



Chapter 13: Aids to Navigation

Introduction

This chapter introduces the aids to navigation (AtoN) used on many of the lakes in Utah including the Great Salt Lake. AtoN are devices or marks that assist mariners in determining their vessel's position, or course, or to warn of dangers, obstructions, or regulatory requirements affecting safe navigation. The Division is responsible for servicing and maintaining AtoN under state jurisdiction. [The Harbor Master of the Great Salt Lake State Marina has been tasked with overseeing the placement, maintenance, and publication of AtoN as well as authorization for placement of buoys by outside entities or agencies. Great Salt Lake uses the Uniform State Waterway Marking System \(USWMS\).](#)

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Section A. Aids to Navigation System

Introduction

Buoys, beacons, and other short-range AtoN are used in the same way signs, lane separations, and traffic lights guide motor vehicle drivers. Together, these AtoN make up the short-range AtoN system, which uses charted reference marks to provide information for safely navigating waterways. In the U.S., short-range aids conform to the International Association of Lighthouse Authorities (IALA) Region B. This is called System B, the U.S. Lateral System, or the U.S. Aids to Navigation System. The Division maintains short-range aids to provide:

- Daytime visual system of daymarks, beacons and buoys.
- Nighttime visual system of light signals.

NOTE “Natural AtoN” are charted prominent structures or landmarks that supplement the short range AtoN system. They are not a part of the IALA System B, and are not a Division responsibility to service or maintain. [Examples of these would be the Kennebec and MagCorp smokestacks, Little Mountain antenna light array, and prominent features on the islands of the Great Salt Lake.](#)

In This Section

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Lateral and Cardinal Significance

A.1. Lateral System

In the lateral system, buoys indicate the sides of the channel or route relative to a conventional direction of buoys. In U.S. waters, AtoN use the IALA-B system of lateral marks with few exceptions (see A 2 below), arranged in geographic order known as the “conventional direction of buoyage” (see **Figure 13-1**). Under this, the memory aid 3R rule of “red, right, returning” applies when a vessel is returning from seaward. This means, when returning from sea, keep red markers to the right of the vessel from”

- North to south along the Atlantic Coast.
- South to north and east to west along the Gulf Coast
- South to north and east to west along the Pacific Coast.
- East to west in the Great Lakes except for Lake Michigan which is north to south.

A.2. The Cardinal System

The Cardinal System uses a buoy to indicate the location of a danger relative to the buoy itself. In the U.S., the USWMS uses cardinal marks on the waters where a state exercises sole jurisdiction. This is the case with Great Salt Lake. The colors of these marks differ from those of IALA.



Figure 13-1
Proceeding from Seaward

General Characteristics of Short-Range AtoN

A.3. Description

Aids to navigation have many different characteristics. An aid's color, size, or light signify what mariners should do when they see it. Characteristics of short-range aids used in the following paragraph.

A.4. Type

The location and the intended use determine which one of the two types of AtoN will be placed in a spot or waterway:

- Floating (buoy).
- Fixed (beacon).

A.5. AtoN Identification (Numbers and Letters)

Solid red AtoN buoys and beacons bear even numbers and all solid green AtoN bear odd numbers. No other AtoN are numbered. When proceeding from seaward toward a marina the numbers increase. Numbers are kept in approximate sequence on both sides of the channel with previously completed numerical sequences. For instance, a buoy added between R4 and R6 in a channel would be numbered R4A. Letters will also increase in alphabetical order.

For the Great Salt Lake Marina there are two distinct channels that may be marked to approach the marina. The *Deep Channel* buoys are marked traditionally as G1, R2, G3, R4, and so on. The *Reef Channel* is marked with an extra R such as R-G1, R-R2, R-G3, R-R4 and so on to identify it as a different channel.

NOTE: The marinas being used and maintained by the brine shrimp industry do not have markers or beacons that conform to IALA or U.S. Inland Waterway system.

A.6. Color

During daylight hours, the color of an AtoN indicates the port or starboard side of a channel, preferred channels, safe water, isolated dangers, and special features.

