-6730 PHONE: NIGHT 305-415-6800	South Carolina, Georgia, Florida to 83° 50'W, and Puerto Rico and adjacent islands of the United States.
EIGHTH	Hale Boggs Federal Building 501 Magazine Street New Orleans LA 70130-3396 PHONE: DAY 504-589-6277 PHONE: NIGHT 504-589-6225	Florida westward from 83°50'W, Alabama, Mississippi, Louisiana, Texas, the Mississippi River System except that portion of the Illinois River north of Joliet, Illinois.
NINTH	1240 East 9th Street Cleveland, OH 44199-2060 PHONE: DAY 216-902-6060 PHONE: NIGHT 216-902-6117	Great Lakes and St. Lawrence River above St. Regis River.
ELEVENTH	Coast Guard Island Building 50-6 Alameda, CA 94501-5100 PHONE: DAY 510-437-2976	California.
THIRTEENTH	Federal Building 915 Second Avenue Seattle, WA 98174-1067 PHONE: DAY 206-220-7270 PHONE: NIGHT 206-220-7004	Oregon, Washington, Idaho, and Montana.
FOURTEENTH	Prince Kalanianaole Federal Bldg. 300 Ala Moana Blvd 9th Floor, Room 9139 Honolulu, HI 96850-4982 PHONE: DAY 808-541-2315 PHONE: NIGHT 808-541-2500	Hawaiian, American Samoa, Marshall, Marianas, and Caroline Islands.
SEVENTEENTH	P.O. Box 25517 Juneau, AK 99802-5517 PHONE: DAY 907-463-2262 PHONE: NIGHT 907-463-2004	Alaska.

INTRODUCTION

Arrangement. Aids to navigation on the Atlantic coast from St. Croix River, Maine to Shrewsbury River, New Jersey are listed in this volume.

Aids to navigation are arranged in geographic order from north to south along the Atlantic coast. Seacoast aids to navigation are listed first, followed by entrance and harbor aids to navigation, listed from seaward to the head of navigation

Names of aids to navigation are printed as follows to help distinguish at a glance the type of aid to navigation listed:

Seacoast Lights and Secondary Lights
Radiobeacons
RACONS
Sound Signals
RIVER, HARBOR, AND OTHER LIGHTS
Lighted Buoys
Daybeacons and Unlighted Buoys

Light List numbers are assigned to all aids to navigation in order to facilitate reference in the Light List and to resolve ambiguity when referencing aids to navigation. Aids to navigation are numbered by fives in accordance with their order of appearance in each volume of the Light List. Other numbers and decimal fractions are assigned where newly established aids to navigation are listed between previously numbered aids to navigation. The Light Lists are renumbered periodically to assign whole numbers to all aids to navigation.

International numbers are assigned to certain aids to navigation in cooperation with the International Hydrographic Organization. They consist of an alphabetic character followed by three or four numeric characters. A cross reference listing appears after the index.

DESCRIPTION OF COLUMNS

Column (1): Light List number.

Column (2): Name of the aid to navigation.

A dash (–) is used to indicate the bold heading is part of the name of the aid to navigation. When reporting defects or making reference to such aids to navigation in correspondence, the full name of the aid, including the geographic heading, should be given.

Bearings are in degrees true, read clockwise from 000° through 359°.

Bearings on rangelines are given in degrees and tenths of minutes.

Column (3): Geographic position of the aid to navigation in latitude and longitude. *NOTE:* Latitude and longitude is approximate, to the nearest second, and is intended only to facilitate locating the aid on the chart.

Column (4): Light characteristic for a lighted aid to navigation. Morse code characteristic for a radiobeacon.

Column (5): Height above water from the focal plane of the fixed light to mean high water, listed in feet. For metric conversion, see table inside rear cover.

Column (6): Nominal range of lighted aids to navigation, in nautical miles, listed by color for alternating sector and passing lights. Not listed for ranges, directional lights or private aids to navigation.

Column (7): Structural characteristic of the aid to navigation, including; dayboard (if any), description of fixed structure, color and type of buoy, height of structure above ground.

Column (8): General remarks, including; fog signal characteristic, RACON characteristic, light sector's arc of visibility, radar reflector if installed on fixed structure, emergency lights, seasonal remarks, and private aid to navigation identification.

Abbreviations used in the Light Lists.

Al – Alternating
bl - blast
C - Canadian
ec - Eclipse
ev - Every
F – Fixed
fl - flash
Fl - Flashing
FS - Fog Signal
Fl(2) - Group flashing
G - Green
I - Interrupted
Iso - Isophase (Equal interval)
kHz - Kilohertz
LFl - Long Flash
lt - Lighted
MHz - Megahertz
Mo - Morse Code
Oc - Occulting
ODAS - Anchored Oceanographic Data Buoy
Q - Quick (Flashing)
Ra ref - Radar reflector
RBN - Radiobeacon
R - Red
s - seconds
si - silent
SPM - Single Point Mooring Buoy
W - White
Y – Yellow

RELATED PUBLICATIONS

OTHER LIGHT LISTS PUBLISHED BY THE U.S. COAST GUARD

VOLUME II, ATLANTIC COAST, describes aids to navigation from Shrewsbury River, New Jersey to Little River, South Carolina.

VOLUME III, ATLANTIC and GULF COASTS, describes aids to navigation from Little River, South Carolina to Econfina River, Florida (includes Puerto Rico and U.S. Virgin Islands).

VOLUME IV, GULF OF MEXICO, describes aids to navigation from Econfina River, Florida to the Rio Grande, Texas.

VOLUME V, MISSISSIPPI RIVER SYSTEM, describes aids to navigation on the Mississippi River and its navigable tributaries.

VOLUME VI, PACIFIC COAST AND PACIFIC ISLANDS, describes aids to navigation on the Pacific coast and outlying Pacific islands.

VOLUME VII, GREAT LAKES, describes aids to navigation on the Great Lakes and the St. Lawrence River above the St. Regis River.

Coast Guard Light Lists are sold by the Superintendent of Documents, U.S. Government Printing Office (GPO) and can be ordered by phone: (202) 512-1800; FAX: (202) 512-2250; or mail: Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954. Light Lists are also available at GPO Bookstores and from GPO Sales Agents.

NOTICES TO MARINERS

Broadcast Notices to Mariners are made by the Coast Guard through Coast Guard and Navy radio stations. These broadcast notices, which are broadcast on VHF-FM, NAVTEX, and other maritime frequencies, are navigational warnings that contain information of importance to the safety of navigation. Included are reports of deficiencies and changes to aids to navigation, the positions of ice and derelicts, and other important hydrographic information.

Radio stations broadcasting Notices to Mariners are listed in the National Ocean Service Coast Pilots and in the National Imagery and Mapping Agency publication Radio Navigational Aids (RAPUB 117).

Local Notices to Mariners (U.S. regional coverage) are another means by which the Coast Guard disseminates navigation information for the United States, its territories, and possessions. A Local Notice to Mariners is issued by each Coast Guard district and is used to report changes to, and deficiencies in, aids to navigation maintained by and under the authority of the Coast Guard. Local Notices to Mariners contain other marine information such as channel depths, naval operations, regattas, etc., which may affect vessels and waterways within the jurisdiction of each Coast Guard district. Reports of channel conditions, obstructions, menaces to navigation, danger areas, new chart editions, etc., are also included in the Local Notice to Mariners.

These notices are essential to all navigators for the purposes of keeping their charts, Lights Lists, Coast Pilots and other nautical publications up-to-date. These notices are published as often as required, but usually weekly. They may be obtained, free of charge, by making application to the appropriate Coast Guard district commander (see pg. v). Vessels operating in ports and waterways in several districts will have to obtain the Local Notice to Mariners from each district in order to be fully informed.

Weekly Notices to Mariners (worldwide coverage) are prepared jointly by the National Imagery and Mapping Agency, the U.S. Coast Guard, and the National Ocean Service, and are published weekly by National Imagery and Mapping Agency.

The Weekly Notices to Mariners advise mariners of important matters affecting navigational safety including new hydrographic discoveries, changes in channels and aids to navigation. Also included are corrections to Light Lists, Coast Pilots, and Sailing Directions. Foreign marine information is also included. This notice is intended for mariners and others who have a need for information related to oceangoing operations. Because it is intended for use by oceangoing vessels, many corrections that affect small craft navigation and waters are not included. Information concerning small craft is contained in the Coast Guard Local Notices to Mariners only. The Weekly Notices to Mariners may be obtained free of charge from commercial maritime sources and upon request to Defense Logistics Agency, Defense Supply Center Richmond, ATTN: JNB, 8000 Jefferson Davis Highway, Richmond, VA 23297-5100 or FAX (804) 279-6510, ATTN: Accounts Manager, RMF.

Change of Address. Persons receiving the Local Notices to Mariners or the Weekly Notices to Mariners are requested to notify the appropriate agency of a change of address, or when the Notices to Mariners are no longer needed. Both the old and new address should be given in the case of an address change.

NAUTICAL CHARTS AND PUBLICATIONS

Charts and Coast Pilots covering the United States and its territories are published by the National Ocean Service (NOS), Silver Spring, MD 20910, and are for sale by NOS and authorized NOS Sales Agents. A free catalog of available NOS/NOAA products can be obtained from NOS by phone: (301) 436-6990/(800) 638-8972; FAX: (301) 436-6829; or mail: National Ocean Service/NOAA, Distribution Division N/ACC3, Riverdale, MD 20737-1199.

Sailing Directions covering the waters outside of the U.S. and its territories are published by the National Imagery and Mapping Agency and is available from the Superintendent of Documents, U.S. Government Printing Office (GPO). They can be ordered by phone: (202) 512-1800; FAX: (202) 512-2250; or mail: Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954.

Radio Navigational Aids (RAPUB 117) is published by the National Imagery and Mapping Agency. This publication lists selected radio stations (worldwide) that provide services to mariners. Included are stations transmitting radio navigation warnings, radio time signals, medical advice; chapters on distress, emergency and safety traffic; AMVER, and miscellaneous navigational instructions and procedures. Also included are descriptions of long range aids to navigation such as Loran. Discussions and instructions for use of radio navigational aids are also provided. RAPUB 117 is available from the Superintendent of Documents, U.S. Government Printing Office (GPO).

Maps for the Mississippi River System are published by the various District Engineers, U.S. Army Corps of Engineers.

Tide Tables and Tidal Current Tables are no longer printed or distributed by NOS. Private publishing companies are printing the tables using data provided by NOS. These products may be obtained from local stores that carry marine publications.

DEFECTS IN AIDS TO NAVIGATION

Mariners should realize the Coast Guard cannot keep the thousands of aids to navigation comprising the U.S. Aids to Navigation System under simultaneous and continuous observation and that it is impossible to maintain every aid to navigation operating properly and on its assigned position at all times. Therefore, for the safety of all mariners, any person who discovers an aid to navigation that is either off station or exhibiting characteristics other than those listed in the Light Lists should promptly notify the nearest Coast Guard unit. Radio messages should be prefixed "COAST GUARD" and transmitted directly to one of the U.S. Government radio stations listed in *Chapter 3, Section 300L, Radio Navigational Aids (RAPUB 117).*

Recommendations and requests for aids to navigation and to report aids to navigation that are no longer needed should be mailed to the Coast Guard district concerned (see pg. v).

U.S. AIDS TO NAVIGATION SYSTEM

The waters of the United States and its territories are marked to assist navigation by the U.S. Aids to Navigation System. This system encompasses buoys and beacons, conforming to the International Association of Lighthouse Authorities (IALA) buoyage guidelines, and other short range aids to navigation.

The U.S. Aids to Navigation System is intended for use with nautical charts. The exact meaning of a particular aid to navigation may not be clear to the mariner unless the appropriate nautical chart is consulted. Information supplementing that shown on charts is contained in the Light List, Coast Pilots, and Sailing Directions.

TYPES OF MARKS

Lateral marks are buoys or beacons indicating the port and starboard sides of a route to be followed, and are used in conjunction with a *conventional direction of buoyage.*

Generally, lateral aids to navigation indicate which side of an aid to navigation a vessel should pass when channels are entered from seaward and a vessel proceeds in the conventional direction of buoyage. Since all channels do not lead from seaward, certain assumptions must be made so the system can be consistently applied. In the absence of a route leading from seaward, the conventional direction of buoyage generally follows a clockwise direction around land masses.

Virtually all U.S. lateral marks are located in IALA Region B and follow the traditional 3R rule of **red, right, returning.** In U.S. waters, returning from seaward and proceed-

ing toward the head of navigation is generally considered as moving southerly along the Atlantic coast, westerly along the Gulf coast and northerly along the Pacific coast. In the Great Lakes, the conventional direction of buoyage is generally considered westerly and northerly, except on Lake Michigan, where southerly movement is considered as returning from sea. A summary of the port and starboard hand lateral mark characteristics is contained in the following table.

Characteristic	Port Hand Marks	Starboard Hand Marks
Color	Green	Red
Shape (buoys)	Cylindrical (can) or pillar	Conical (nun) or pillar
Dayboard	Green square	Red triangle
Topmark (if fitted)	Cylinder	Cone, point upward
Light Color (if lighted)	Green	Red
Reflector Color	Green	Red
Number	Odd	Even

Preferred channel marks are aids to navigation which mark channel **junctions** or **bifurcations** and often mark wrecks or obstructions. Preferred channel marks may normally be passed on either side by a vessel, but indicate to the mariner the preferred channel. Preferred channel marks are colored with red and green bands.

At a point where a channel divides, when proceeding in the "conventional direction of buoyage", a preferred channel in IALA 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 band	Red with one broad green band
Shape (buoys)	Cylindrical (can) or pillar	Conical (nun) or pillar
Dayboard	Green square, lower half red	Red triangle, lower half green
Topmark (when fitted)	Green square or cylinder	Red triangular cone, point upward
Light Color (if lighted)	Green	Red
Rhythm	Composite group flashing (2+1)	Composite group flashing (2+1)
Reflector color	Green	Red

NOTE: U.S. lateral aids to navigation at certain Pacific islands are located within IALA Region A and thus exhibit opposite color significance. Port hand marks are red with square or cylindrical shapes while starboard hand marks are green with triangular or conical shapes.

