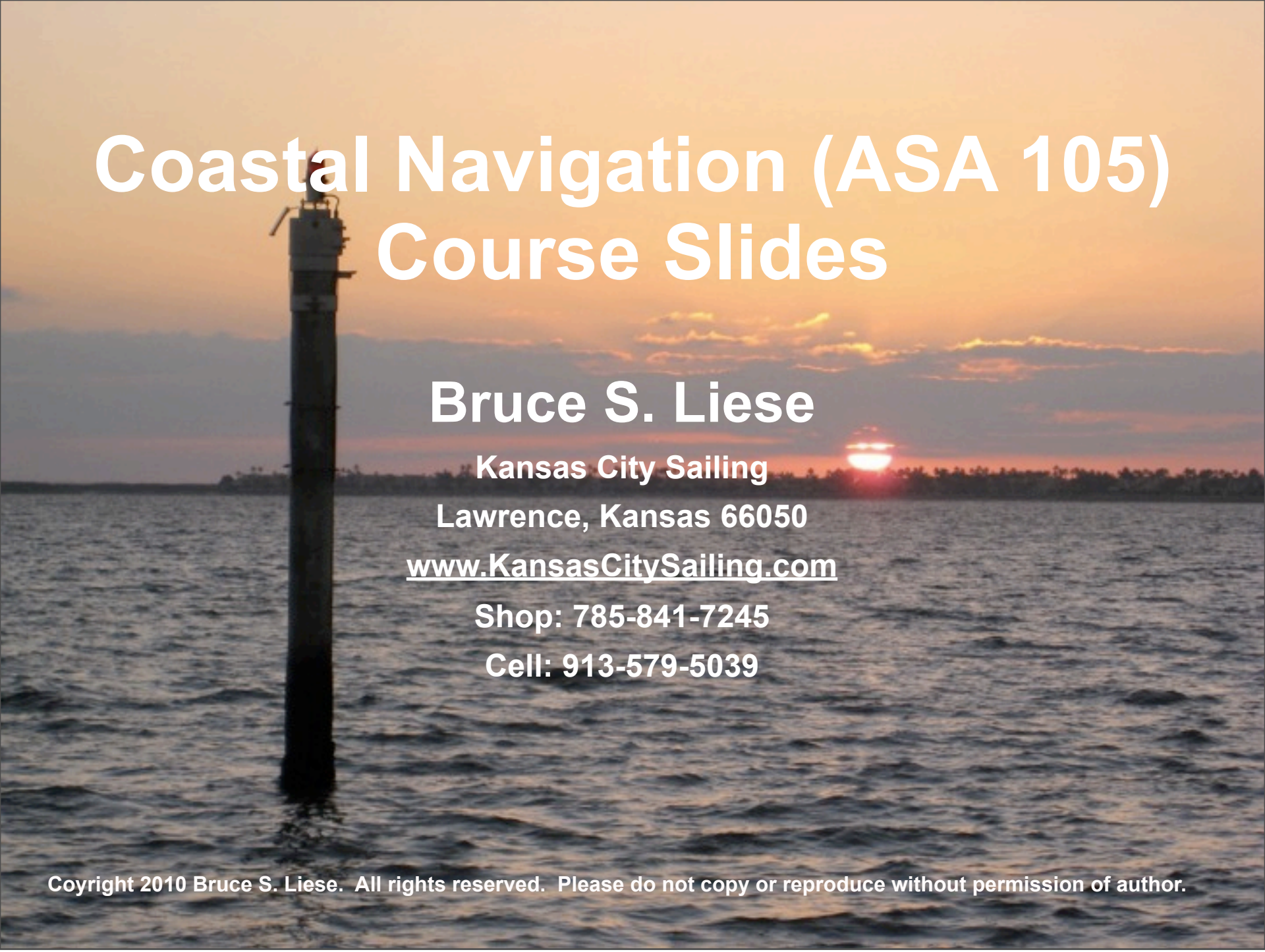

Coastal Navigation (ASA 105) Course Slides

Bruce S. Liese

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Cell: 913-579-5039

ASA 105 Knowledge Base

- Charts (symbols, longitude, latitude, coordinates, compass rose, scale)
- Publications (cruising guides, tide and current tables, navigation rules, light list)
- Sources and publishers
- Instruments (compass, rulers, dividers)
- Keeping charts current
- Tides and currents

ASA 105 Knowledge Base (con't)

- Plotting a position
- Charting a course
- Aids to navigation (ATONs)
- True, magnetic, compass directions
- Checking compass deviation
- Dead Reckoning (using speed, time, course to steer)
- Current and leeway (estimated position, course to steer)

Definitions

- ***Navigation***: Practical use of visual observations and charting to answer two questions:
  - "Where am I?"
  - "How can I safely get where I want to go?"

Definitions (con't)

- ***Coastal Navigation:*** **Passagemaking within sight of land (vs. celestial navigation which uses sun, moon, planets, stars)**
- ***Piloting:*** **Directing safe passage within very restrictive waters, with continuous reference to landmarks, buoys, soundings, etc.**

The Chart

- ***Mercator Projection***: Meridians of longitude run parallel to each other. Parallels of latitude cross at right angles (with the globe flattened out).
- ***Contents***: warnings, seabed, compass rose, ATONs, obstructions, facilities, topography, date, depth contours, landmarks, lights, natural features, title, currents, ports, variation.