A.7. Shape

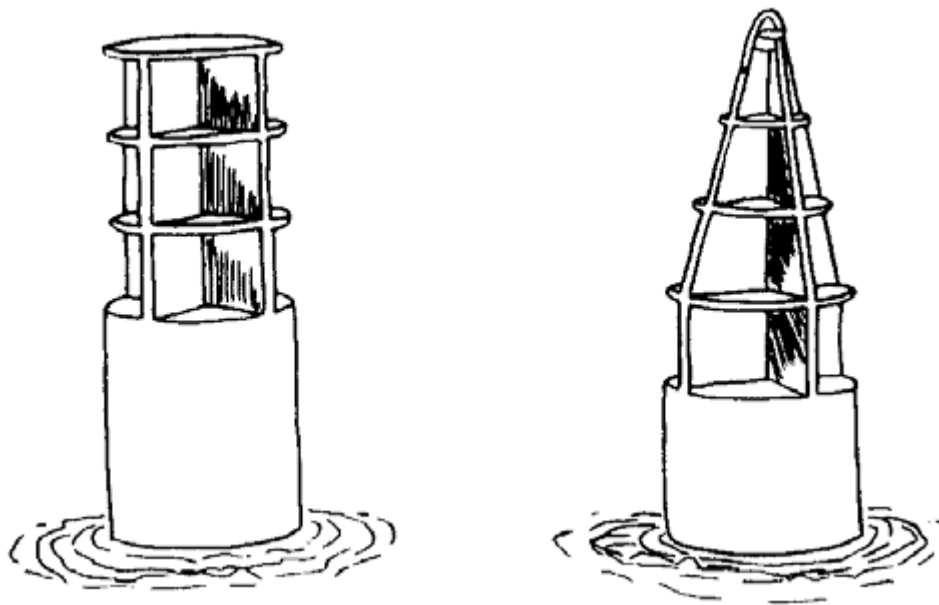
Shapes of buoys and beacons help identify them from a distance or at dawn or dusk, when colors may be hard to see. Like other characteristics of AtoN, mariners should not rely solely on shape to identify and aid.

A.7.a. Cylindrical (Can) Buoys

Cylindrical buoys, often referred to as “can buoys,” are unlighted AtoN. When used as a lateral mark, they indicate the left side of a channel or of the preferred channel when returning from the seaward. They are painted solid green and have a top reflective green band. Can buoys are also used as unlighted special marks and will be colored based on their use (see **Figure 13-2**)

A.7.b. Conical (Nun) Buoys

Conical buoys, often referred to as “nun buoys,” are unlighted AtoN. When used as a lateral mark, they indicate the right side of a channel or of the preferred channel when returning from seaward. They are painted solid red with a red reflective band near the top. Nun buoys may also be used as unlighted special marks and will be colored based on their use. (see **Figure 13-2**)



Can Buoy (Left)

Nun Buoy (right)

Figure 13-2

Can and Nun Buoys, “When Returning From Sea”

A.8. Light Colors

Though there are white and yellow lights, only AtoN with green or red lights have lateral significance. When proceeding in the conventional direction of buoyage, AtoN will display the following light colors:

- Green
- Red
- White and Yellow

A.8.a. Green

Green lights mark port sides of channels and wrecks or obstructions. When proceeding from seaward, these aids are passed by keeping them on the port side. Green lights are also used on preferred channel marks where the preferred channel is to starboard. When proceeding along the conventional direction of buoyage (from seaward), a preferred channel mark fitted with a green light would be kept on the port side.

A.8.b. Red

Red lights mark starboard sides of channels and wrecks or obstructions. When proceeding from seaward, these aids would be passed by keeping them on the starboard side. Red lights are also used on preferred channel marks where the preferred channel is to port. When proceeding along the conventional direction of buoyage (from seaward), a preferred channel mark fitted with a red light would be kept on the starboard side.

A.8.c. White and Yellow

White and yellow lights have no lateral significance. They are used on top of buoys to mark hazards.

A.8.d. Light Signals

Lights are installed on AtoN to provide signals to distinguish one navigation light from another, or from the general background of shore lights. [Lights used on the Great Salt Lake usually have a flashing pattern of once every one, two, or three seconds. \(fl 1", fl 2", fl 3" as denoted on a chart\).](#)

A.9. Retroreflective Material

Most minor AtoN are fitted with retroreflective material to increase their visibility at night. While this material does not produce light on its own, when illuminated by a light source (searchlight), it reflects the light back towards the operator with great intensity.