CAUTION: 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.

Non-lateral marks have no lateral significance, but may be used to supplement the lateral aids to navigation specified above. Occasionally, daybeacons or minor lights outside of the normal channel will not have lateral significance since they do not define limits to navigable waters. These aids to navigation will utilize diamond-shaped dayboards and are divided into four diamond-shaped sectors. The side sectors of these dayboards are colored white, and the top and bottom sectors are colored black, red, or green as the situation dictates.

Safe water marks are used to mark fairways, mid-channels, and offshore approach points, and have unobstructed water on all sides. They can also be used by the mariner transiting offshore waters to identify the proximity of intended landfall. Safe water marks are red and white striped and have a red spherical topmark to further aid in identification. If lighted, they display a white light with the characteristic Morse code "A".

Isolated danger marks are erected on, or moored above or near, an isolated danger, which has navigable water all around it. These marks should not be approached closely without special caution.

Isolated danger marks are colored with black and red bands, and if lighted, display a group flashing (2) white light. A topmark consisting of two black spheres, one above the other, is fitted for both lighted and unlighted marks.

Special marks are not intended to assist in navigation, but rather to alert the mariner to a special feature or area. The feature should be described in a nautical document such as a chart, Light List, Coast Pilot or Notice to Mariner. Some areas which may be marked by these aids to navigation are spoil areas, pipelines, traffic separation schemes, jetties, or military exercise areas. Special marks are yellow in color and, if lighted, display a yellow light.

Information and regulatory marks are used to alert the mariner to various warnings or regulatory matters. These marks have orange geometric shapes against a white background. The meanings associated with the orange shapes are as follows:

1) An open-faced diamond signifies danger.

2) A diamond shape having a cross centered within indicates that vessels are excluded from the marked area.

3) A circular shape indicates that certain operating restrictions are in effect within the marked area.

BUOYS AND BEACONS

The IALA maritime buoyage guidelines apply to buoys and beacons that indicate the lateral limits of navigable channels, obstructions, other dangers such as wrecks, and other areas or features of importance to the mariner. This system provides five types of marks: lateral marks, safe water marks, special marks, isolated danger marks and cardinal marks. (Cardinal marks are not presently used in the United States.) Each type of mark is differentiated from other types by distinctive colors, shapes and light rhythms. Examples are provided on the enclosed color illustrations.

Buoys are floating aids to navigation used extensively throughout U.S. waters. They are moored to the seabed by concrete sinkers with chain or synthetic rope moorings of various lengths connected to the buoy body. *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.

Buoy moorings vary in length. The mooring lengths define a *watch circle,* and buoys can be expected to move within this circle. Actual watch circles do not coincide with the symbols representing them on charts.

CAUTION: Mariners attempting to pass a buoy close aboard risk collision with a yawing buoy or with the obstruction which the buoy marks. Mariners must not rely on buoys alone for determining their positions due to factors limiting buoy reliability. 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.

Beacons are aids to navigation which are permanently fixed to the earth's surface. These structures range from lighthouses to small unlighted daybeacons, and exhibit a daymark to make these aids to navigation readily visible and easily identifiable against background conditions. The daymark conveys to the mariner, during daylight hours, the same significance as does the aid to navigation's light at night.

CAUTION: Vessels should not pass fixed aids to navigation close aboard due to the danger of collision with rip-rap or structure foundations, or with the obstruction or danger being marked.

LIGHTED AIDS TO NAVIGATION

Most lighted aids to navigation are equipped with controls which automatically cause the light to operate during darkness and to be extinguished during daylight. These devices are not of equal sensitivity, therefore all lights do not come on or go off at the same time. (Mariners should ensure correct identification of aids to navigation during twilight periods when some lighted aids to navigation are lit while others are not.)

The lighting apparatus is serviced at periodic intervals to assure reliable operation, but there is always the possibility of a light being extinguished or operating improperly. The condition of the atmosphere has a considerable effect upon the distance at which lights can be seen. Sometimes lights are obscured by fog, haze, dust, smoke, or precipitation which may be present at the light, or between the light and the observer, and which is possibly unknown by the observer. Atmospheric refraction may cause a light to be seen farther than under ordinary circumstances.

A light of low intensity will be easily obscured by unfavorable conditions of the atmosphere and little dependence can be placed on it being seen. For this reason, the intensity of a light should always be considered when expecting to sight it in thick weather. Haze and distance may reduce the apparent duration of the flash of a light. In some atmospheric conditions, white lights may have a reddish hue. Lights placed at high elevations are more frequently obscured by clouds, mist, and fog than those lights located at or near sea level.

In regions where ice conditions prevail in the winter, the lantern panes of unattended lights may become covered with ice or snow, which will greatly reduce the visibility of the lights and may also cause colored lights to appear white.

The increasing use of brilliant shore lights for advertising, illuminating bridges, and other purposes, may cause marine navigational lights, particularly those in densely

inhabited areas, to be outshone and difficult to distinguish from the background lighting. Mariners are requested to report such cases in order that steps may be taken to improve the conditions.

The "loom" (glow) of a powerful light is often seen beyond the limit of visibility of the actual rays of the light. The loom may sometimes appear sufficiently sharp enough to obtain a bearing. At short distances, some flashing lights may show a faint continuous light between flashes.

The distance of an observer from a light cannot be estimated by its apparent intensity. Always check the characteristics of lights so powerful lights, visible in the distance, are not mistaken for nearby lights (such as those on lighted buoys) showing similar characteristics of low intensity. If lights are not sighted within a reasonable time after prediction, a dangerous situation may exist requiring prompt resolution or action in order to ensure the safety of the vessel.

The apparent characteristic of a complex light may change with the distance of the observer. For example, a light which actually displays a characteristic of fixed white varied by flashes of alternating white and red (the rhythms having a decreasing range of visibility in the order: flashing white, flashing red, fixed white) may, when first sighted in clear weather, show as a simple flashing white light. As the vessel draws nearer, the red flash will become visible and the characteristics will apparently be alternating flashing white and red. Later, the fixed white light will be seen between the flashes and the true characteristic of the light will finally be recognized as fixed white, alternating flashing white and red (F W Al WR).

If a vessel has considerable vertical motion due to pitching in heavy seas, a light sighted on the horizon may alternately appear and disappear. This may lead the unwary to assign a false characteristic and hence, to err in its identification. The true characteristic will be evident after the distance has been sufficiently decreased or by increasing the height of eye of the observer.

Similarly, the effects of wave motion on lighted buoys may produce the appearance of incorrect light phase characteristics when certain flashes occur, but are not viewed by the mariner. In addition, buoy motion can reduce the distance at which buoy lights are detected.

Sectors of colored glass are placed in the lanterns of some lights in order to produce a system of light sectors of different colors. In general, red sectors are used to mark shoals or to warn the mariner of other obstructions to navigation or of nearby land. Such lights provide approximate bearing information, since observers may note the change of color as they cross the boundary between sectors. These boundaries are indicated in the Light List (Col. 8) and by dotted lines on charts. These bearings, as all bearings referring to lights, are given in true degrees from 000° to 359°, as observed from a vessel toward the light.

Altering course on the changing sectors of a light or using the boundaries between light sectors to determine the bearing for any purpose is not recommended. Be guided instead by the correct compass bearing to the light and do not rely on being able to accurately observe the point at which the color changes. This is difficult to determine because the edges of a colored sector cannot be cut off sharply. On either side of the line of demarcation between white, red, or green sectors, there is always a small arc of uncertain color. Moreover, when haze or smoke are present in the intervening atmosphere, a white sector might have a reddish hue.

The area in which a light can be observed is normally an arc with the light as the center and the range of visibility as the radius. However, on some bearings the range may be reduced by obstructions. In such cases, the obstructed arc might differ with height of eye and distance. When a light is cut off by adjoining land and the arc of visibility is given, the bearing on which the light disappears may vary with the distance of the vessel from which observed and with the height of eye. When the light is cut off by a sloping hill or point of land, the light may be seen over a wider arc by a vessel farther away than by one closer to the light.

The arc drawn on charts around a light is not intended to give information as to the distance at which it can be seen, but solely to indicate, in the case of lights which do not show equally in all directions, the bearings between which the variation of visibility or obstruction of the light occurs.

OIL WELL STRUCTURES

Oil well structures in navigable waters are not listed in the Light List. The structures are shown on the appropriate nautical charts. Information concerning the location and characteristics of those structures which display lights and sound signals not located in obstruction areas are published in Local and/or Weekly Notices to Mariners.

In general, during the nighttime, a series of white lights are displayed extending from

the platform to the top of the derrick when drilling operations are in progress. At other times, structures are usually marked with one or more fixed or quick flashing white or red lights, visible for at least one nautical mile during clear weather. Obstructions which are a part of the appurtenances to the main structure, such as mooring piles, anchor and mooring buoys, etc., normally are not lighted. In addition, some of the structures are equipped with sound signals (bell, siren, whistle, or horn). When operating, bells sound one stroke every 15 seconds, while sirens, whistles, or horns sound a single two-second blast every 20 seconds.

CHARACTERISTICS OF AIDS TO NAVIGATION

LIGHT COLORS

Only aids to navigation with green or red lights have lateral significance. When proceeding in the conventional direction of buoyage, the mariner in IALA Region B, may see the following lighted aids to navigation:

Green lights on aids to navigation mark port sides of channels and locations of wrecks or obstructions which must be passed by keeping these lighted aids to navigation on the port hand of a vessel. Green lights are also used on preferred channel marks where the preferred channel is to starboard (i.e., aid to navigation left to port when proceeding in the conventional direction of buoyage).

Red lights on aids to navigation mark starboard sides of channels and locations of wrecks or obstructions which must be passed by keeping these lighted aids to navigation on the starboard hand of a vessel. Red lights are also used on preferred channel marks where the preferred channel is to port (i.e., aid to navigation left to starboard when proceeding in the conventional direction of buoyage).

White and yellow lights have no lateral significance. The purpose of aids to navigation exhibiting white or yellow lights may be determined by the shapes, colors, letters, and light rhythms.

Most aids to navigation are fitted with retroreflective material to increase their visibility in darkness. Red or green retroreflective material is used on lateral aids to navigation which, if lighted, will display lights of the same color.

LIGHT RHYTHMS

Light rhythms have no lateral significance. Aids to navigation with lateral significance exhibit flashing, quick, occulting or isophase light rhythms. Ordinarily, flashing lights (frequency not exceeding 30 flashes per minute) will be used.

Preferred channel marks exhibit a composite group-flashing light rhythm of two flashes followed by a single flash.

Safe water marks show a white Morse code "A" rhythm (a short flash followed by a long flash).

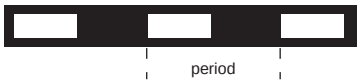
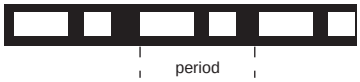
Isolated danger marks show a white flashing (2) rhythm (two flashes repeated regularly).

Special marks show yellow lights and exhibit a flashing or fixed rhythm; however, a flashing rhythm is preferred.

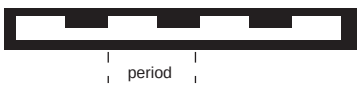
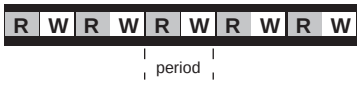
Information and regulatory marks, when lighted, display a white light with any light rhythm except quick flashing, flashing (2) and Morse code "A".

For situations where lights require a distinct cautionary significance, as at sharp turns, sudden channel constrictions, wrecks or obstructions, a quick flashing light rhythm will be used.

CHARACTERISTICS OF LIGHTS

Illustration	Type Description	Abbreviation
	**1. Fixed.** A light showing continuously and steadily.	**F**
	2. Occulting. A light in which the total duration of light in a period is longer than the total duration of darkness and the intervals of darkness (eclipses) are usually of equal duration.	
	**2.1 Single-occulting.** An occulting light in which an eclipse is regularly repeated.	**Oc**
	**2.2 Group-occulting.** An occulting light in which a group of eclipses, specified in numbers, is regularly repeated.	**Oc (2)**
	**2.3 Composite group-occulting.** A light, similar to a group-occulting light, except that successive groups in a period have different numbers of eclipses.	**Oc (2+1)**
	**3. Isophase.** A light in which all durations of light and darkness are equal.	**Iso**
	4. Flashing. A light in which the total duration of light in a period is shorter than the total duration of darkness and the appearances of light (flashes) are usually of equal duration.	
	**4.1 Single-flashing.** A flashing light in which a flash is regularly repeated (frequency not exceeding 30 flashes per minute).	**Fl**

CHARACTERISTICS OF LIGHTS (continued)

Illustration	Type Description	Abbreviation
	**4.2 Group-flashing.** A flashing light in which a group of flashes, specified in number, is regularly repeated.	**Fl (2)**
	**4.3 Composite group-flashing.** A light similar to a group flashing light except that successive groups in the period have different numbers of flashes.	**Fl (2+1)**
	5. Quick. A light in which flashes are produced at a rate of 60 flashes per minute.	
	**5.1 Continuous quick.** A quick light in which a flash is regularly repeated.	**Q**
	**5.2 Interrupted quick.** A quick light in which the sequence of flashes is interrupted by regularly repeated eclipses of constant and long duration.	**IQ**
	**6. MORSE CODE.** A light in which appearances of light of two clearly different durations (dots and dashes) are grouped to represent a character or characters in the Morse code.	**Mo (A)**
	**7. Fixed and flashing.** A light in which a fixed light is combined with a flashing light of higher luminous intensity.	**FFl**
	**8. ALTERNATING.** A light showing different colors alternately	**Al RW**

SHAPES

In order to provide easy identification, certain unlighted buoys and dayboards on beacons are differentiated by shape. These shapes are laterally significant only when associated with laterally significant colors.