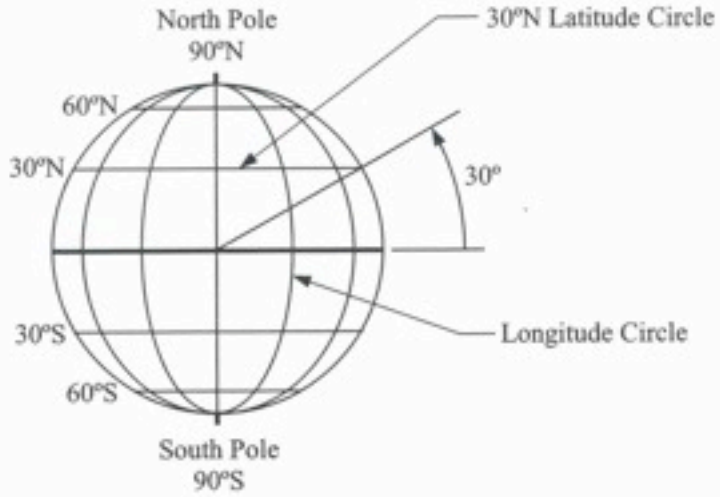


Figure 1-1: Side view of earth showing Latitude-Longitude Grid. In this view, Latitude Circles appear as straight lines and Longitude Circles appear as ellipses.

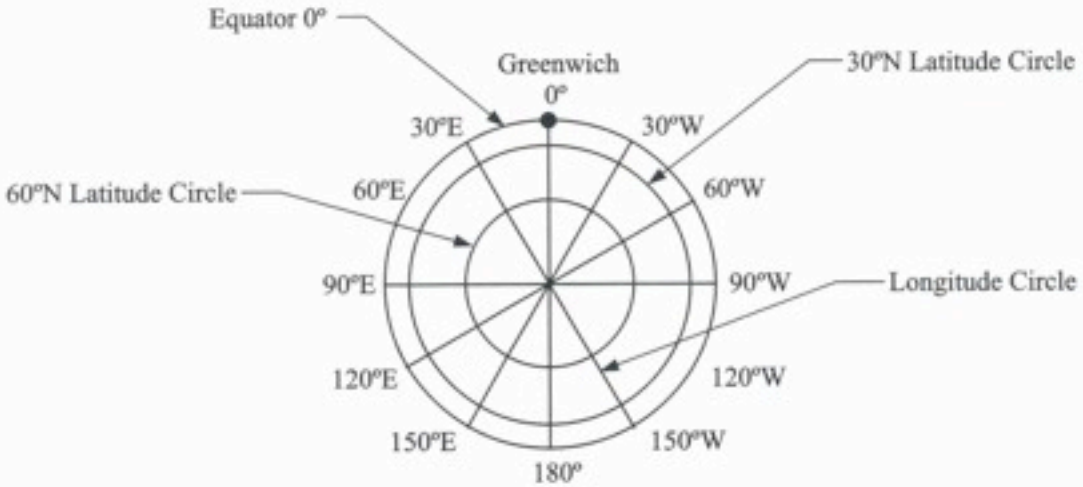


Figure 1-2: Top view of earth looking down on the North Pole. In this view, Latitude Circles appear as circles and Longitude Circles appear as straight lines.

The Chart (con't)

- ***General charts*** (1:600,000 to 1:150,000) show a portion of the coast with only enough detail for navigating between ports (small scale)
- ***Coastal charts*** (1:150,000 to 1:50,000) show a smaller portion of coast with enough detail to navigate in and out of ports and along shore
- ***Harbor charts*** are very detailed (large scale)
- ***Small craft charts*** include ICW, special areas, facilities, and services

35′ 71°30′ 25′

45′

NATIONAL OCEAN SERVICE

UNITED STATES — EAST COAST

MASSACHUSETTS — RHODE ISLAND

MARTHA'S VINEYARD TO BLOCK ISLAND

INCLUDING WESTERN APPROACH TO CAPE COD CANAL

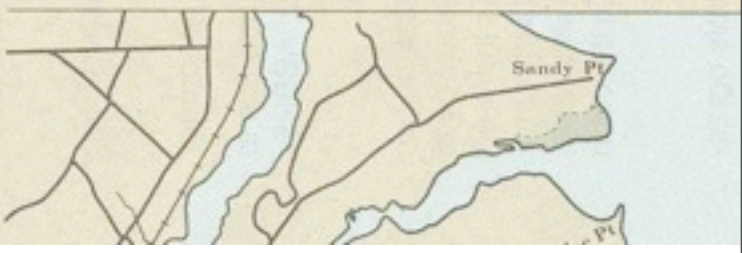
41°
40′

Mercator Projection
Scale 1:80,000 at Lat. 41°27′

SOUNDINGS IN FEET
AT MEAN LOW WATER

1 2

To find SPEED, place one point
right point on 60 and left point will



Mercator Projection
Scale 1:80,000 at Lat. 41°27′

SOUNDINGS IN FEET
AT MEAN LOW WATER

ANCHORAGE AREAS

202.140 (see note A)

Limits and design of anchorage areas are shown in color.

GENERAL ANCHORAGES–Except in great emergency all vessels shall anchor within these anchorage areas.

(C) (D) (E)
(F) (I)

LOCAL MAGNETIC DISTURBANCE

Differences of as much as 3° from the normal variation have been observed on Cuttyhunk Island between Buzzards Bay and Vineyard Sound.

NOTE A

Navigation regulations are published in Chapter 2, Coast Pilot 2, or subsequent yearly supplements and weekly Notices to Mariners. Copies of regulations may be obtained at the office of the District Engineer, Corps of Engineers in Waltham, Mass.

Refer to sections number shown with area designation.