In most cases, the color of the reflective material panel is the same as the surface it covers (red on red, green on green). Numbers on buoys will either be white or black.

MEMORY AID: Red, Right, Return

A.10 Major Lights

[Major lights on the Great Salt Lake can be an AtoN even though not maintained by the Division. Some of these major lights would be the Kennecott smokestack. The MagCorp smokestack, the white light in White Rock Bay \(Antelope Island\), the radio towers at Little Mountain as well as the radio tower near SR 202. The coordinates of these lights along with their features are listed below:](#)

[\(Coordinates are listed in WGS 84\)](#)

[Kennecott Smokestack \(white row of vertical blinking strobes\) 40° 43.3' x 112° 11.880](#)

[Radio Tower at SR 202 & I-80 \(white light blinking at top\) 40° 44.710' x 112° 10.600'](#)

[Little Mountain Tower Array \(four towers with red blinking lights\) 41° 14.930' x 112° 15.287'](#)

[MagCorp Smokestack \(white lights\) 40° 54.940 x 112° 44.030](#)

Section B. U.S. Aid to Navigation System

B.1. Categories of Aid

The U.S. Aid to Navigation is designed for use by many types of operators and small vessels on lakes and inland waterways not shown on nautical charts. The conventional direction of buoyage is considered upstream or towards the head of navigation. This system has two categories of aids:

- System of AtoN compatible with and supplements the U.S. lateral system in states' waters, not federal jurisdiction.
- System of regulatory markers that warn of danger or provide general information and directions.

B.2. Regulatory Marks

Regulatory marks are white with two international orange horizontal bands completely around the buoy circumference. One band is near the top of the buoy while the second band is just above the waterline. Geometric shapes are placed on the buoy's body and are colored international orange. (See **Figure 13-11**) There are four basic geometric shapes authorized for these marks and each one has a specific meaning associated with it. These are:

- A vertical open-faced diamond shape having a cross centered in the diamond means that vessels are excluded from entering the marked area.
- A vertical open-faced diamond means danger.
- A circular shape indicates a control zone where vessels in the area are subject to certain operating restrictions.
- A square or rectangular shape is used to display information such as direction and/or distance to a location.

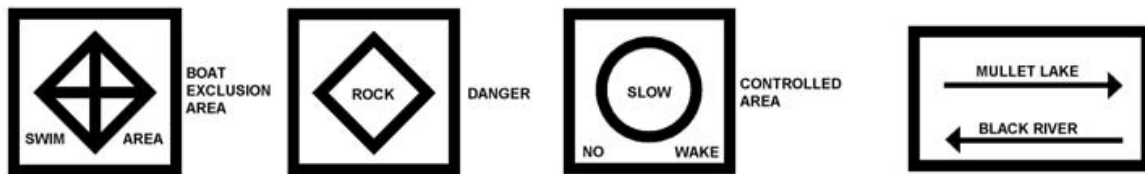


Figure 13-11
Regulatory Mark Information



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

LATERAL SYSTEM AS SEEN ENTERING FROM SEAWARD

PORT SIDE ODD NUMBERED AIDS	PREFERRED CHANNEL NO NUMBERS--MAY BE LETTERED	PREFERRED CHANNEL NO NUMBERS--MAY BE LETTERED	STARBOARD SIDE EVEN NUMBERED AIDS
<p>GREEN LIGHT ONLY</p> <p>FLASHING (2) </p> <p>FLASHING </p> <p>OCCULTING </p> <p>QUICK FLASHING </p> <p>ISO </p>	<p>PREFERRED CHANNEL TO STARBOARD</p> <p>TOPMOST BAND GREEN</p> <p>GREEN LIGHT ONLY</p> <p>COMPOSITE GROUP FLASHING (2+1) </p>	<p>PREFERRED CHANNEL TO PORT</p> <p>TOPMOST BAND RED</p> <p>RED LIGHT ONLY</p> <p>COMPOSITE GROUP FLASHING (2+1) </p>	<p>RED LIGHT ONLY</p> <p>FLASHING (2) </p> <p>FLASHING </p> <p>OCCULTING </p> <p>QUICK FLASHING </p> <p>ISO </p>
<p>1 LIGHT </p> <p>9 LIGHTED BUOY </p> <p>9 CAN </p> <p>5 DAYBEACON </p>	<p>A LIGHTED BUOY </p> <p>U CAN </p> <p>S CAN </p>	<p>B LIGHTED BUOY </p> <p>C NUN </p> <p>G DAYBEACON </p>	<p>2 LIGHT </p> <p>8 LIGHTED BUOY </p> <p>6 NUN </p> <p>2 DAYBEACON </p>