Cylindrical buoys (referred to as "can buoys") and square dayboards mark the left side of a channel when proceeding from seaward. These aids to navigation are associated with solid green or green and red banded marks where the topmost band is green.

Conical buoys (referred to as "nun buoys") and triangular dayboards mark the right side of the channel when proceeding from seaward. These aids to navigation are associated with solid red or red and green banded marks where the topmost band is red.

Unless fitted with topmarks; lighted, sound, pillar, and spar buoys have no shape significance. Their meanings are conveyed by their numbers, colors, and light characteristics.

NUMBERS

All solid red and solid green aids to navigation are numbered, with red aids to navigation bearing even numbers and green aids to navigation bearing odd numbers. The numbers for each increase from seaward, proceeding in the conventional direction of buoyage. Numbers are kept in approximate sequence on both sides of the channel by omitting numbers where necessary.

Letters may be used to augment numbers when lateral aids to navigation are added to channels with previously completed numerical sequences. Letters will increase in alphabetical order from seaward, proceeding in the conventional direction of buoyage and are added to numbers as suffixes.

No other aids to navigation are numbered. Preferred channel, safe water, isolated danger, special marks, and information and regulatory aids to navigation may be lettered, but not numbered.

DAYBOARDS

In order to describe the appearance and purpose of each dayboard used in the U.S. System, standard designations have been formulated. A brief explanation of the designations and of the purpose of each type of dayboard in the system is given below, followed by a verbal description of the appearance of each dayboard type.

Designations:

1. First Letter - Shape or Purpose

   S: Square used to mark the port (left) side of channels when proceeding from seaward.

   T: Triangle used to mark the starboard (right) side of channels when proceeding from seaward.

   J: Junction (square or triangle) used to mark (preferred channel) junctions or bifurcations in the channel, or wrecks or obstructions which may be passed on either side; color of top band has lateral significance for the preferred channel.

   M: Safe water (octagonal) used to mark the fairway or middle of the channel.

   C: Crossing (western rivers only) diamond-shaped, used to indicate the points at which the channel crosses the river.

   K: Range (rectangular) when both the front and rear range dayboards are aligned on the same bearing, the observer is on the azimuth of the range, usually used to mark the center of the channel.

   N: No lateral significance (diamond or rectangular-shaped) used for special purpose, warning, distance, or location markers.

2. Second letter - Key color

   G - Green R - Red
   B - Black W - White
   Y - Yellow

3. Third letter (color of center stripe; range dayboards only)

4. Additional information after a (-)

   -I: Intracoastal Waterway; a yellow reflective horizontal strip on a dayboard; indicates the aid to navigation marks the Intracoastal Waterway.

   -SY: Intracoastal Waterway; a yellow reflective square on a dayboard; indicates the aid to navigation is a port hand mark for vessels traversing the Intracoastal Waterway. May appear on a triangular daymark where the Intracoastal Waterway coincides with a waterway having opposite conventional direction of buoyage.

   -TY: Intracoastal Waterway; a yellow reflective triangle on a dayboard; indi-

cates the aid to navigation is a starboard hand mark for vessels traversing the Intracoastal Waterway. May appear on a square daymark where the Intracoastal Waterway coincides with a waterway having opposite conventional direction of buoyage.

Example: The designation KRW-I indicates a range dayboard (K); key color red (R); with a white stripe (W); in the Intracoastal Waterway (-I).

Descriptions:

SG: Square green dayboard with a green reflective border.

SG-I: Square green dayboard with a green reflective border and a yellow reflective horizontal strip.

SG-SY: Square green dayboard with a green reflective border and a yellow reflective square.

SG-TY: Square green dayboard with a green reflective border and a yellow reflective triangle.

SR: Square red dayboard with a red reflective border. (IALA Region "A")

TG: Triangular green dayboard with a green reflective border. (IALA Region "A")

TR: Triangular red dayboard with a red reflective border.

TR-I: Triangular red dayboard with a red reflective border and a yellow reflective horizontal strip.

TR-SY: Triangular red dayboard with a red reflective border and a yellow reflective square.

TR-TY: Triangular red dayboard with a red reflective border and a yellow reflective triangle.

JG: Dayboard bearing horizontal bands of green and red, green band topmost, with a green reflective border.

JG-I: Square dayboard bearing horizontal bands of green and red, green band topmost, with a green reflective border and a yellow reflective horizontal strip.

JG-SY: Square dayboard bearing horizontal bands of green and red, green band topmost, with a green reflective border and a yellow reflective square.

JG-TY: Square dayboard bearing horizontal bands of green and red, green band topmost, with a green reflective border and a yellow reflective triangle.

JR: Dayboard bearing horizontal bands of red and green, red band topmost, with a red reflective border.

JR-I: Triangular dayboard bearing horizontal bands of red and green, red band topmost, with a red reflective border and a yellow horizontal strip.

JR-SY: Triangular dayboard bearing horizontal bands of red and green, red band topmost, with a red reflective border and a yellow reflective square.

JR-TY: Triangular dayboard bearing horizontal bands of red and green, red band topmost, with a red reflective border and a yellow reflective triangle.

MR: Octagonal dayboard bearing stripes of white and red, with a white reflective border.

MR-I: Octagonal dayboard bearing stripes of white and red, with a white reflective border and a yellow reflective horizontal strip.

CG: Diamond-shaped dayboard divided into four diamond-shaped colored sectors with the sectors at the side corners white and the sectors at the top and bottom corners green, with a white reflective border.

CR: Diamond-shaped dayboard divided into four diamond-shaped colored sectors with the sectors at the side corners white and the sectors at the top and bottom corners red, with a white reflective border.

KBG: Rectangular black dayboard bearing a central green stripe.

KBG-I: Rectangular black dayboard bearing a central green stripe and a yellow reflective horizontal strip.

KBR: Rectangular black dayboard bearing a central red stripe.

KBR-I: Rectangular black dayboard bearing a central red stripe and a yellow reflective horizontal strip.

KBW: Rectangular black dayboard bearing a central white stripe.

KBW-I: Rectangular black dayboard bearing a central white stripe and a yellow reflective horizontal strip.

KGB: Rectangular green dayboard bearing a central black stripe.

KGB-I: Rectangular green dayboard bearing a central black stripe and a yellow reflective horizontal strip.

KGR: Rectangular green dayboard bearing a central red stripe.

KGR-I: Rectangular green dayboard bearing a central red stripe and a yellow reflective horizontal strip.

KGW: Rectangular green dayboard bearing a central white stripe.

KGW-I: Rectangular green dayboard bearing a central white stripe and a yellow reflective horizontal strip.

KRB: Rectangular red dayboard bearing a central black stripe.

KRB-I: Rectangular red dayboard bearing a central black stripe and a yellow reflective horizontal strip.

KRG: Rectangular red dayboard bearing a central green stripe.

KRG-I: Rectangular red dayboard bearing a central green stripe and a yellow reflective horizontal strip.

KRW: Rectangular red dayboard bearing a central white stripe.

KRW-I: Rectangular red dayboard bearing a central white stripe and a yellow reflective horizontal strip.

KWB: Rectangular white dayboard bearing a central black stripe.

KWB-I: Rectangular white dayboard bearing a central black stripe and a yellow reflective horizontal strip.

KWG: Rectangular white dayboard bearing a central green stripe.

KWG-I: Rectangular white dayboard bearing a central green stripe and a yellow reflective horizontal strip.

KWR: Rectangular white dayboard bearing a central red stripe.

KWR-I: Rectangular white dayboard bearing a central red stripe and a yellow reflective horizontal strip.

NB: Diamond-shaped dayboard divided into four diamond-shaped colored sectors with the sectors at the side corners white and the sectors at the top and bottom corners black, with a white reflective border.

NG: Diamond-shaped dayboard divided into four diamond-shaped colored sectors with the sectors at the side corners white and the sectors at the top and bottom corners green, with a white reflective border.

NR: Diamond-shaped dayboard divided into four diamond-shaped colored sectors with the sectors at the side corners white and the sectors at the top and bottom corners red, with a white reflective border.

NW: Diamond-shaped white dayboard with an orange reflective border and black letters describing the information or regulatory nature of the mark.

ND: Rectangular white mileage marker with black numerals indicating the mile number (western rivers only).

NL: Rectangular white location marker with an orange reflective border and black letters indicating the location.

NY: Diamond-shaped yellow dayboard with yellow reflective border.

These abbreviated descriptions are used in column (7) and may also be found on the illustration of U.S. Aids to Navigation System.

OTHER SHORT RANGE AIDS TO NAVIGATION

Lighthouses are placed on shore or on marine sites and most often do not show lateral markings. They assist the mariner in determining his position or safe course, or warn of obstructions or dangers to navigation. Lighthouses with no lateral significance usually exhibit a white light.

Occasionally, lighthouses use sectored lights to mark shoals or warn mariners of other dangers. Lights so equipped show one color from most directions and a different color or colors over definite arcs of the horizon as indicated on the appropriate nautical chart. These sectors provide approximate bearing information and the observer should note a change of color as the boundary between the sectors is crossed. Since sector bearings are not precise, they should be considered as a warning only, and used in conjunction with a nautical chart.

Seasonal aids to navigation are placed into service or changed at specified times of the year. The dates shown in the Light List (Col. 8) are approximate and may vary due to adverse weather or other conditions.

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 navigable 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.

Sound signal is a generic term used to describe aids to navigation that produce an audible signal designed to assist the mariner in fog or other periods of reduced visibility. These aids to navigation can be activated by several means (e.g., manually, remotely, or fog detector). In cases where a fog detector is in use, there may be a delay in the automatic activation of the signal. Additionally, fog detectors may not be capable of detecting patchy fog conditions. Sound signals are distinguished by their tone and phase characteristics.

Tones are determined by the devices producing the sound, e.g., diaphones, diaphragm horns, sirens, whistles, bells, and gongs.

Phase characteristics are defined by the signal's sound pattern, i.e., the number of blasts and silent periods per minute and their durations. Sound signals sounded from fixed structures generally produce a specific number of blasts and silent periods each minute when operating. Buoy sound signals are generally activated by the motion of the sea and therefore do not emit a regular signal characteristic. It is common, in fact, for a buoy to produce no sound signal when seas are calm. Mariners are reminded that buoy positions are not always reliable.

The characteristic of a sound signal can be located in column (8) of the Light List. Unless it is specifically stated that a sound signal "Operates continuously", or the signal is a bell, gong, or whistle on a buoy, it can be assumed that the sound signal only operates during times of fog, reduced visibility, or adverse weather.

An emergency sound signal is sounded at some locations when the main and standby signals are inoperative. If the emergency signal is of a different type or characteristic than the main signal, its characteristic is listed in column (8) of this publication.

CAUTION: 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.

VARIATIONS TO THE U.S. SYSTEM

Intracoastal Waterway aids to navigation: The Intracoastal Waterway runs parallel to the Atlantic and Gulf coasts from Manasquan Inlet, New Jersey to the Mexican border. Aids to navigation marking these waters have some portion of them marked with yellow. Otherwise, the coloring and numbering of the aids to navigation follow the same system as that in other U.S. waterways.

In order that vessels may readily follow the Intracoastal Waterway route, special markings are employed. These marks consist of a yellow square and yellow triangle and indicate which side the aid to navigation should be passed when following the conventional direction of buoyage. The yellow square indicates that the aid to navigation should be kept on the left side and the yellow triangle indicates that the aid to navigation should be kept on the right side.

NOTE: The conventional direction of buoyage in the Intracoastal Waterway is generally southerly along the Atlantic coast and generally westerly along the Gulf coast.

The **Western Rivers System,** a variation of the standard U.S. Aids to Navigation Sys-

tem described in the preceding sections, is employed on the Mississippi River and its tributaries above Baton Rouge, LA and on certain other rivers which flow toward the Gulf of Mexico.

The Western Rivers System varies from the standard U.S. system as follows:

1) Aids to navigation are not numbered.

2) Numbers on aids to navigation do not have lateral significance, but rather indicate mileage from a fixed point (normally the river mouth).

3) Diamond shaped crossing dayboards, red and white or green and white as appropriate, and are used to indicate where the river channel crosses from one bank to the other.

4) Lights on green aids to navigation show a single-flash characteristic which may be green or white.

5) Lights on red aids to navigation show a group-flash characteristic which may be red or white.

6) Isolated danger marks are not used.

Uniform State Waterway Marking System (USWMS): This system was developed in 1966 to provide an easily understood system for operators of small boats. While designed for use on lakes and other inland waterways that are not portrayed on nautical charts, the USWMS was authorized for use on other waters as well. It supplements the existing Federal marking system and is generally compatible with it.

The conventional direction of buoyage is considered upstream or towards the head of navigation.

The USWMS varies from the standard U.S. system as follows:

1) The color black is used instead of green.

2) There are three aids to navigation which reflect cardinal significance:

a. A white buoy with a red top indicates an obstruction and the buoy should be passed to the south or west.

b. A white buoy with a black top indicates an obstruction and the buoy should be passed to the north or east.

c. A red and white vertically striped buoy indicates that an obstruction exists between that buoy and the nearest shore.

3) Mooring buoys are white buoys with a horizontal blue band midway between the water line and the top of the buoy. This buoy may be lighted and will generally show a slow flashing light.

BRIDGE MARKINGS

Bridges across navigable waters are generally marked with red, green and/or white lights for nighttime navigation. Red lights mark piers and other parts of the bridge. Red lights are also used on drawbridges to show when they are in the closed position.

Green lights are used on drawbridges to show when they are in the open position. The location of these lights will vary according to the bridge structure. Green lights are also used to mark the centerline of navigable channels through fixed bridges. If there are two or more channels through the bridge, the preferred channel is also marked by three white lights in a vertical line above the green light.

Red and green retroreflective panels may be used to mark bridge piers and may also be used on bridges not required to display lights.