AUTHORITIES

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

HEIGHTS

Heights in feet above Mean High Water

RACING BUOYS

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

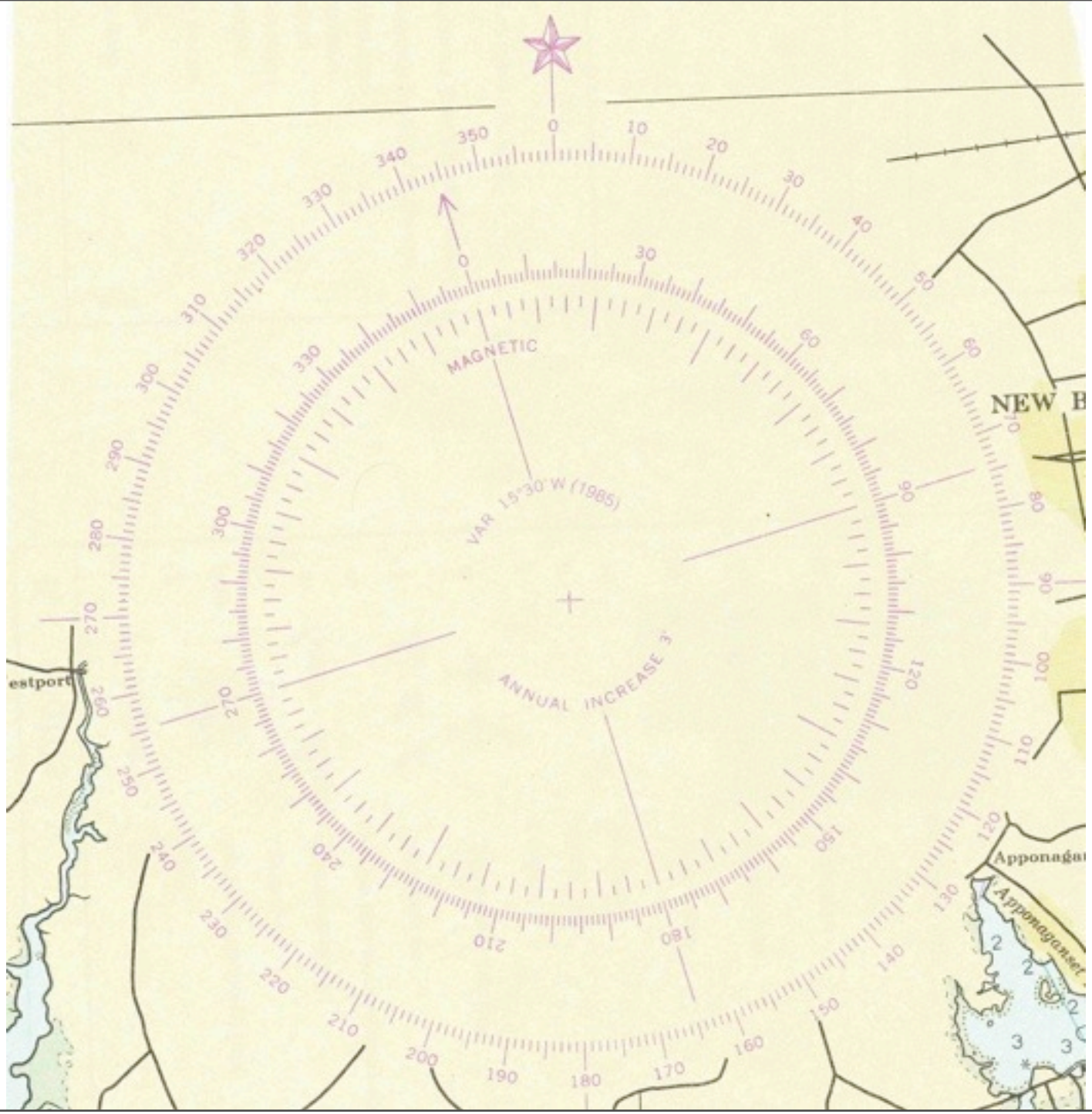
NOTE B
FISH TRAP AREAS

Boundary lines of fish trap areas are shown thus: ——— — ——— — ———

Submerged piling may exist in these areas.

Areas 2 and 3 are available for fish traps from April 25 to July 25.

CAUTION


MAGNETIC
VAR 15°30'W (1985)
ANNUAL INCREASE 3'
NEW B
estport
Apponagan
Apponagansett