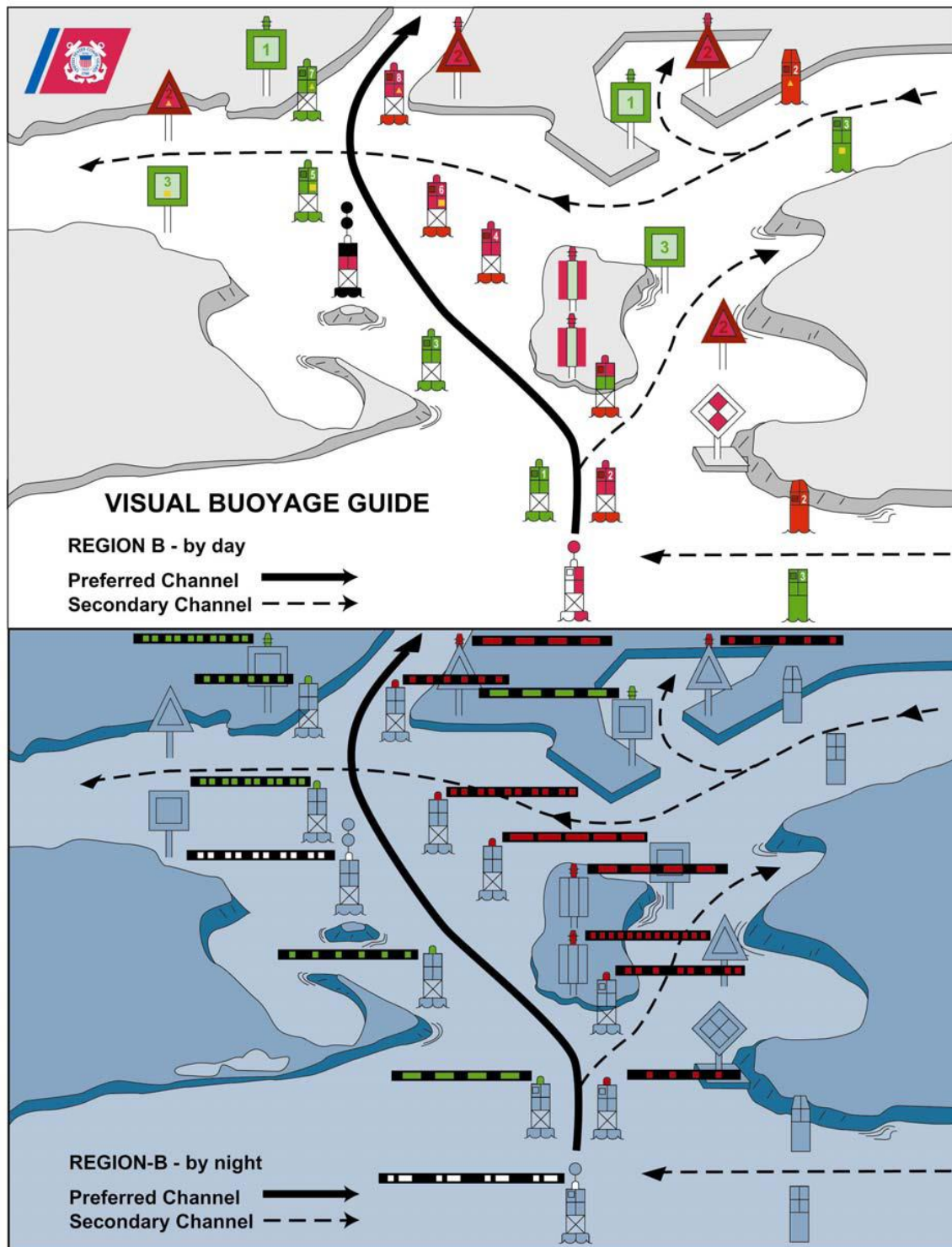
AIDS TO NAVIGATION HAVING NO LATERAL SIGNIFICANCE