Main channels through bridges may be marked by lateral red and green lights and dayboards. Adjacent piers should be marked with fixed yellow lights when the main channel is marked with lateral aids to navigation.

Centerlines of channels through fixed bridges may be marked with a safe water mark and an occulting white light when lateral marks are used to mark main channels. The centerline of the navigable channel through the draw span of floating bridges may be marked with a special mark. The mark will be a yellow diamond with yellow retroreflective panels and may exhibit a yellow light that displays a Morse code "B"(**-...**).

Clearance gauges may be installed to enhance navigation safety. The gauges are located on the right channel pier or pier protective structure facing approaching vessels. They indicate the vertical clearance available under the span.

Drawbridges equipped with radiotelephones display a blue and white sign which indicates what VHF radiotelephone channels should be used to request bridge openings.

ELECTRONIC AIDS TO NAVIGATION

RACONS

Aids to navigation may be enhanced by the use of **RA**dar bea**CONS** (RACONS). RACONS, when triggered by pulses from a vessel's radar, will transmit a coded reply to the vessel's radar. This reply serves to identify the RACON station by exhibiting a series of dots and dashes which appear on the radar display emanating radially from the RACON. This display will represent the approximate range and bearing to the RACON. Although RACONS may be used on both laterally significant and non-laterally significant aids to navigation, the RACON signal itself is for identification purposes only, and therefore carries no lateral significance. RACONS are also used as bridge marks to mark the point of best passage.

All RACONS operate in the marine radar X-band from 9,300 to 9,500 MHz. Some frequency-agile RACONS also operate in the 2,900 to 3,000 MHz marine radar S-band.

RACONS have a typical output of 100 to 300 milliwatts and are considered a short range aid to navigation. Reception varies from a nominal range of 6 to 8 nautical miles when mounted on a buoy to as much as 17 nautical miles for a RACON with a directional antenna mounted at a height of 50 feet on a fixed structure. It must be understood that these are nominal ranges and are dependent upon many factors.

The beginning of the RACON presentation occurs about 50 yards beyond the RACON position and will persist for a number of revolutions of the radar antenna (depending on its rotation rate). Distance to the RACON can be measured to the point at which the RACON flash begins, but the figure obtained will be greater than the ship's distance from the RACON. This is due to the slight response delay in the RACON apparatus.

Radar operators may notice some broadening or spoking of the RACON presentation when their vessel approaches closely to the source of the RACON. This effect can be minimized by adjustment of the IF gain or sweep gain control of the radar. If desired, the RACON presentation can be virtually eliminated by operation of the FTC (fast time constant) controls of the radar.

Radar Reflectors

Many aids to navigation incorporate special fixtures designed to enhance the reflection of radar energy. These fixtures, called radar reflectors, help radar equipped vessels to detect buoys and beacons which are so equipped. They do not however, positively identify a radar target as an aid to navigation.

Radiobeacons

As the first electronic system of navigation, radiobeacons provided offshore coverage and also became the first all-weather electronic aid to navigation. As of January 2001, only 1 Coast Guard operated traditional marine radiobeacon remains, located at Ediz Hook, WA. 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 5 to 65 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 the National Imagery and Mapping Agency publication, Radio Navigational Aids (RAPUB 117).

All radiobeacons operated and maintained by the U.S. Coast Guard are classified as continuous radiobeacons. Continuous radiobeacons operate continuously through every minute of the hour.

All Coast Guard-operated radiobeacons are assigned Morse code characteristics for ease in station identification.

The accuracy to be expected from radiobeacons depends to a large extent on the skill of the operator, the condition and type of equipment being used, the range from the stations, and the accuracy of the ship's calibration curve.

The range at which a particular marine radiobeacon signal will be received depends on atmospheric conditions and on the receiver sensitivity. The advertised service range of marine radiobeacons is expressed in nautical miles.

In general, the better the sensitivity of a receiver (i.e., the lower the signal strength required to obtain satisfactory bearings) the better the receiver is for direction-finding purposes. Unless the receiver and antenna combination is capable of obtaining a radio bearing on a signal as low as 50 microvolts per meter, full benefit will not be obtained from the system.

The selectivity of a receiver is important because it allows the direction finder to receive a desired signal on a particular frequency, while rejecting any undesired signals which may be present on adjacent frequencies.

Since the bandwidth of the transmitted radiobeacon signal is relatively narrow, being only 2.1 kilohertz, a narrow-band receiver, having good selectivity is well suited for direction finding purposes. The narrow-band receiver should extract all of the useful information from the transmitted marine radiobeacon signal.

Although a wider-band receiver may also extract all of the useful information from the transmitted signal, it will also admit more noise and more undesired signals, if these signals are present on adjacent frequencies. The additional noise and undesired signal interference may reduce the usefulness of the desired signal and effectively reduce the service range of the radiobeacon below its advertised value. This is a receiver defect, not a system error.

LORAN-C

LORAN, an acronym for LOng RAnge Navigation, is an electronic aid to navigation consisting of shore-based radio transmitters. The LORAN system enables users equipped with a LORAN receiver to determine their position quickly and accurately, day or night, in practically any weather.

A LORAN-C chain consists of three to six transmitting stations separated by several hundred miles. Within a chain, one station is designated as master (M) while the other stations are designated as secondary. Each secondary station is identified as either Victor (V), Whiskey (W), X-ray (X), Yankee (Y), or Zulu (Z).

The master station is always the first station to transmit. It transmits a series of nine pulses. The secondary stations then follow in turn, transmit eight pulses each, at precisely timed intervals. This cycle continuously repeats itself. The length of the cycle is measured in microseconds and is called a Group Repetition Interval (GRI).

LORAN-C chains are designated by the four most significant digits of their GRI. For example, a chain with a GRI of 89,700 microseconds is referred to as 8970. A different GRI is used for each chain because all LORAN-C stations broadcast in the same 90 to 110 kilohertz frequency band and would otherwise interfere with one another.

The LORAN-C system can be used in either a hyperbolic or range mode. In the widely used hyperbolic mode, a LORAN-C line of position is determined by measuring the time difference between synchronized pulses received from two separate transmitting stations. In the range mode, a line of position is determined by measuring the time required for LORAN-C pulses to travel from a transmitting station to the user's receiver.

A user's position is determined by locating the crossing point of two lines of position on a LORAN-C chart. Many receivers have built-in coordinate converters that automatically display the receiver's latitude and longitude. With a coordinate converter, a position can be determined using a chart that is not overprinted with LORAN-C lines of position.

CAUTION: The latitude/longitude computation in some receivers is based upon an all seawater propagation path. This may lead to error if the LORAN-C signals from the various stations involve appreciable overland propagation paths. These errors may put the mariner at risk in areas requiring precise positioning, if the proper correctors (ASF) are not applied. *Therefore, it is recommended that mariners using Coordinate Converters check the manufacturer's operating manual to determine if and how corrections are to be applied to compensate for timing variations caused by the overland paths.*

There are two types of LORAN-C accuracy; absolute and repeatable. Absolute accuracy is a measure of the navigator's ability to determine latitude and longitude position from the LORAN-C time differences measured. Repeatable accuracy is a measure of the LORAN-C navigator's ability to return to a position where readings have been taken before.

The absolute accuracy of LORAN-C is 0.25 nautical miles, with 95% confidence within the published coverage area using standard LORAN-C charts and tables. Repeatable accuracy depends on many factors, so measurements must be taken to determine the repeatable accuracy in any given area. Coast Guard surveys have found repeatable accuracy to be between 30 and 170 meters in most ground wave coverage areas.

If the timing or pulse shape of a master-secondary pair deviates from specified tol-

erances, the first two pulses of secondary station's pulse train will blink on and off. The LORAN-C receiver sees this blinking signal and indicates a warning to the user. This warning will continue until the signals are once again in tolerance. A blinking signal is not exhibited during off-air periods, so a separate receiver alarm indicates any loss of signal. Never use a blinking secondary signal for navigation.

Although LORAN-C signal availability normally exceeds 99.9% and scheduled off-air periods are broadcast to the mariners, LORAN-C should not be relied upon as the only aid to navigation. A prudent navigator will use radar, a radio direction finder, a fathometer and any other aid to navigation, in addition to the LORAN-C receiver.

LORAN-C interference

Interference to LORAN-C may result from radio transmissions by public or private sources operating near the LORAN-C band of 90-110kHz. Anyone observing interference to LORAN-C, should promptly report it to the Coast Guard command listed below. Include, in such reports, information regarding the date, time, identifying characteristics, strength of the interfering signals and your vessel's position. These interference reports are very important and cooperation from users of LORAN-C will assist the Coast Guard in improving LORAN-C service.

Commanding Officer
U.S. Coast Guard
NAVCEN
7323 Telegraph Road
Alexandria, VA 22310-3998

Phone: (703) 313-5900
FAX: (703) 313-5920
Internet: http://www.navcen.uscg.mil

LORAN-C Charts and Publications

Navigational charts overprinted with LORAN-C lines of position are published by the National Ocean Service and the National Imagery and Mapping Agency and are sold through National Ocean Service/NOAA. A free catalog of available products can be obtained from NOS by phone: (301) 436-6990/(800) 638-8972; FAX: (301) 436-6829; or mail: National Ocean Service/NOAA, Distribution Division N/ACC3, Riverdale, MD 20737-1199.

GLOBAL POSITIONING SYSTEM (GPS)

The Global Positioning System (GPS) is a satellite-based Radionavigation System providing continuous worldwide coverage. GPS provides navigation, position, and timing information to air, marine, and land users. The GPS System has reached Full Operating Capability (FOC). FOC status signifies that the system meets specific requirements of performance. The GPS is operated and controlled by the Department of Defense (DOD) under U.S. Air Force management.

GPS consists of a constellation of 24 satellites, orbiting Earth in six planes of 4 satellites each, at an altitude of 10,900 nautical miles. The orbit period of each satellite is 12 hours. Mariners can expect 7-9 satellites available for use with unrestricted view of the sky. Fewer satellites will be available in areas where portions of the sky are blocked by mountains, buildings, or vegetation. At least three satellites are required for a two-dimensional solution. On May 1st, 2000, the United States stopped the intentional degradation of GPS Signals known as "Selective Availability" and users can now expect accuracy to within 20 meters. The GPS system does not provide integrity information and mariners should exercise extreme caution when using GPS in restricted waterways.

Although originally intended for military use only, Federal radionavigation policy has established that GPS will be available for civil use. Whenever possible, advance notice of when the GPS satellites should not be used will be provided by the DOD and made available by the U.S. Coast Guard. GPS status messages are available at http://www.navcen.uscg.mil.

DIFFERENTIAL GPS (DGPS)

The Coast Guard has implemented a system for marine navigation called Differential GPS (DGPS). As the newest electronic system of navigation, DGPS transmitters provide offshore coverage and an all-weather electronic aid to navigation capability. The Coast Guard DGPS transmitting sites provide coverage to the Great Lakes, and coastal areas of the continental United States as well as selected portions of Alaska, Hawaii, Puerto Rico and the inland river system.

The Coast Guard's DGPS system achieved Full Operational Capability (FOC) on March 15, 1999. The network now meets the high standards of accuracy, integrity, reliability, availability and coverage required for the Harbor Entrance and Approach phase of navigation. As of November 2000, 56 sites were providing differential correction.

The Department of Transportation (DOT) has recognized the benefit of an augmented GPS signal for other public safety applications. In DOT's effort to expand the maritime DGPS signals into a Nationwide DGPS (NDGPS) network, an additional 10 sites

are currently transmitting DGPS corrections. Some of these sites provide wide coverage to navigable waters with the same performance criteria as the Maritime DGPS signal. Where available, these signals are also useable for maritime navigation. The NDGPS network will not be completed for several years.

DGPS is an augmentation to the GPS signals. Each site corrects for small variations in the signals from each satellite that is in view at that time. Satellite signals can vary due to small changes in the satellite's circuitry and orbit and from changes caused by local weather conditions. Satellite corrections are transmitted to users via radio signals in the medium frequency band (285-325 kHz) previously used for marine radiobeacons. DGPS corrections and integrity information are transmitted using Minimum Shift Keying (MSK) modulation; the modulation data rate is usually 100 or 200 bits per second (bps) but can also be 50 bps. The range of DGPS transmissions is from 40 to 300 nautical miles.

DGPS is the first federal radionavigation system capable of providing the 10-meter navigation service required for the harbor entrance and approach phase of maritime navigation. DGPS provides integrity messages for signals from the GPS satellites as well as DGPS position corrections and provides absolute position accuracy of 1-5 meters.

Each DGPS site has two reference stations (which calculate the differential corrections), two integrity monitors (which ensure the differential corrections are accurate), a transmitter and communications equipment to communicate status information to and receive control commands from the control station. Each transmitter and reference station has a unique ID number that permits users to determine which site/equipment is providing their differential corrections. As distance from the transmitting site increases, the small error in the differential corrections increases; best accuracy is achieved when using the DGPS site closest to the user.

Information regarding the location of DGPS transmitters is given on pages xxiv and xxv. Users can access additional information and DGPS system status, submit questions, and provide comments via the Navigation Information Service website or by calling the Coast Guard Navigation Center watchstander (see below).

NAVIGATION INFORMATION SERVICE (NIS)

The Coast Guard is the government interface for civil users of GPS and has established a Navigation Information Service (NIS) to meet the information needs of the civil user. The NIS is a Coast Guard facility that is manned 24 hours a day, 7 days a week, and is located at the Navigation Center (NAVCEN) in Alexandria, VA. It provides voice broadcasts, data broadcasts, facsimile, and on-line computer-based information services, which are all available 24 hours a day. The information provided includes present or future satellite outages and constellation changes, user instructions and tutorials, lists of service and receiver provider/users, and other GPS, DGPS, and LORAN related information.

NIS Internet Service (www)

Users with access to the World Wide Web (www) can access real time or archived GPS, NDGPS, DGPS and Loran-C information at www.navcen.uscg.mil as well as subscribe to a list server which enables users to receive GPS status messages and Notice to NAVSTAR User (NANU) messages via direct internet e-mail.