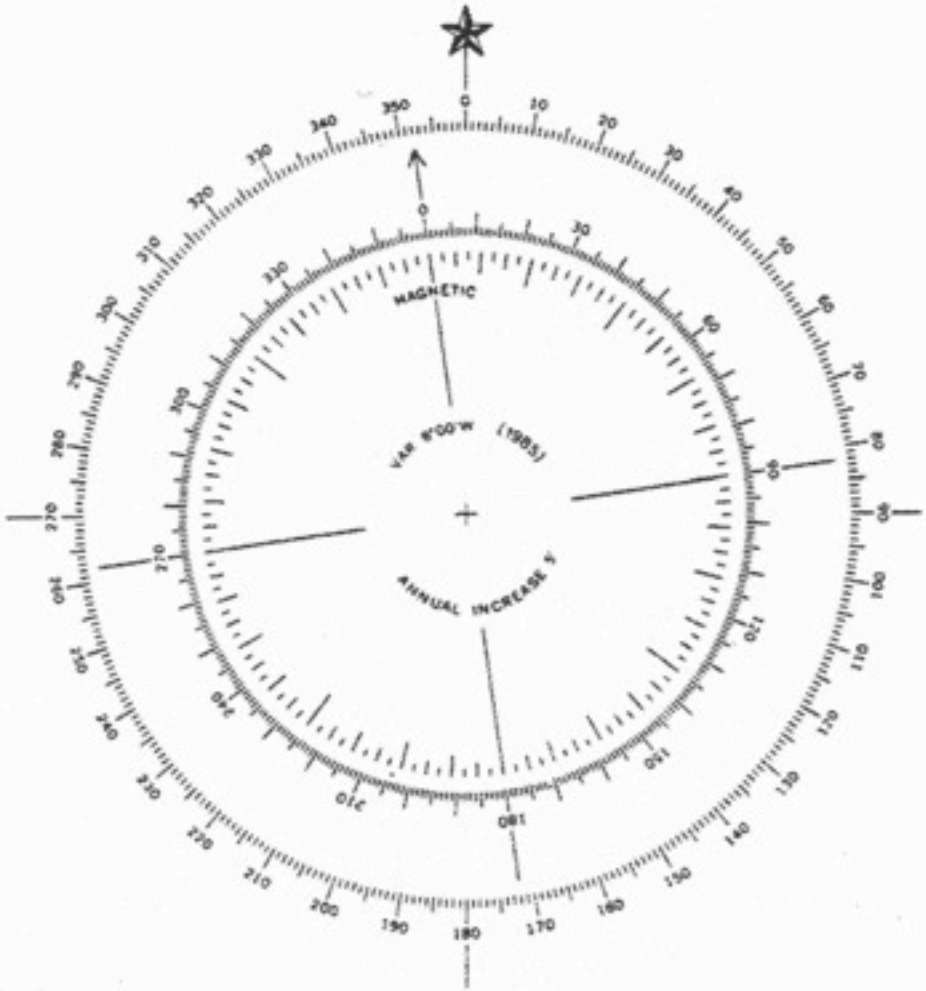


Figure 1-7: Compass Rose from a coastal chart showing True North (outer circle with a star) and Magnetic North (middle circle with an arrow head). The innermost circle is divided into 32 "points" and these are each divided into "1/4 points"; this scale is generally not used by mariners in modern times.

Dangers

		Old symbols for wrecks
	PA	*Wreck always partially submerged*
+++		*Sunken wreck dangerous to surface navigation (less than 11 fathoms over wreck)*
+++		*Sunken wreck covered 20 to 30 meters*
5½ Wk	+++ (9)	*Wreck over which depth is known*
21 Wk	5 Wk	*Wreck with depth cleared by wire drag*
5 Wk	+++ 21 Wk	
8 Wk		*Unsurveyed wreck over which the exact depth is unknown, but is considered to have a safe clearance to the depth shown*
+++		*Sunken wreck, not dangerous to surface navigation*
Foul	#	*Foul ground, Foul bottom*

28			*Wreck*
29	Wreckage	Wks	*Wreckage*
29a			*Wreck remains (dangerous only for anchoring)*
• 30	Subm piles	Subm piling	*Submerged piling*
	Subm piles	Stakes, Perches	
• 30a	Snags	Stumps	*Snags; Submerged stumps*
31			*Lesser depth possible*
32	Uncov		*Dries*
33	Cov		

Q Soundings

1 SD — *Doubtful sounding*

2 65 — *No bottom found*

3 (23) 1036 — *Out of position*

4 (5) — *Least depth in narrow channels*

5 30 FEET APR 1984 — *Dredged channel (with controlling depth indicated)*

6 24 FEET OCT 1983 — *Dredged area*

7 6 — *Swept channel*

8 2 — *Drying (or uncovering) heights above chart sounding datum*

9 89 17 119 15 — *Swept area, not adequately sounded (shown by purple or green tint)*

9a 29 23 3 22 8 30 19 7 21 18 — *Swept area adequately sounded (swept by wire drag to depth indicated)*