ISOLATED DANGER NO NUMBERS--MAY BE LETTERED	SAFE WATER NO NUMBERS--MAY BE LETTERED
<p>WHITE LIGHT ONLY</p> <p>FI (2) 5s </p> <p>BR "A" FI (2) 5s </p> <p>BR "C" </p>	<p>WHITE LIGHT ONLY MORSE CODE</p> <p>Mo (A) </p> <p>MR </p> <p>SPHERICAL </p> <p>UNLIGHTED AND/OR SOUND </p>
<p>DAYBOARDS--MAY BE LETTERED</p> <p>WHITE LIGHT ONLY</p> <p>NR </p> <p>NG </p> <p>NB </p> <p>RW Bn </p> <p>GW Bn </p> <p>BW Bn </p>	<p>RANGE DAYBOARDS--MAY BE LETTERED</p> <p>KGW </p> <p>KWG </p> <p>KWB </p> <p>KBW </p> <p>KWR </p> <p>KRW </p> <p>KRB </p> <p>KBR </p> <p>KGB </p> <p>KBG </p> <p>KGR </p> <p>KRG </p>
<p>TYPICAL INFORMATION AND REGULATORY MARKS</p> <p>INFORMATION AND REGULATORY MARKERS</p> <p>WHEN LIGHTED, INFORMATION AND REGULATORY MARKS MAY DISPLAY ANY LIGHT RHYTHM EXCEPT QUICK FLASHING AND FLASHING (2)</p> <p>WHITE LIGHT ONLY</p> <p>NW </p> <p>W Bn </p> <p>DANGER </p> <p>EXCLUSION AREA </p> <p>RESTRICTED OPERATIONS </p> <p>DANGER </p>	<p>SPECIAL MARKS--MAY BE LETTERED</p> <p>YELLOW LIGHT ONLY</p> <p>FIXED FLASHING </p> <p>UNLIGHTED </p> <p>Y "A" </p> <p>N "C" </p> <p>Y "B" </p> <p>Y "B" FI </p> <p>SHAPE OPTIONAL--BUT SELECTED TO BE APPROPRIATE FOR THE POSITION OF THE MARK IN RELATION TO THE NAVIGABLE WATERWAY AND THE DIRECTION OF BUOYAGE.</p>