The NIS 24 hour voice recording is a 3-line telephone answering machine. Up to 3 callers can listen to the 90 second recording at the same time.

The NIS also disseminates GPS and DGPS safety advisory broadcast messages through USCG broadcast stations utilizing VHF-FM voice, HF-SSB voice, and NAVTEX broadcasts. The broadcasts provide the GPS and DGPS user in the marine environment with the current status of the navigation systems, as well as any planned/unplanned system outages that could affect GPS, DGPS, and LORAN navigational accuracy.

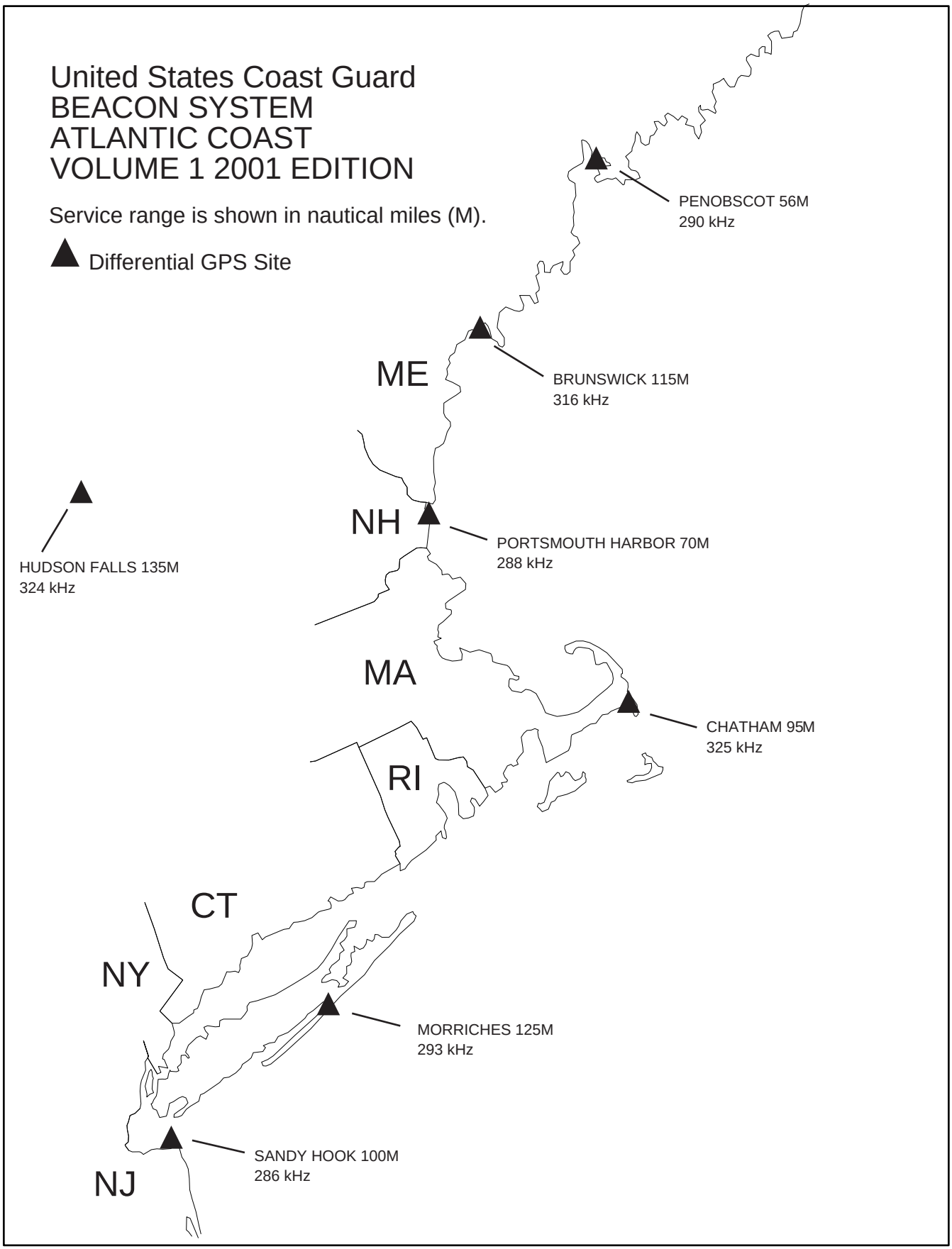
To comment on any of these services or ask questions about the service offered by NIS, contact the NIS at:

Commanding Officer
U.S. Coast Guard
NAVCEN (NIS)
7323 Telegraph Road
Alexandria, VA 22310-3998

Phone: (703) 313-5900
FAX: (703) 313-5920
Internet: http://www.navcen.uscg.mil

DIFFERENTIAL GPS SITES – ATLANTIC COAST

Broadcast Site	*Freq kHz*	*Trans Rate (BPS)*	*Lat. (N)* ° ′ ″	*Long. (W)* ° ′ ″	*Range (n.m.)*	*Radiobeacon ID #*
PENOBSCOT	290	200	44 27 06	68 46 18	56	779
BRUNSWICK	316	100	43 53 42	69 56 17	115	800
HUDSON FALLS	324	200	43 16 13	73 32 19	135	844
PORTSMOUTH	288	100	43 04 15	70 42 36	70	801
CHATHAM	325	200	41 40 17	69 57 02	95	802
MORICHES	293	100	40 47 04	72 44 07	125	803
SANDY HOOK	286	200	40 28 18	74 00 42	100	804


United States Coast Guard
BEACON SYSTEM
ATLANTIC COAST
VOLUME 1 2001 EDITION
Service range is shown in nautical miles (M).
Differential GPS Site
PENOBSCOT 56M
290 kHz
ME
BRUNSWICK 115M
316 kHz
NH
PORTSMOUTH HARBOR 70M
288 kHz
HUDSON FALLS 135M
324 kHz
MA
CHATHAM 95M
325 kHz
RI
CT
NY
MORRICHES 125M
293 kHz
SANDY HOOK 100M
286 kHz
NJ

GLOSSARY OF AIDS TO NAVIGATION TERMS

Adrift: Afloat and unattached in any way to the shore or seabed.

Aid to navigation: Any device external to a vessel or aircraft specifically intended to assist navigators in determining their position or safe course, or to warn them of dangers or obstructions to navigation.

Alternating light: A rhythmic light showing light of alternating colors.

Arc of visibility: The portion of the horizon over which a lighted aid to navigation is visible from seaward.

Articulated beacon: A beacon-like buoyant structure, tethered directly to the seabed and having no watch circle. Called articulated light or articulated daybeacon, as appropriate.

Assigned position: The latitude and longitude position for an aid to navigation.

Beacon: A lighted or unlighted fixed aid to navigation attached directly to the earth's surface. (Lights and daybeacons both constitute beacons.)

Bearing: The horizontal direction of a line of sight between two objects on the surface of the earth.

Bell: A sound signal producing bell tones by means of a hammer actuated by electricity on fixed aids and by sea motion on buoys.

Bifurcation: The point where a channel divides when proceeding from seaward. The place where two tributaries meet.

Broadcast Notice to Mariners: A radio broadcast designed to provide important marine information.

Buoy: A floating object of defined shape and color, which is anchored at a given position and serves as an aid to navigation.

Characteristic: The audible, visual, or electronic signal displayed by an aid to navigation to assist in the identification of an aid to navigation. Characteristic refers to lights, sound signals, RACONS, radiobeacons, and daybeacons.

Commissioned: The action of placing a previously discontinued aid to navigation back in operation.

Composite group-flashing light: A group-flashing light in which the flashes are combined in successive groups of different numbers of flashes.

Composite group-occulting light: A light similar to a group-occulting light except that the successive groups in a period have different numbers of eclipses.

Conventional direction of buoyage: The general direction taken by the mariner when approaching a harbor, river, estuary, or other waterway from seaward, or proceeding upstream or in the direction of the main stream of flood tide, or in the direction indicated in appropriate nautical documents (normally, following a clockwise direction around land masses).

Daybeacon: An unlighted fixed structure which is equipped with a dayboard for daytime identification.

Dayboard: The daytime identifier of an aid to navigation presenting one of several standard shapes (square, triangle, rectangle) and colors (red, green, white, orange, yellow, or black.)

Daymark: The daytime identifier of an aid to navigation. (See column 7 of the Light List.)

Diaphone: A sound signal which produces sound by means of a slotted piston moved back and forth by compressed air. A "two-tone" diaphone produces two sequential tones with the second tone of lower pitch.

Directional light: A light illuminating a sector or very narrow angle and intended to mark a direction to be followed.

Discontinued: To remove from operation (permanently or temporarily) a previously authorized aid to navigation.

Discrepancy: Failure of an aid to navigation 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.

Dolphin: A minor aid to navigation structure consisting of a number of piles driven into the seabed or riverbed in a circular pattern and drawn together with wire rope.

Eclipse: An interval of darkness between appearances of a light.

Emergency light: A light of reduced intensity displayed by certain aids to navigation when the main light is extinguished.

Establish: To place an authorized aid to navigation in operation for the first time.

Extinguished: A lighted aid to navigation which fails to show a light characteristic.

Fixed light: A light showing continuously

GLOSSARY OF AIDS TO NAVIGATION TERMS

and steadily, as opposed to a rhythmic light. (Do not confuse with "fixed" as used to differentiate from "floating.")

Flash: A relatively brief appearance of a light, in comparison with the longest interval of darkness in the same character.

Flash tube: An electronically controlled high-intensity discharge lamp with a very brief flash duration.

Flashing light: A light in which the total duration of light in each period is clearly shorter than the total duration of darkness and in which the flashes of light are all of equal duration. (Commonly used for a single-flashing light which exhibits only single flashes which are repeated at regular intervals.)

Floating aid to navigation: A buoy, secured in its assigned position by a mooring.

Fog detector: An electronic device used to automatically determine conditions of visibility which warrant the activation of a sound signal or additional light signals.

Fog signal: See sound signal.

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.

Global Positioning System (GPS): A satellite-based radionavigation system providing continuous worldwide coverage. It provides navigation, position, and timing information to air, marine, and land users.

Gong: A wave actuated sound signal on buoys which uses a group of saucer-shaped bells to produce different tones.

Group-flashing light: A flashing light in which a group of flashes, specified in number, is regularly repeated.

Group-occulting light: An occulting light in which a group of eclipses, specified in number, is regularly repeated.

Horn: A sound signal which uses electricity or compressed air to vibrate a disc diaphragm.

Inoperative: Sound signal or electronic aid to navigation out of service due to a malfunction.

Interrupted quick light: A quick flashing light in which the rapid alternations are interrupted at regular intervals by eclipses of long duration.

Isolated danger mark: A mark erected on, or moored above or very near, an isolated danger which has navigable water all around it.

Isophase light: A rhythmic light in which all durations of light and darkness are equal. (Formerly called equal interval light.)

Junction: The point where a channel divides when proceeding seaward. The place where a distributary departs from the main stream.

Lateral system: A system of aids to navigation in which characteristics of buoys and beacons indicate the sides of the channel or route relative to a conventional direction of buoyage (usually upstream).

Light: The signal emitted by a lighted aid to navigation. The illuminating apparatus used to emit the light signal. A lighted aid to navigation on a fixed structure.

Light sector: The arc over which a light is visible, described in degrees true, as observed from seaward towards the light. May be used to define distinctive color difference of two adjoining sectors, or an obscured sector.

Lighted ice buoy (LIB): A lighted buoy without a sound signal, and designed to withstand the forces of shifting and flowing ice. Used to replace a conventional buoy when that aid to navigation is endangered by ice.

Lighthouse: A lighted beacon of major importance.

Local Notice to Mariners: A written document issued by each U.S. Coast Guard district to disseminate important information affecting aids to navigation, dredging, marine construction, special marine activities, and bridge construction on the waterways within that district.

LORAN: An acronym for LOng RAnge Navigation, is an electronic aid to navigation consisting of shore-based radio transmitters. The LORAN system enables users equipped with a LORAN receiver to determine their position quickly and accurately, day or night, in practically any weather.

Luminous range: The greatest distance a light can be expected to be seen given its nominal range and the prevailing meteorological visibility (see page xxxvii).

Mark: A visual aid to navigation. Often called navigation mark, includes floating marks (buoys) and fixed marks (beacons).

GLOSSARY OF AIDS TO NAVIGATION TERMS

Meteorological visibility: The greatest distance at which a black object of suitable dimension could be seen and recognized against the horizon sky by day, or, in the case of night observations, could be seen and recognized if the general illumination were raised to the normal daylight level.

Mileage number: A number assigned to aids to navigation which gives the distance in sailing miles along the river from a reference point to the aid to navigation. The number is used principally in the Mississippi River System.

Nominal range: The maximum distance a light can be seen in clear weather (meteorological visibility of 10 nautical miles). Listed for all lighted aids to navigation except range lights, directional lights, and private aids to navigation.

Occulting light: A light in which the total duration of light in each period is clearly longer than the total duration of darkness and in which the intervals of darkness (occultations) are all of equal duration. (Commonly used for single-occulting light which exhibits only single occultations which are repeated at regular intervals.)

Ocean Data Acquisition System (ODAS): Certain very large buoys in deep water for the collection of oceanographic and meteorological information. All ODAS buoys are yellow in color and display a yellow light.

Off shore tower: Monitored light stations built on exposed marine sites to replace lightships.

Off station: A floating aid to navigation not on its assigned position.

Passing light: A low intensity light which may be mounted on the structure of another light to enable the mariner to keep the latter light in sight when passing out of its beam during transit.

Period: The interval of time between the commencement of two identical successive cycles of the characteristic of the light or sound signal.

Pile: A long, heavy timber driven into the seabed or riverbed to serve as a support for an aid to navigation.

Port hand mark: A buoy or beacon which is left to the port hand when proceeding in the "conventional direction of buoyage".