10 — *Hairline depth figures*

10a 19 8_2 $7\frac{3}{4}$ — *Figures for ordinary soundings*

11 — *Soundings taken from foreign charts*

12 8_2 19 — *Soundings taken from older surveys (or smaller scale charts)*

13 8_2 19 — *Echo soundings*

14 8_2 19 — *Sloping figures*

15 8_2 19 — *Upright figures*

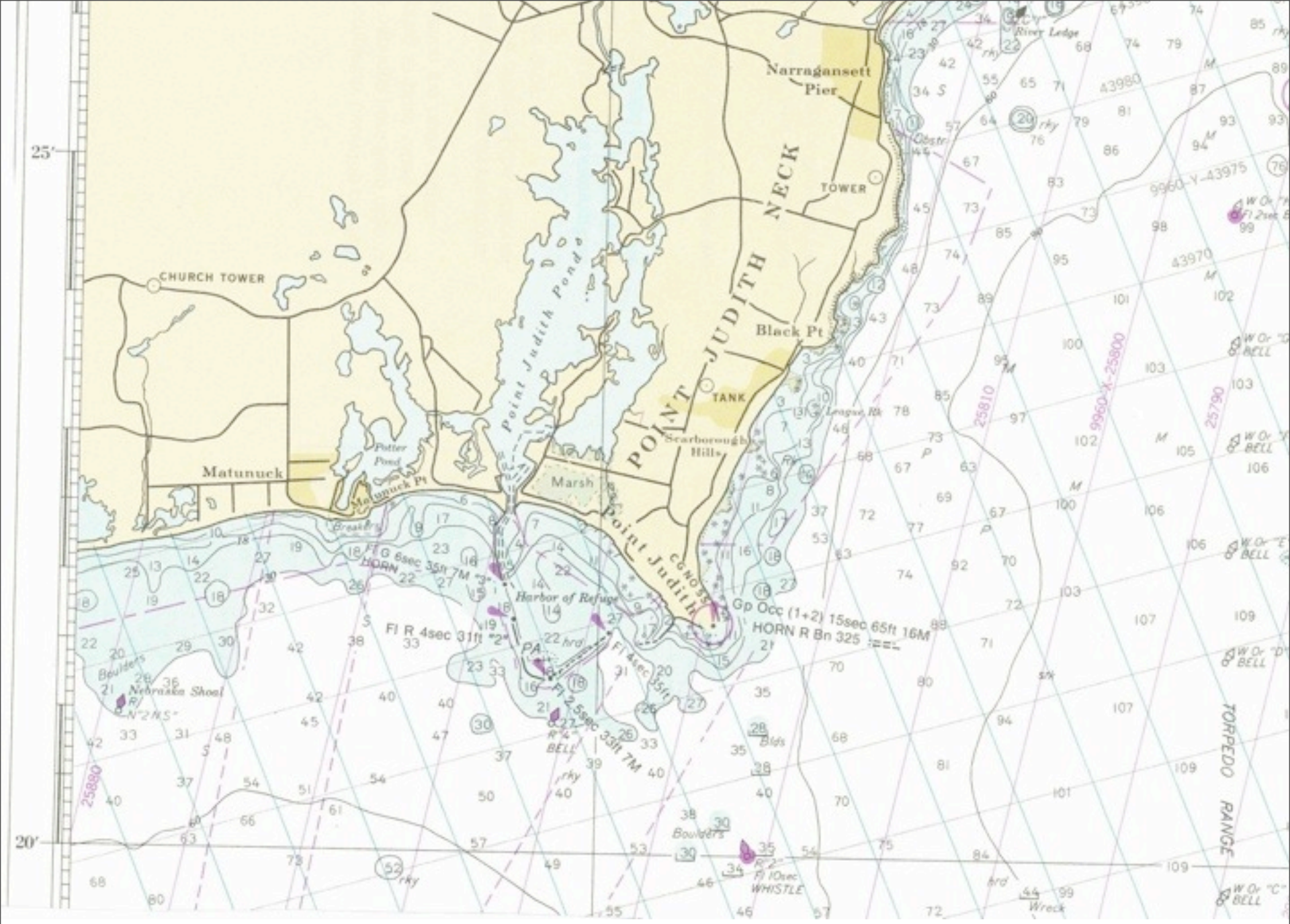
16 (25) (2) — *Bracketed figures*

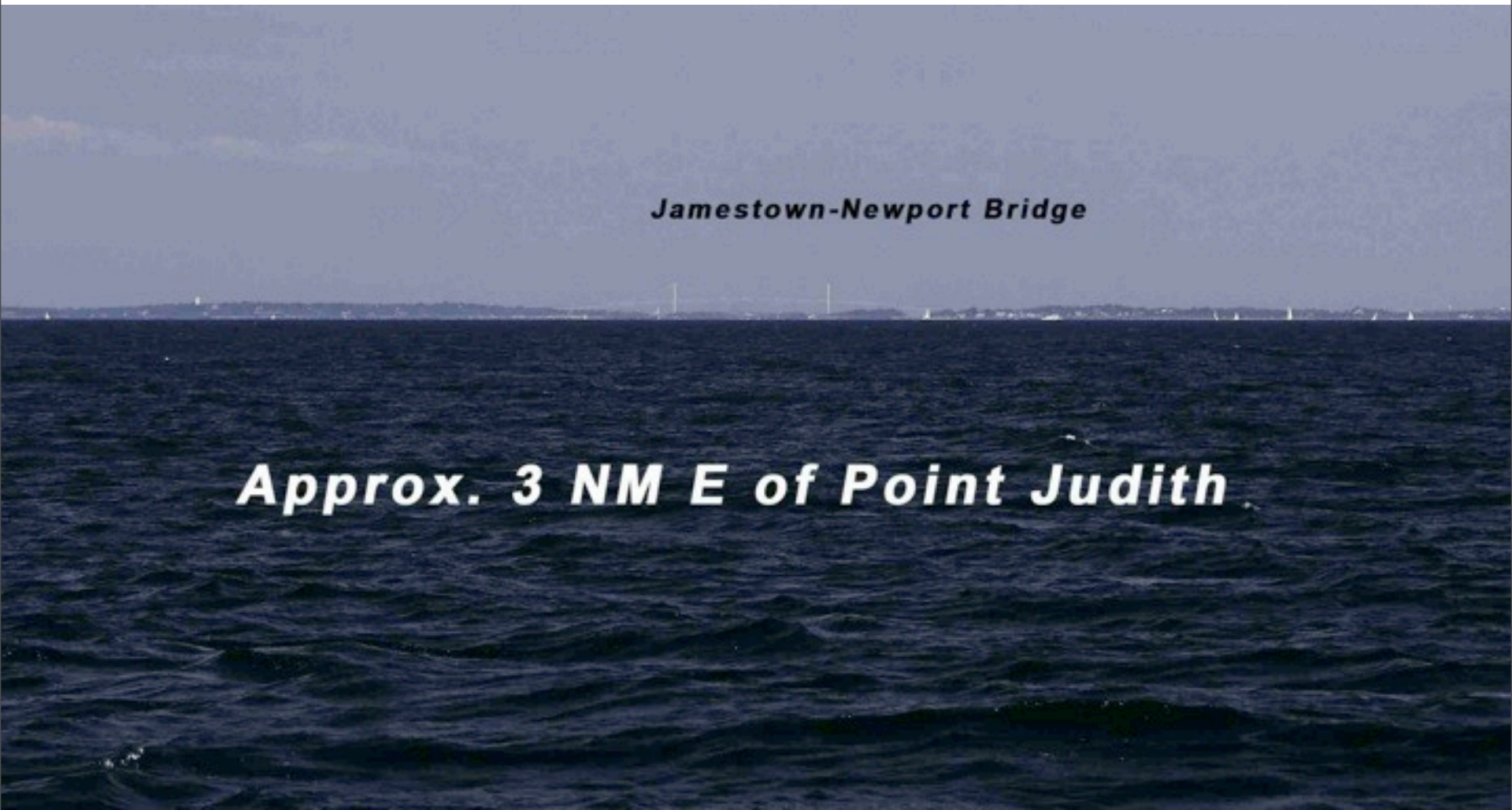
17 6 — *Underlined sounding figures (drying)*