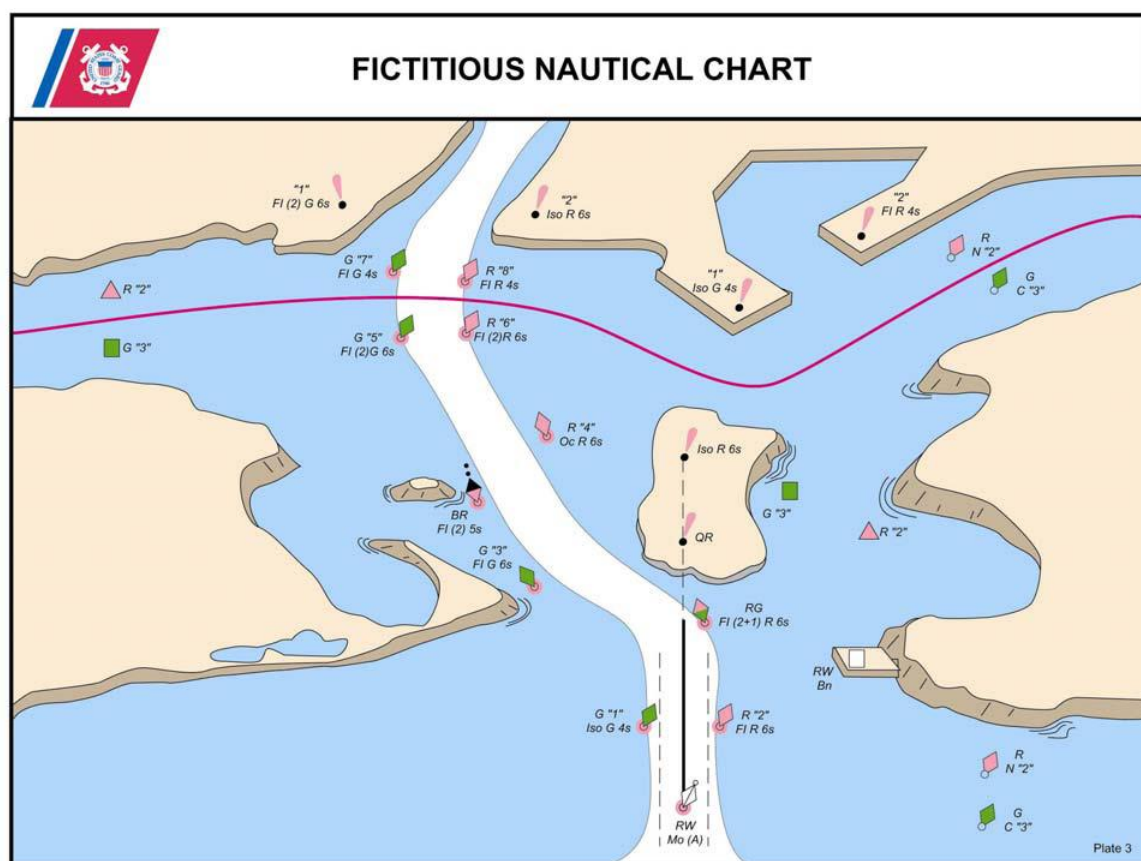
Aids to navigation marking the Intercoastal Waterway (ICW) display unique yellow symbols to distinguish them from aids marking other waters. Yellow triangles indicate aids should be passed by keeping them on the starboard (right) hand of the vessel. Yellow squares indicate aids should be passed by keeping 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

Section C. Visual Buoyage Guide



Section D. How the Visual Guide Would Appear on a Nautical Chart (Fictitious Nautical Chart)



Section E. Radionavigation Systems

Intr

Introduction

Radionavigation systems are used by mariners for obtaining a position fix. Depending upon their range and accuracy, some systems can be used in the middle of the ocean, or while entering a difficult harbor approach. All of the systems transmit a signal from a land or space-based transmitter to a shipboard receiver, allowing mariners to determine their position. The most recognizable systems are:

- LORAN-C
- Global Positioning System (GPS)
- Differential Global Positioning System (DGPS)

E.1. LORAN-C

Derived from the words long-range navigation, LORAN-C is a navigation system network of transmitters consisting of one master station and two or more secondary stations. LORAN-C is a pulsed, hyperbolic (uses curved lines) system. LORAN-C receivers measure the time difference (TD) between the master transmitter site signal and the secondary transmitter site signal to obtain a single LOP. A second pair of LORAN-C transmitting stations produces a second LOP. Plotting positions using TDs requires charts overprinted with LORAN-C curves. However, most LORAN-C receivers can convert LORAN-C signals into a readout of latitude and longitude. The mariner then can use a standard nautical chart without LORAN-C curves.

E.1.a. Accuracy

LORAN-C is accurate to better than 460 meters and available better than 99.9% of the time for each station. When used to return to a position with known TDs, LORAN-C can produce an accuracy within 20 meters (60 feet).

E.1.b. Area Coverage

U.S. and Canadian coastal areas are covered by LORAN-C transmitter sites controlled by the U.S. Coast Guard. LORAN-C is used by other countries and provides coverage for most of the North Atlantic, Europe, Mediterranean Sea, Japan, China, and Korea

E.2. Global Positioning System (GPS)

The Global Positioning System (GPS) is a system of 24 satellites operated by the Department of Defense (DoD). It is available 24 hours per day, worldwide, in all weather conditions. Each GPS satellite transmits its precise location, meaning position and elevation. In a process called “ranging,” a GPS receiver on the boat uses the signal to determine the distance between it and the satellite. Once the receiver has computed the range of at least four satellites, it processes a position that is accurate to within 13 meters horizontally. GPS provides two levels of service:

- Standard Positioning Service (SPS) for civilian users
- Precise Positioning Service (PPS) for military users.