Preferred channel mark: A lateral mark indicating a channel junction or bifurcation, or a wreck or other obstruction which, after consulting a chart, may be passed on either side.

Primary aid to navigation: An aid to navigation established for the purpose of making landfalls and coastwise passages from headland to headland.

Quick light: A light exhibiting very rapid regular alternations of light and darkness, normally 60 flashes per minute. (Formerly called quick flashing light).

RACON: A radar beacon which produces a coded response, or radar paint, when triggered by a radar signal.

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 to the "target".

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 aid to navigation for use by vessels with radar.

Radiobeacon: Electronic apparatus which transmits a radio signal for use in providing a mariner a line of position.

Range: A line formed by the extension of a line connecting two charted points.

Range lights: Two lights associated to form a range which often, but not necessarily, indicates a channel centerline. The front range light is the lower of the two, and nearer to the mariner using the range. The rear range light is higher and further from the mariner.

Rebuilt: A fixed aid to navigation, previously destroyed, which has been restored as an aid to navigation.

Regulatory marks: A white and orange aid to navigation with no lateral significance. Used to indicate a special meaning to the mariner, such as danger, restricted operations, or exclusion area.

Relighted: An extinguished aid to navigation returned to its advertised light characteristics.

Replaced: An aid to navigation previously off station, adrift, or missing, restored by another aid to navigation of the same type and characteristics.

Replaced (temporarily): An aid to navigation previously off station, adrift, or missing, restored by another aid to navigation of different type and/or characteristic.

Reset: A floating aid to navigation previously off station, adrift, or missing, re-

GLOSSARY OF AIDS TO NAVIGATION TERMS

turned to its assigned position (station).

Rhythmic light: A light showing intermittently with a regular periodicity.

Sector: See light sector.

Setting a buoy: The act of placing a buoy on assigned position in the water.

Siren: A sound signal which uses electricity or compressed air to actuate either a disc or a cup-shaped rotor.

Skeleton tower: A tower, usually of steel, constructed of heavy corner members and various horizontal and diagonal bracing members.

Sound signal: A device which transmits sound, intended to provide information to mariners during periods of restricted visibility and foul weather.

Starboard hand mark: A buoy or beacon which is left to the starboard hand when proceeding in the conventional direction of buoyage.

Topmark: One or more relatively small objects of characteristic shape and color placed on an aid to identify its purpose.

Traffic Separation Scheme: Shipping corridors marked by buoys which separate incoming from outgoing vessels. Improperly called SEA LANES.

Watching properly: An aid to navigation on its assigned position exhibiting the advertised characteristics in all respects.

Whistle: A wave actuated sound signal on buoys which produces sound by emitting compressed air through a circumferential slot into a cylindrical bell chamber.

Winter marker: An unlighted buoy without sound signal, used to replace a conventional buoy when that aid to navigation is endangered by ice.

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.

Withdrawn: The discontinuance of a floating aid to navigation during severe ice conditions or for the winter season.

ABBREVIATIONS USED IN BROADCAST NOTICES TO MARINERS

Light characteristics

Fixed	F
Occulting	OC
Group-Occulting	OC(2)
Composite Group-Occulting	OC(2+1)
Isophase	ISO
Single-Flashing	FL
Group-Flashing	FL(3)
Composite Group-Flashing	FL(2+1)
Continuous Quick-Flashing	Q
Interrupted Quick-Flashing	IQ
Morse Code	MO(A)
Fixed and Flashing	FFL
Alternating	AL
Characteristic	CHAR

Colors

Black	B
Blue	BU
Green	G
Orange	OR
Red	R
White	W
Yellow	Y

Aids to Navigation

Aeronautical Radiobeacon	AERO RBN
Articulated Daybeacon	ART DBN
Articulated Light	ART LT
Destroyed	DESTR
Discontinued	DISCONTD
Established	ESTAB
Exposed Location Buoy	ELB
Fog signal station	FOG SIG
Large Navigation Buoy	LNB
Light	LT
Light List Number	LLNR
Lighted Bell Buoy	LBB
Lighted Buoy	LB
Lighted Gong Buoy	LGB
Lighted Horn Buoy	LHB
Lighted Whistle Buoy	LWB
Ocean Data Acquisition System	ODAS
Privately Maintained	PRIV MAINTD
Radar responder beacon	RACON
Radar Reflector	RA REF
Radiobeacon	RBN
Temporarily replaced by unlighted buoy	TRUB
Temporarily replaced by lighted buoy	TRLB
Whistle	WHIS

Organizations

Coast Guard	CG
Commander, Coast Guard District (#)	CCGD(#)
U S Army Corps of Engineers	COE
National Imagery and Mapping Agency	NIMA
National Ocean Service	NOS
National Weather Service	NWS

Vessels

Aircraft	A/C
Fishing Vessel	F/V
Liquefied Natural Gas Carrier	LNG
Motor Vessel	M/V[1]
Pleasure Craft	P/C
Research Vessel	R/V
Sailing Vessel	S/V

Compass Directions

East	E
North	N
Northeast	NE
Northwest	NW
South	S
Southeast	SE
Southwest	SW
West	W

Months

January	JAN
February	FEB
March	MAR
April	APR
May	MAY
June	JUN
July	JUL

[1] M/V includes: Steam Ship, Container Vessel, Cargo Vessel, etc.

ABBREVIATIONS USED IN BROADCAST NOTICES TO MARINERS

August	AUG
September	SEP
October	OCT
November	NOV
December	DEC

Days of the Week

Monday	MON
Tuesday	TUE
Wednesday	WED
Thursday	THU
Friday	FRI
Saturday	SAT
Sunday	SUN

Various

Anchorage	ANCH
Anchorage prohibited	ANCH PROHIB
Approximate	APPROX
Atlantic	ATLC
Authorized	AUTH
Average	AVG
Bearing	BRG
Breakwater	BKW
Broadcast Notice to Mariners	BNM
Channel	CHAN
Code of Federal Regulations	CFR
Continue	CONT
Degrees (temperature; geo pos)	DEG
Diameter	DIA
Edition	ED
Effect/Effective	EFF
Entrance	ENTR
Explosive Anchorage	EXPLOS ANCH
Fathom(s)	FM(S)
Foot/Feet	FT
Harbor	HBR
Height	HT
Hertz	HZ
Horizontal clearance	HOR CL
Hour	HR
International Regulations for Preventing Collisions at Sea, 1972	COLREGS
Kilohertz	KHZ
Kilometer	KM
Knot(s)	KT(S)
Latitude	LAT
Local Notice to Mariners	LNM
Longitude	LONG
Maintained	MAINTD
Maximum	MAX
Megahertz	MHZ
Millibar	MB
Millimeter	MM
Minute (time; geo pos)	MIN
Moderate	MDT
Mountain, Mount	MT
Nautical Mile(s)	NM
Notice to Mariners	NTM
Obstruction	OBSTR
Occasion/Occasionally	OCCASION
Operating Area	OPAREA
Pacific	PAC
Point(s)	PT(S)
Position	PSN
Position Approximate	PA
Pressure	PRES
Private, Privately	PRIV
Prohibited	PROHIB
Publication	PUB
Range	RGE
Reported	REP
Restricted	RESTR
Rock	RK
Saint	ST
Second (time; geo pos)	SEC
Signal station	SIG STA
Station	STA
Statute Mile(s)	SM
Storm signal station	S SIG STA
Temporary	TEMP
Through	THRU
Thunderstorm	TSTM
True	T
Uncovers; Dries	UNCOV
Universal Coordinate Time	UTC
Urgent Marine Information Broadcast	UMIB
Velocity	VLCTY
Vertical clearance	VERT CL
Visibility	VSBY
Warning	WRNG
Weather	WEA

ABBREVIATIONS USED IN BROADCAST NOTICES TO MARINERS

Wreck	WK
Yard(s)	YD

Countries and States

Alabama	AL
Alaska	AK
American Samoa	AS
Arizona	AZ
Arkansas	AR
California	CA
Canada	CN
Colorado	CO
Connecticut	CT
Delaware	DE
District of Columbia	DC
Federated States of Micronesia	FSM
Florida	FL
Georgia	GA
Guam	GU
Hawaii	HI
Idaho	ID
Illinois	IL
Indiana	IN
Iowa	IA
Kansas	KS
Kentucky	KY
Louisiana	LA
Maine	ME
Maryland	MD
Massachusetts	MA
Mexico	MX
Michigan	MI
Minnesota	MN
Mississippi	MS
Missouri	MO
Montana	MT
Nebraska	NE
New Hampshire	NH
Nevada	NV
New Jersey	NJ
New Mexico	NM
New York	NY
North Carolina	NC
North Dakota	ND
Northern Marianas	CM
Ohio	OH
Oklahoma	OK
Oregon	OR
Pennsylvania	PA
Puerto Rico	PR
Rhode Island	RI
South Carolina	SC
South Dakota	SD
Tennessee	TN
Texas	TX
United States	US
Utah	UT
Vermont	VT
Virgin Islands	VI
Virginia	VA
Washington	WA
West Virginia	WV
Wisconsin	WI
Wyoming	WY

GEOGRAPHIC RANGE TABLE

The following table gives the approximate geographic range of visibility for an object which may be seen by an observer at sea level. It is necessary to add to the distance for the height of any object the distance corresponding to the height of the observer's eye above sea level.

Height Feet/Meters	Distance Nautical Miles (NM)	Height Feet/Meters	Distance Nautical Miles (NM)	Height Feet/Meters	Distance Nautical Miles (NM)
5/1.5	2.6	70/21.3	9.8	250/76.2	18.5
10/3.1	3.7	75/22.9	10.1	300/91.4	20.3
15/4.6	4.5	80/24.4	10.5	350/106.7	21.9
20/6.1	5.2	85/25.9	10.8	400/121.9	23.4
25/7.6	5.9	90/27.4	11.1	450/137.2	24.8
30/9.1	6.4	95/29.0	11.4	500/152.4	26.2
35/10.7	6.9	100/30.5	11.7	550/167.6	27.4
40/12.2	7.4	110/33.5	12.3	600/182.9	28.7
45/13.7	7.8	120/36.6	12.8	650/198.1	29.8
50/15.2	8.3	130/39.6	13.3	700/213.4	31.0
55/16.8	8.7	140/42.7	13.8	800/243.8	33.1
60/18.3	9.1	150/45.7	14.3	900/274.3	35.1
65/19.8	9.4	200/61.0	16.5	1000/304.8	37.0

Example: Determine the geographic visibility of an object, with a height above water of 65 feet, for an observer with a height of eye of 35 feet. Enter above table;

Height of object .....65 feet = 9.4 NM
Height of observer.....35 feet = 6.9 NM
Computed geographic visibility 16.3 NM

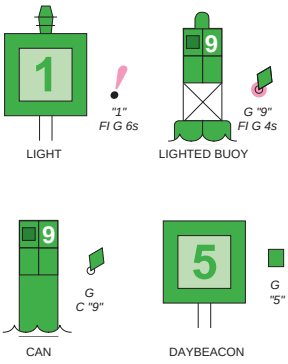
U.S. AIDS TO NAVIGATION SYSTEM
on navigable waters except Western Rivers

LATERAL SYSTEM AS SEEN ENTERING FROM SEAWARD

PORT SIDE
ODD NUMBERED AIDS

GREEN LIGHT ONLY

FLASHING (2)
FLASHING
OCCULTING
QUICK FLASHING
ISO

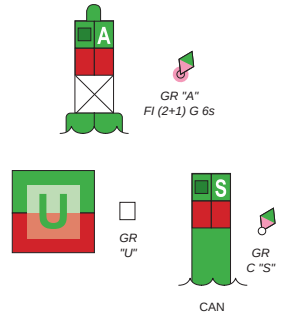


PREFERRED CHANNEL
NO NUMBERS-MAY BE LETTERED

PREFERRED CHANNEL TO STARBOARD TOPMOST BAND GREEN

GREEN LIGHT ONLY

COMPOSITE GROUP FLASHING (2+1)

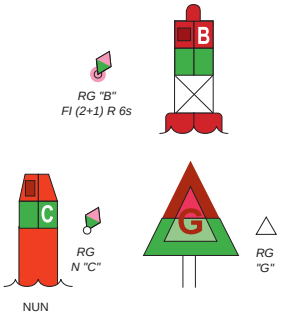


PREFERRED CHANNEL
NO NUMBERS-MAY BE LETTERED

PREFERRED CHANNEL TO PORT TOPMOST BAND RED

RED LIGHT ONLY

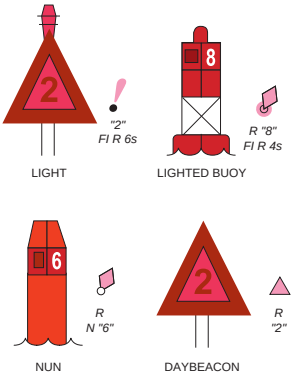
COMPOSITE GROUP FLASHING (2+1)



STARBOARD SIDE
EVEN NUMBERED AIDS

RED LIGHT ONLY

FLASHING (2)
FLASHING
OCCULTING
QUICK FLASHING
ISO

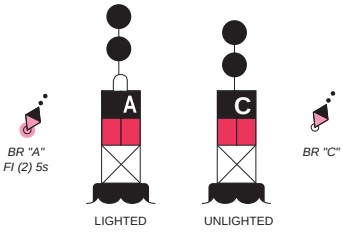


AIDS TO NAVIGATION HAVING NO LATERAL SIGNIFICANCE

ISOLATED DANGER
NO NUMBERS--MAY BE LETTERED

WHITE LIGHT ONLY

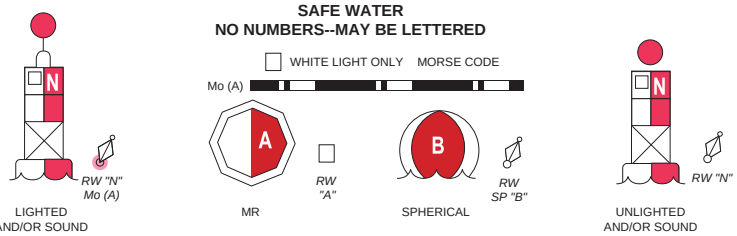
Fl (2) 5s



SAFE WATER
NO NUMBERS--MAY BE LETTERED

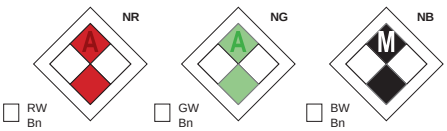
WHITE LIGHT ONLY MORSE CODE

Mo (A)