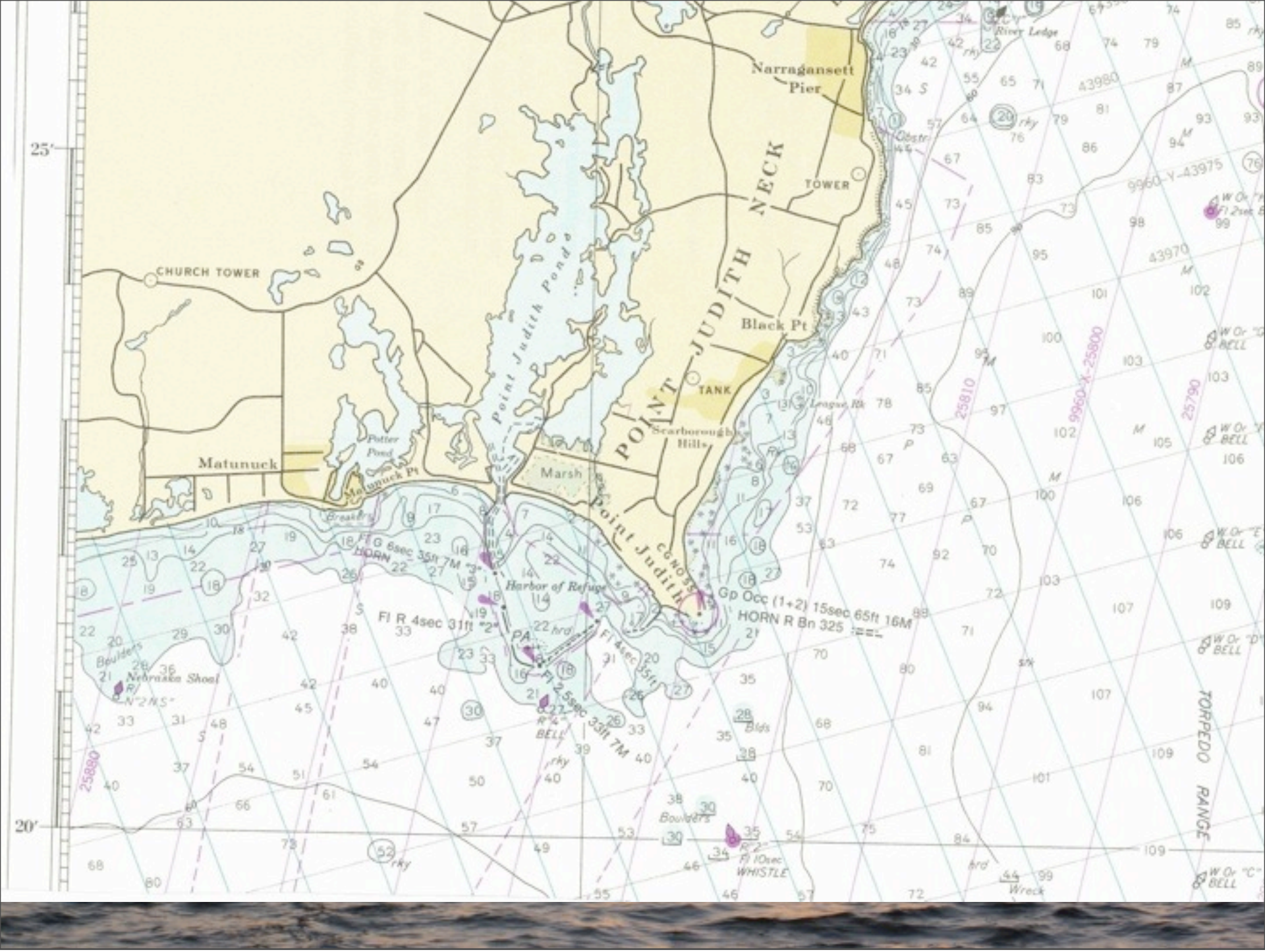
18 3_2 6_1 — *Soundings expressed in fathoms and feet*