E.2.a. Standard Positioning Service

SPS is available on a continuous basis to any user worldwide. It is accurate to a radius within 13 meters of the position shown on the receiver about 99% of the time.

E.2.b. Precise Positioning Service

PPS provides position fixes accurate to within 10 meters. This service is limited to approved U.S. Federal Government, allied military, and civil users.

E.3. Differential Global Positioning System (DGPS)

The Coast Guard developed DGPS to improve upon SPS signals of GPS. It uses a local reference receiver to correct errors in the standard GPS signals. These corrections are then broadcast and can be received by any user with a DGPS receiver. The corrections are applied within the user’s receiver providing mariners with a position that is accurate within 10 meters, with 99.7% probability.

The Coast Guard uses selected marine radiobeacons to send DGPS corrections to users. DGPS provides accurate and reliable navigation information to maritime users in Harbor Entrance and Approach (HEA), along U.S. coastal waters, the Great Lakes, navigable portions of the western rivers, Puerto Rico, Hawaii, and Alaska.

Section F. AtoN on the Great Salt Lake

Introduction

The Division places and maintains multiple AtoN around Great Salt Lake. Placing and maintaining these buoys is the responsibility of the Harbor Master. Types of buoys that are maintained are:

- Deep Channel for the Great Salt Lake Marina
- Reef Channel for the Great Salt Lake Marina
- Channel Markers for Antelope Island Marina
- Danger or Hazard Buoys.

F.1 Channel Markers for Antelope Island Marina

(All positions are based on WGS 84 and are in hddd mm.mmm)

Description	Name	Latitude	Longitude	Description/Light
Entrance	Ant G1	41° 03.914	112° 14.456	Green Can buoy fl 2"
Entrance	Ant R1	40° 03.893	112° 14.526	Red Nun buoy fl 2"

F.2. Deep Channel for the Great Salt Lake Marina

(All positions are based on WGS 84 and are in hddd mm.mmm)

Description	Name	Latitude	Longitude	Description/Light
	GSLM G1	40° 44.901	112° 12.492	Green Can buoy fl 2"
	GSLM R2	40° 44.879	112° 12.545	Red Nun buoy fl 2"
	GSLM G3	40° 44.499	112° 12.374	Green Can buoy
	GSLM R4	40° 44.525	112° 12.400	Red Nun buoy fl 2"
	GSLM G5	40° 44.393	112° 12.496	Green Can buoy
	GSLM R6	40° 44.418	112° 12.518	Red Nun buoy
	GSLM G7	40° 44.290	112° 12.638	Green Can buoy
	GSLM R8	40° 44.310	112° 12.673	Red Nun buoy
	GSLM G9	40° 44.230	112° 12.742	Green Can buoy
	GSLM R10	40° 44.252	112° 12.758	Red Nun buoy
	GSLM G11	40° 44.124	112° 12.848	Green Can buoy fl 2"
	GSLM R12	40° 44.136	112° 12.891	Red Nun buoy fl 2"

F.3. Reef Channel for the Great Salt Lake Marina

Description	Name	Latitude	Longitude	Description/Light
	GSLM R-G1	40° 44.600	112° 13.122	Green Can buoy fl 2"
	GSLM R-R2	40° 44.564	112° 13.160	Red Nun buoy fl 2"

	GSLM R-G3	40° 44.330	112° 13.000	Green Can buoy fl 2"
	GSLM R-R4	40° 44.313	112° 13.031	Red Nun buoy fl 2"