DAYBOARDS--MAY BE LETTERED

WHITE LIGHT ONLY

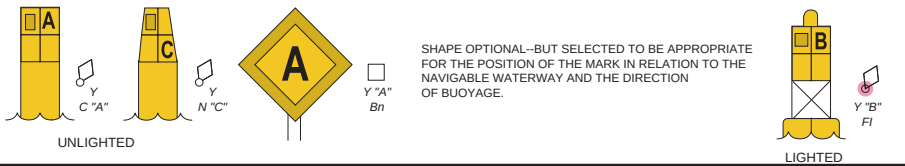


RANGE DAYBOARDS--MAY BE LETTERED

SPECIAL MARKS--MAY BE LETTERED

YELLOW LIGHT ONLY

FIXED
FLASHING

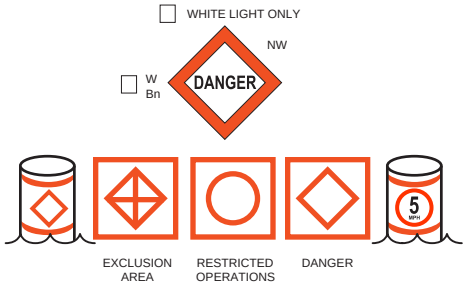


TYPICAL INFORMATION AND REGULATORY MARKS

INFORMATION AND REGULATORY MARKERS

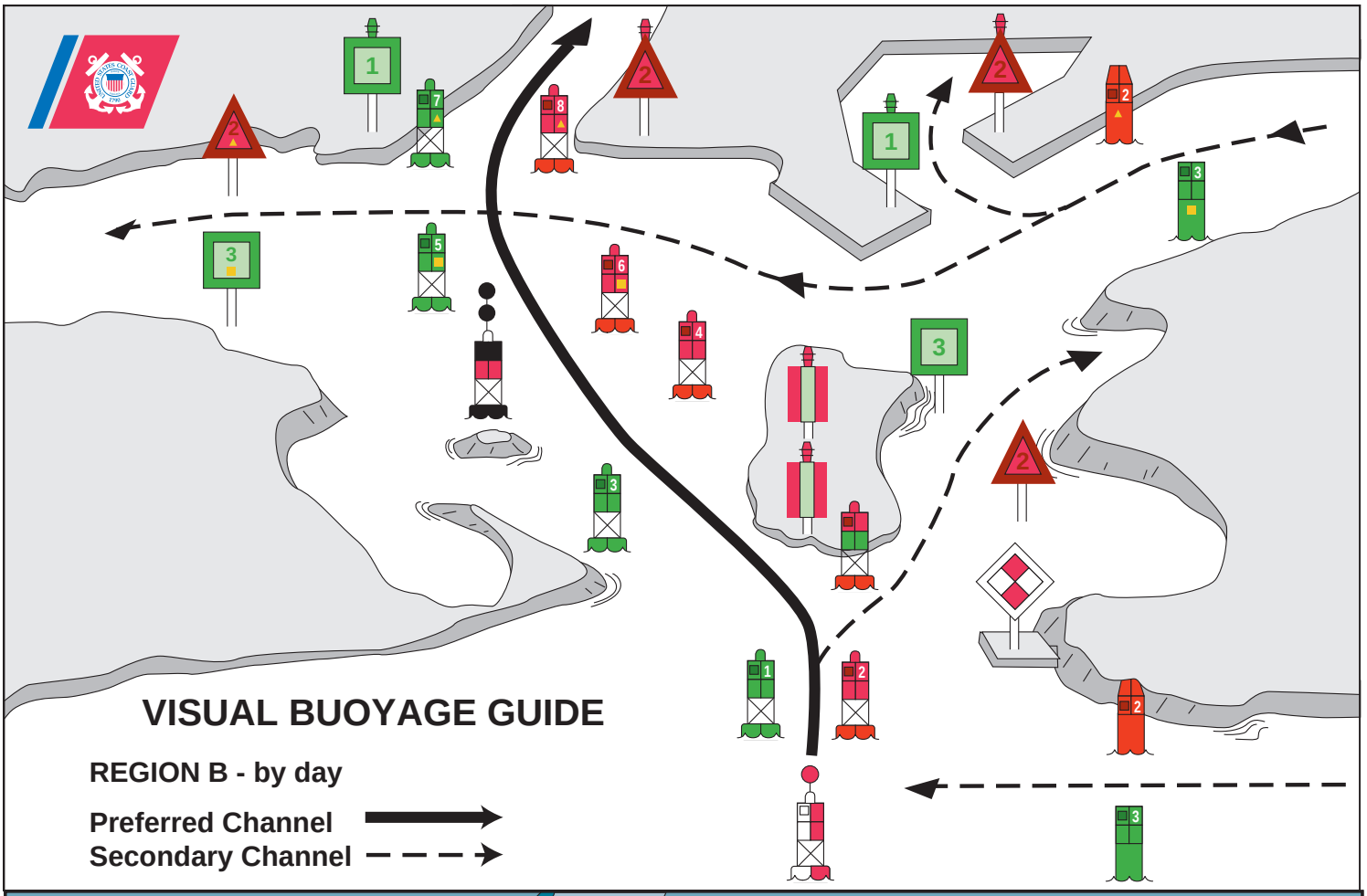
WHEN LIGHTED, INFORMATION AND REGULATORY MARKS MAY DISPLAY ANY LIGHT RHYTHM EXCEPT QUICK FLASHING AND FLASHING (2)

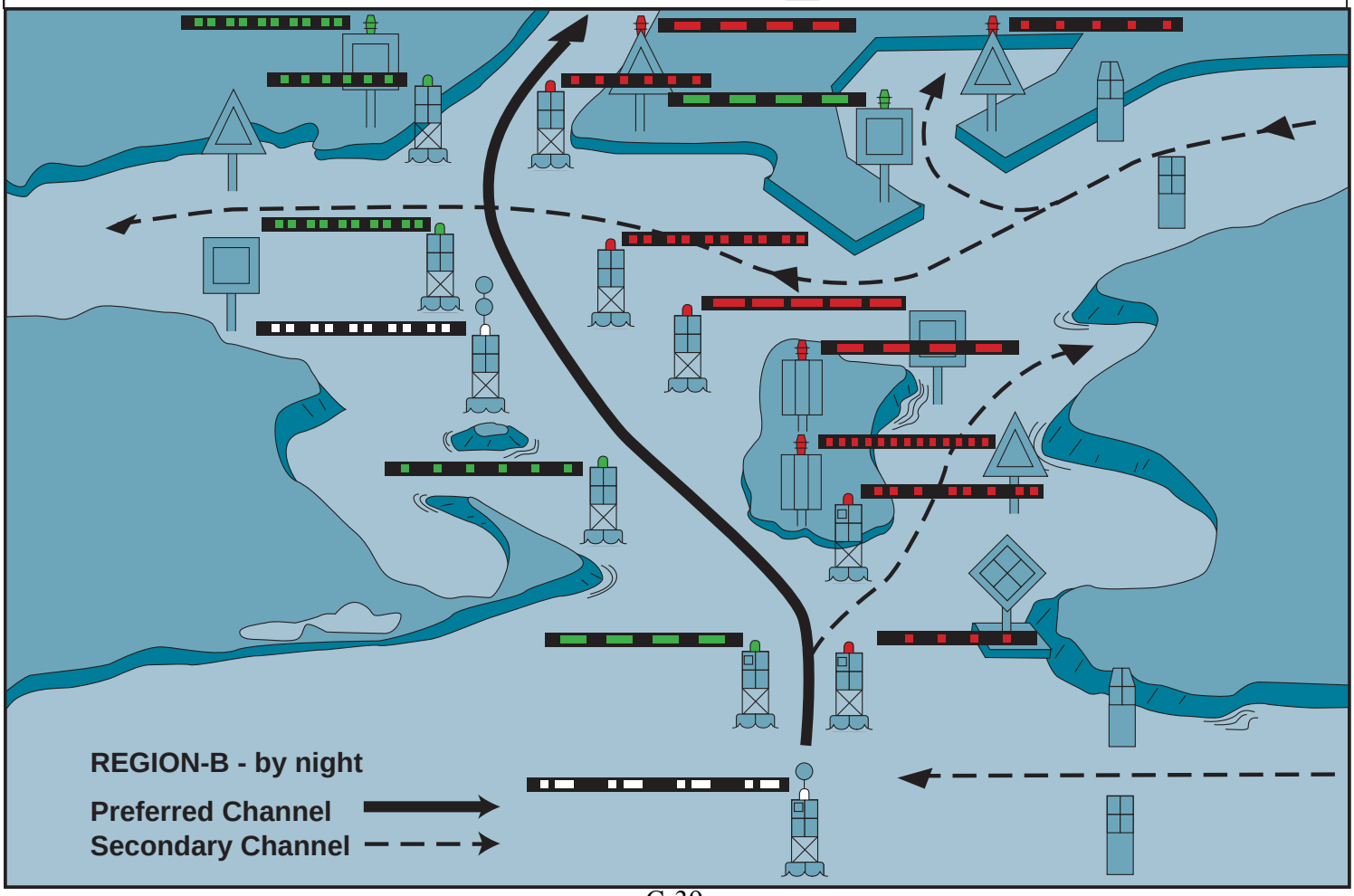
WHITE LIGHT ONLY



Aids to navigation marking the Intercoastal Waterway (ICW) display unique yellow symbols to distinguish them from aids marking other waters. Yellow triangles ▲ indicate aids should be passed by keeping them on the starboard (right) hand of the vessel. Yellow squares ■ indicate aids should be passed by keeping them on the port (left) hand of the vessel. A yellow horizontal band ▬ provides no lateral information, but simply identifies aids as marking the ICW.

Plate 1


VISUAL BUOYAGE GUIDE
REGION B - by day
Preferred Channel
Secondary Channel


REGION-B - by night
Preferred Channel
Secondary Channel

FICTITIOUS NAUTICAL CHART

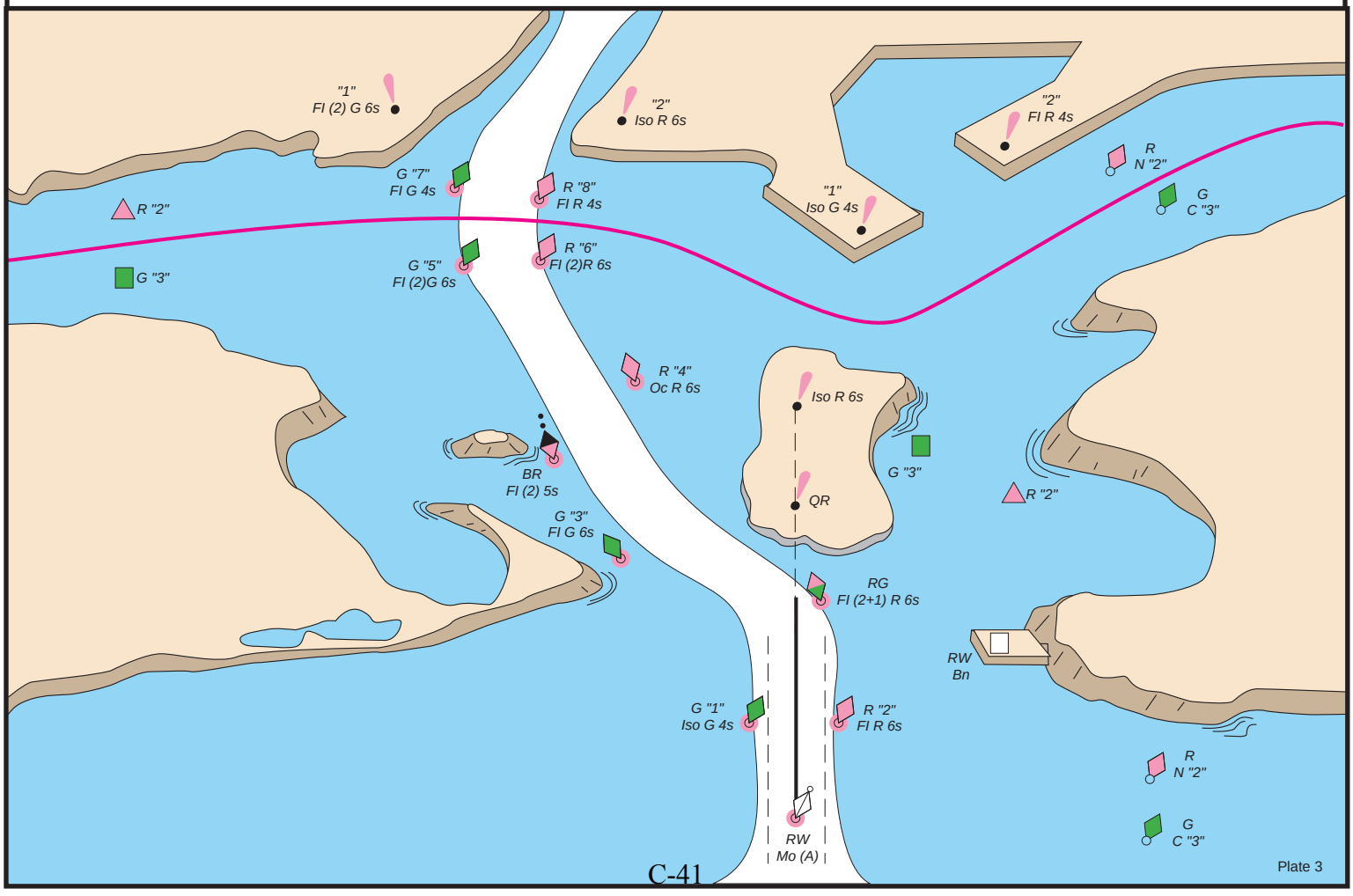


Plate 3

U.S. AIDS TO NAVIGATION SYSTEM
on the Western River System

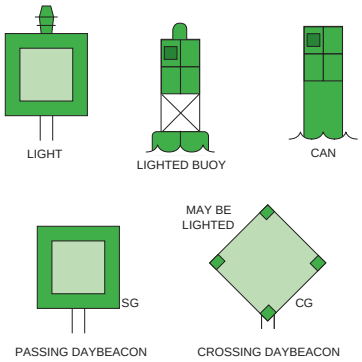
AS SEEN ENTERING FROM SEAWARD

PORT SIDE OR RIGHT DESCENDING BANK

GREEN OR WHITE LIGHTS

FLASHING

ISO



PASSING DAYBEACON

CROSSING DAYBEACON

176.9

MILE BOARD

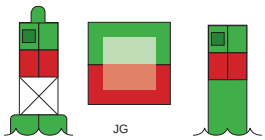
PREFERRED CHANNEL

MARK JUNCTIONS AND OBSTRUCTIONS
COMPOSITE GROUP FLASHING (2+1)