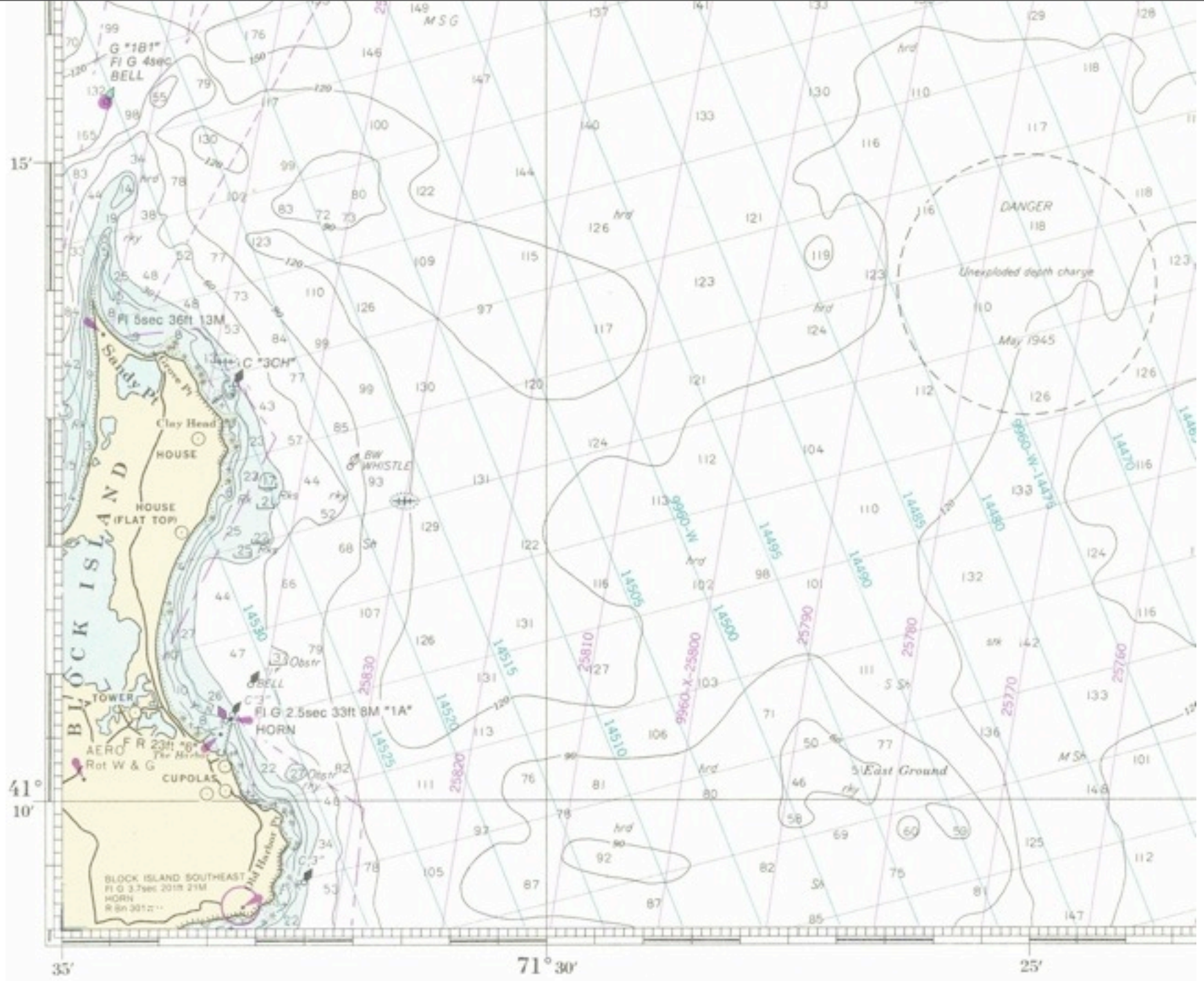
22 — *Unsounded area*

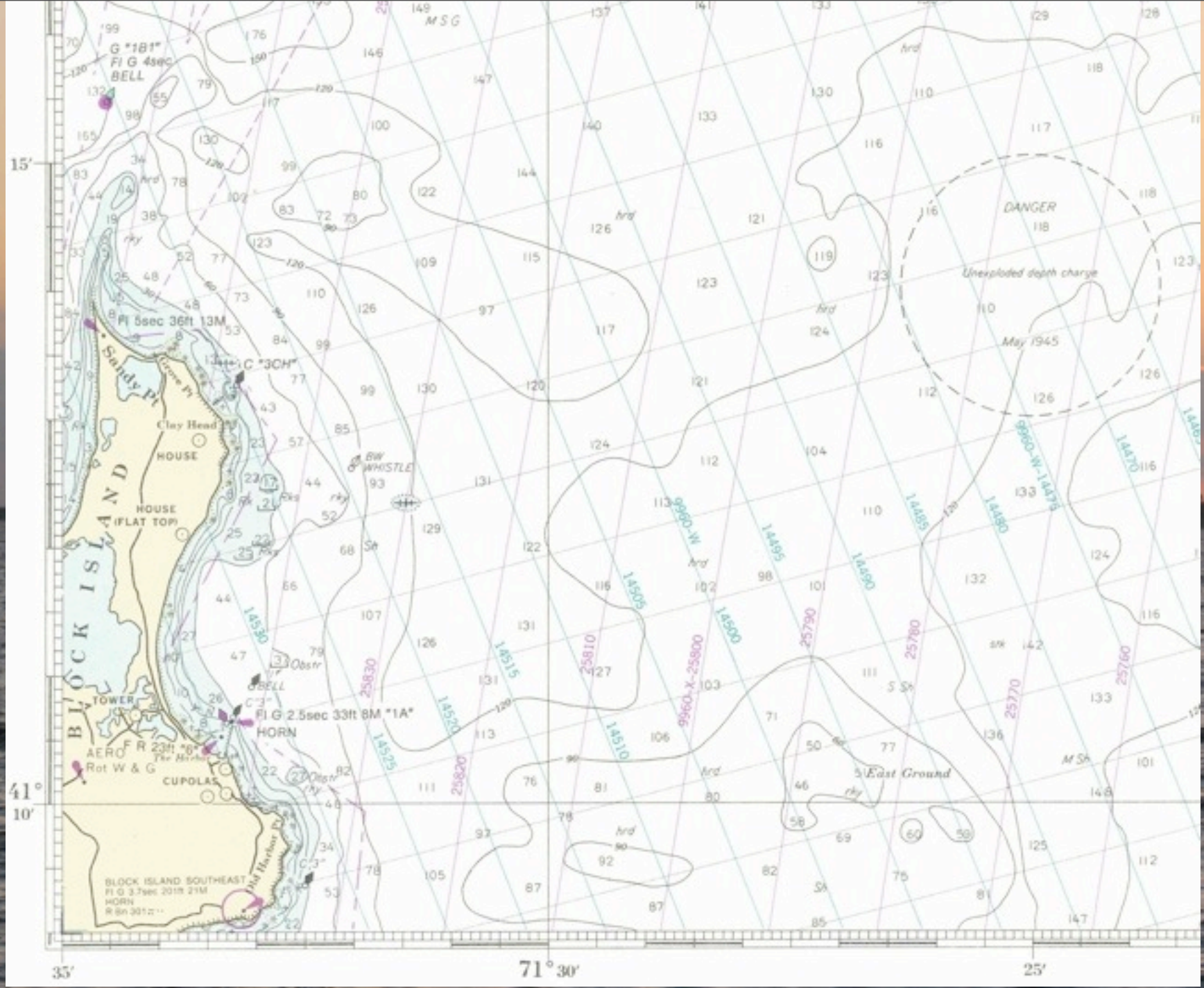
(Qa) 6 5 2 ft — *Stream*


Narragansett Pier
TOWER
POINT JUDITH NECK
Point Judith Pond
CHURCH TOWER
Black Pt
TANK
Scarborough Hills
Potter Pond
Matunuck
Matunuck Pt
Breakers
Marsh
Point Judith
Harbor of Refuge
Fl R 4sec 31ft "2"
Fl G 6sec 35ft 7M "3"
HORN 22
Gp Occ (1+2) 15sec 65ft 16M
HORN R Bn 325
Fl 4sec 35ft
Fl 2.5sec 35ft 7M
Nebraska Shoal
Boulders
Fl 10sec
WHISTLE
Wreck
TORPEDO RANGE
25'
20'