F.4 Hazard and Danger Buoys

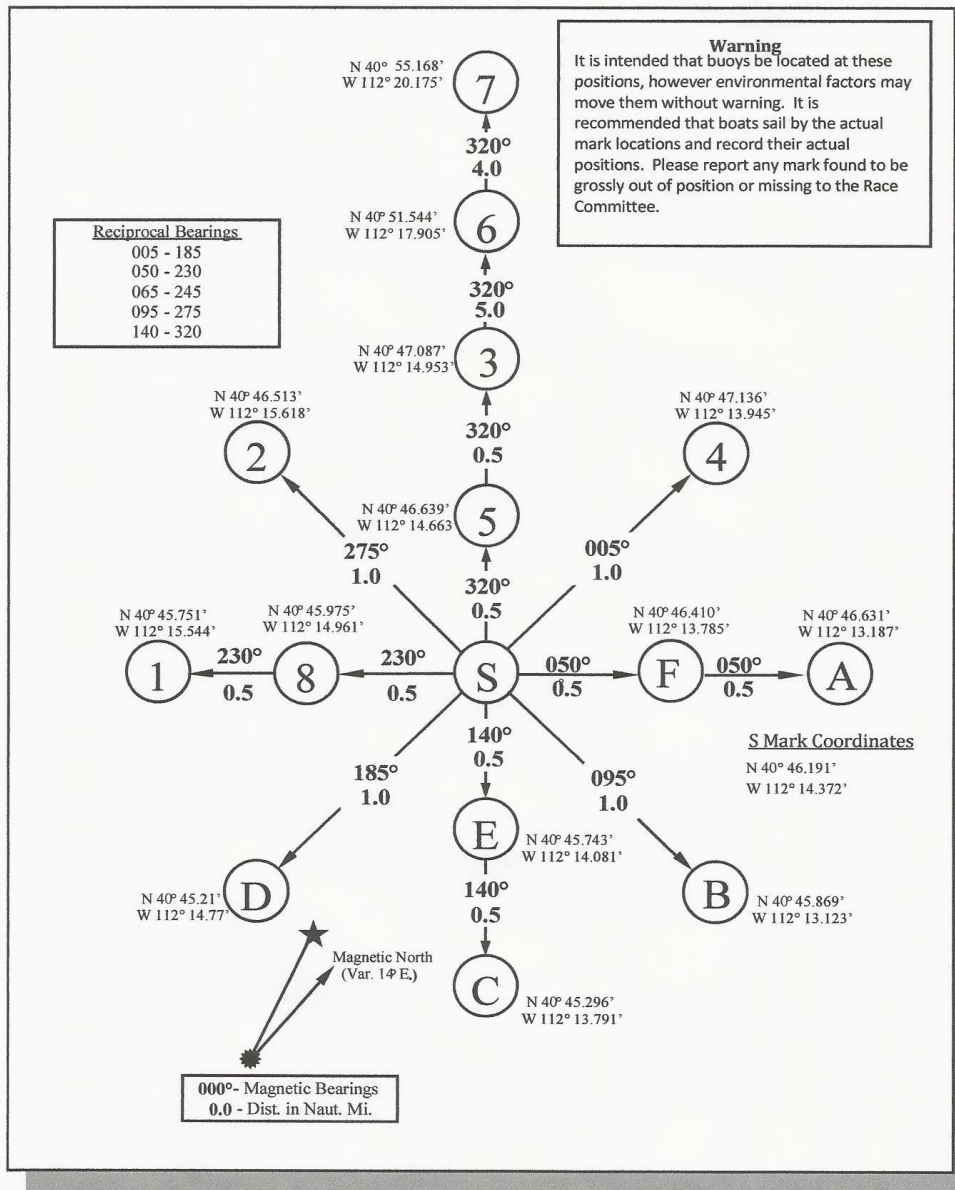
Description	Name	Latitude	Longitude	Description/Light
Eardley Warning Buoy	Eardley	40° 44.513	112° 17.900	White Can buoy fl 2"
Egg Island Warning Buoy	Egg	41° 04.493	112° 16.225	White Can buoy fl 2"
Hat Island Warning Buoy	Hat	41° 06.000	112° 33.500	White Can buoy fl 2"
Miera Spit Warning Buoy	Miera	40° 52.189	112° 15.000	White Can buoy fl 2"
Miller Point Warning Buoy	Miller	41° 10.273	112° 25.467	White Can buoy fl 2"
Quad County Line Buoy	Quad	41° 04.600	112° 29.600	White Can buoy

Section G. Other Buoys on the Great Salt Lake

Introduction

At times, other parties or agencies will apply for permission to place waterway markers, race buoys, research buoys on the lake. This section addresses these known buoys.

G.1. Great Salt Lake Yacht Club Racing Buoys



G.2. USGS Buoys

Description	Name	Latitude	Longitude	Description/Light

Last updated August 2014