PREFERRED CHANNEL TO STARBOARD

TOPMOST BAND GREEN

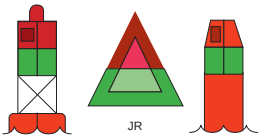
Fl (2+1) G



PREFERRED CHANNEL TO PORT

TOPMOST BAND RED

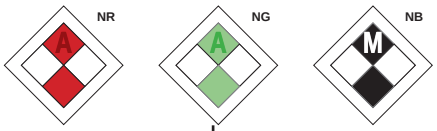
Fl (2+1) R



DAYBOARDS HAVING NO LATERAL SIGNIFICANCE

MAY BE LETTERED

WHITE LIGHT ONLY

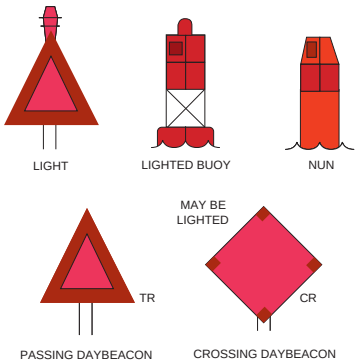


STARBOARD SIDE OR LEFT DESCENDING BANK

RED OR WHITE LIGHTS

FLASHING (2)

ISO



PASSING DAYBEACON

CROSSING DAYBEACON

123.5

MILE BOARD

TYPICAL INFORMATION AND REGULATORY MARKS

INFORMATION AND REGULATORY MARKERS

WHEN LIGHTED, INFORMATION AND REGULATORY MARKS MAY DISPLAY ANY LIGHT RHYTHM EXCEPT QUICK FLASHING AND FLASHING (2)

NW WHITE LIGHT ONLY

EXCLUSION AREA

RESTRICTED OPERATIONS

DANGER

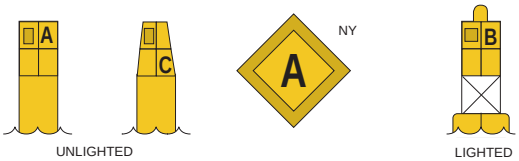
SPECIAL MARKS--MAY BE LETTERED

SHAPE: OPTIONAL--BUT SELECTED TO BE APPROPRIATE FOR THE POSITION OF THE MARK IN RELATION TO THE NAVIGABLE WATERWAY AND THE DIRECTION OF BUOYAGE.

YELLOW LIGHT ONLY

FIXED

FLASHING



UNLIGHTED

LIGHTED

UNIFORM STATE WATERWAY MARKING SYSTEM

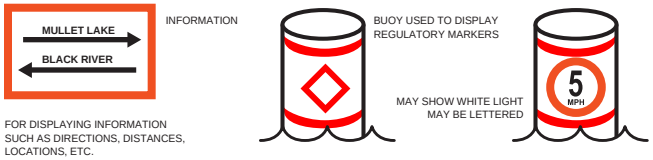
STATE WATERS AND DESIGNATED STATE WATERS FOR PRIVATE AIDS TO NAVIGATION

REGULATORY MARKERS

EXPLANATION MAY BE PLACED OUTSIDE THE CROSSED DIAMOND SHAPE, SUCH AS DAM, RAPIDS, SWIM AREA, ETC.

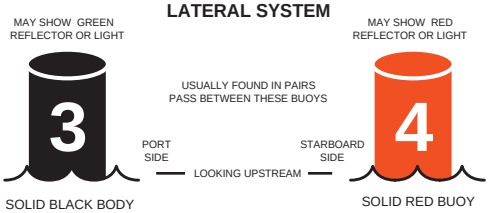
THE NATURE OF DANGER MAY BE INDICATED INSIDE THE DIAMOND SHAPE, SUCH AS ROCK, WRECK, SHOAL, DAM, ETC.

TYPE OF CONTROL IS INDICATED IN THE CIRCLE, SUCH AS SLOW, NO WAKE, ANCHORING, ETC.



FOR DISPLAYING INFORMATION SUCH AS DIRECTIONS, DISTANCES, LOCATIONS, ETC.

LATERAL SYSTEM



SOLID BLACK BODY

SOLID RED BUOY

CARDINAL SYSTEM

MAY SHOW WHITE REFLECTOR OR LIGHT

RED-STRIPED WHITE BUOY

MAY BE LETTERED
DO NOT PASS BETWEEN BUOY AND NEAREST SHORE

BLACK-TOPPED WHITE BUOY

RED-TOPPED WHITE BUOY

MAY BE NUMBERED

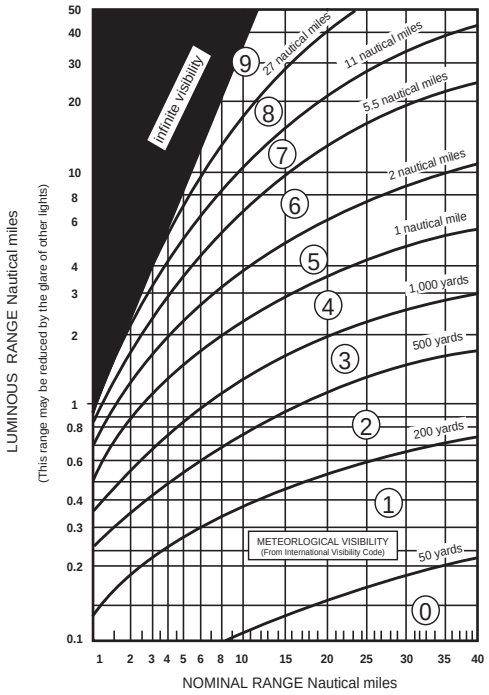
PASS TO NORTH OR EAST OF BUOY

PASS TO SOUTH OR WEST OF BUOY

Plate 4

Luminous Range Diagram

The nominal range given in this Light List is the maximum distance a given light can be seen when the meteorological visibility is 10 nautical miles. If the existing visibility is less than 10 NM, the range at which the light can be seen will be reduced below its nominal range. And, if the visibility is greater than 10 NM, the light can be seen at greater distances. The distance at which a light may be expected to be seen in the prevailing visibility is called its luminous range.



METEOROLOGICAL VISIBILITY (From International Visibility Code)		
Code	Metric	Nautical (approximate)
0	less than 50 meters	less than 50 yards
1	50-200 meters	50-200 yards
2	200-500 meters	200-500 yards
3	500-1,000 meters	500-1,000 yards
4	1-2 kilometers	1,000-2,000 yards
5	2-4 kilometers	1-2 nautical miles
6	4-10 kilometers	2-5.5 nautical miles
7	10-20 kilometers	5.5-11 nautical miles
8	20-50 kilometers	11-27 nautical miles
9	greater than 50 km	greater than 27 nm

This diagram enables the mariner to determine the approximate luminous range of a light when the nominal range and the prevailing meteorological visibility are known. The diagram is entered from the bottom border using the nominal range listed in column 6 of this book. The intersection of the nominal range with the appropriate visibility curve (or, more often, a point between two curves) yields, by moving horizontally to the left border, the luminous range.

CAUTION

When using this diagram it must be remembered that:

1. The ranges obtained are approximate.
2. The transparency of the atmosphere may vary between the observer and the light.
3. Glare from background lighting will considerably reduce the range at which lights are sighted.
4. The rolling motion of the mariner and/or of a lighted aid to navigation may reduce the distance at which lights can be detected and identified.

CONVERSION TABLES

FEET TO METERS
(1 foot = 0.3048 meters) – (1 meter = 3.2808 feet)

Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters
0	0	35	10.7	70	21.3	105	32.0	140	42.7	175	53.3
1	0.3	36	11.0	71	21.6	106	32.3	141	43.0	176	53.6
2	0.6	37	11.3	72	22.0	107	32.6	142	43.3	177	54.0
3	0.9	38	11.6	73	22.3	108	32.9	143	43.6	178	54.3
4	1.2	39	11.9	74	22.6	109	33.2	144	43.9	179	54.6
5	1.5	40	12.2	75	22.9	110	33.5	145	44.2	180	54.9
6	1.8	41	12.5	76	23.2	111	33.8	146	44.5	181	55.2
7	2.1	42	12.8	77	23.5	112	34.1	147	44.8	182	55.5
8	2.4	43	13.1	78	23.8	113	34.4	148	45.1	183	55.8
9	2.7	44	13.4	79	24.1	114	34.8	149	45.4	184	56.1
10	3.1	45	13.7	80	24.4	115	35.1	150	45.7	185	56.4
11	3.4	46	14.0	81	24.7	116	35.4	151	46.0	186	56.7
12	3.7	47	14.3	82	25.0	117	35.7	152	46.3	187	57.0
13	4.0	48	14.6	83	25.3	118	36.0	153	46.6	188	57.3
14	4.3	49	14.9	84	25.6	119	36.3	154	46.9	189	57.6
15	4.6	50	15.2	85	25.9	120	36.6	155	47.2	190	57.9
16	4.9	51	15.5	86	26.2	121	36.9	156	47.6	191	58.2
17	5.2	52	15.9	87	26.5	122	37.2	157	47.9	192	58.5
18	5.5	53	16.2	88	26.8	123	37.5	158	48.2	193	58.8
19	5.8	54	16.5	89	27.1	124	37.8	159	48.5	194	59.1
20	6.1	55	16.8	90	27.4	125	38.1	160	48.8	195	59.4
21	6.4	56	17.1	91	27.7	126	38.4	161	49.1	196	59.7
22	6.7	57	17.4	92	28.0	127	38.7	162	49.4	197	60.1
23	7.0	58	17.7	93	28.4	128	39.0	163	49.7	198	60.4
24	7.3	59	18.0	94	28.7	129	39.3	164	50.0	199	60.7
25	7.6	60	18.3	95	29.0	130	39.6	165	50.3	200	61.0
26	7.9	61	18.6	96	29.3	131	39.9	166	50.6	300	91.4
27	8.2	62	18.9	97	29.6	132	40.2	167	50.9	400	121.9
28	8.5	63	19.2	98	29.9	133	40.5	168	51.2	500	152.4
29	8.8	64	19.5	99	30.2	134	40.8	169	51.5	600	182.9
30	9.1	65	19.8	100	30.5	135	41.2	170	51.8	700	213.4
31	9.5	66	20.1	101	30.8	136	41.5	171	52.1	800	243.8
32	9.8	67	20.4	102	31.1	137	41.8	172	52.4	900	274.3
33	10.1	68	20.7	103	31.4	138	42.1	173	52.7	1000	304.8
34	10.4	69	21.0	104	31.7	139	42.4	174	53.0	2000	609.6

STATUTE MILES (St M) TO NAUTICAL MILES (NM)
(1 St M = 5,280 feet) – (1 NM = 6,076.1 feet)

St M	NM	St M	NM	St M	NM	St M	NM	St M	NM	St M	NM
1	0.9	21	18.3	41	35.6	61	53.0	81	70.4	101	87.8
2	1.7	22	19.1	42	36.5	62	53.9	82	71.3	102	88.6
3	2.6	23	20.0	43	37.4	63	54.8	83	72.1	103	89.5
4	3.5	24	20.9	44	38.2	64	55.6	84	73.0	104	90.3
5	4.4	25	21.7	45	39.1	65	56.5	85	73.9	105	91.2
6	5.2	26	22.6	46	40.0	66	57.4	86	74.7	106	92.1
7	6.1	27	23.5	47	40.8	67	58.2	87	75.6	107	93.0
8	7.0	28	24.3	48	41.7	68	59.1	88	76.4	108	93.8
9	7.8	29	25.2	49	42.6	69	60.0	89	77.3	109	94.7
10	8.7	30	26.1	50	43.5	70	60.8	90	78.2	110	95.6
11	9.6	31	26.9	51	44.3	71	61.7	91	79.1	111	96.5
12	10.4	32	27.8	52	45.2	72	62.6	92	80.0	112	97.3
13	11.3	33	28.7	53	46.1	73	63.4	93	80.9	113	98.2
14	12.2	34	29.6	54	46.9	74	64.3	94	81.7	114	99.1
15	13.0	35	30.4	55	47.8	75	65.2	95	82.6	115	99.9
16	13.9	36	31.3	56	48.7	76	66.0	96	83.4	116	100.8
17	14.8	37	32.2	57	49.5	77	66.9	97	84.3	117	101.7
18	15.6	38	33.0	58	50.4	78	67.8	98	85.2	118	102.5
19	16.5	39	33.9	59	51.3	79	68.7	99	86.0	119	103.4
20	17.4	40	34.8	60	52.1	80	69.5	100	86.9	120	104.3