Narragansett Pier
TOWER
POINT JUDITH NECK
Point Judith Pond
CHURCH TOWER
Black Pt
TANK
Scarborough Hills
Potter Pond
Matunuck
Matunuck Pt
Marsh
Point Judith
Harbor of Refuge
Fl R 4sec 31ft "2"
Fl G 6sec 35ft 7M "3"
HORN 22
Gp Occ (1+2) 15sec 65ft 16M
HORN R Bn 325
Fl 4sec 35ft
Fl 2.5sec 35ft 7M
Nebraska Shoal
Boulders
Fl 10sec WHISTLE
Wreck
TORPEDO RANGE
25'
20'


G "1B1"
Fl G 4sec
BELL
Fl 5sec 36ft 13M
C "3CH"
Sandy Pt
Clay Head
HOUSE
HOUSE
(FLAT TOP)
BLOCK ISLAND
TOWER
AERO
Rot W & G
CUPOLAS
BELL
Fl G 2.5sec 33ft 8M "1A"
HORN
F R 23ft "6"
BLOCK ISLAND SOUTHEAST
Fl G 3.7sec 20ft 21M
HORN
DANGER
Unexploded depth charge
May 1945
East Ground
15'
41° 10'
35'
71° 30'
25'



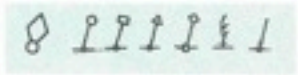
Sunday, March 21, 2010

L Buoys and Beacons

48 Bu Blue

48a Am Amber

48b Or Orange

• 51  Floating beacon (and variations)

• 52 Fixed beacons (unlighted or daybeacons)

Triangular beacon

Black beacon

Square and other shaped beacons

Color unknown

Variations

53 Bn Beacon, in general

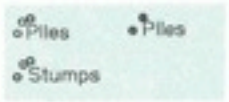
54 Tower beacon

55 Cardinal marking system

56 Deviation Bn Compass adjustment beacon

57 Topmarks

58 Telegraph-cable (landing)

• 59 

Piles

Stumps

Stakes, perches

(Lc) MARKER Marker Private aid to navigation

61 CAIRN Cairn Cairn

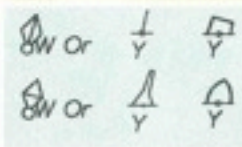
62 Painted patches

63 Landmark (position accurate)

(Ld) Landmark (position approximate)

64 REF Reflector

65 MARKER Range targets, markers

(Le) 

Special-purpose buoys

66 Oil installation buoy

67 Drilling platform

70 NOTE: Refer to IALA Buoyage System description on page 48 for aids used in certain foreign waters.

71 LANBY (Large Auto. Nav. Buoy); Superbuoy

72 TANKER terminal buoy (mooring)

73 ODAS ODAS (Oceanographic Data Aquisition System)

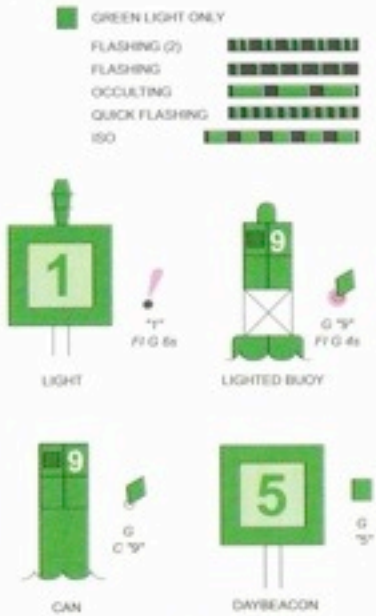
(Lg) Art Articulated light

U.S. AIDS TO NAVIGATION SYSTEM

On navigable waters and some waters marked by States

LATERAL SYSTEM (As Seen Entering From Seaward)

PORT SIDE
ODD NUMBERED AIDS

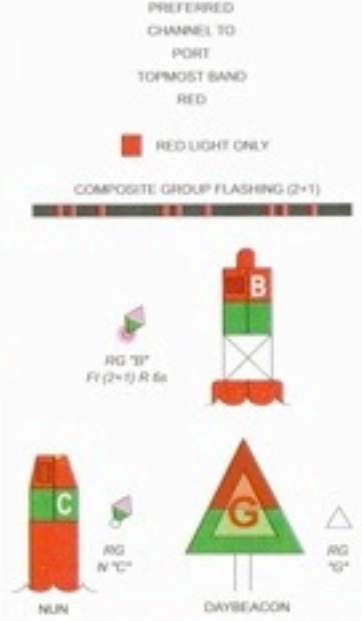


PREFERRED CHANNEL
NO NUMBERS-MAY BE LETTERED

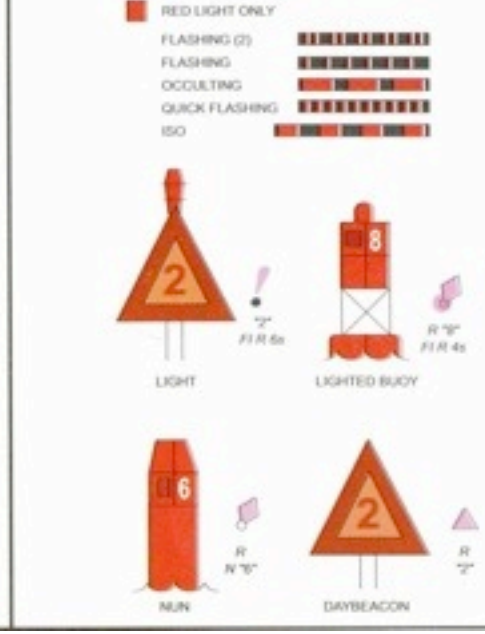
PREFERRED CHANNEL TO STARBOARD TOPMOST BAND GREEN

PREFERRED CHANNEL
NO NUMBERS-MAY BE LETTERED

PREFERRED CHANNEL TO PORT TOPMOST BAND RED



STARBOARD SIDE
EVEN NUMBERED AIDS



Nautical Measurement

- ***Direction***
  - Measured in relation to North (0°)
  - Expressed in degrees (N=0° or 360°; E=90°; S=180°; W=270°)
  - ***Course***: direction you steer the boat
  - ***Bearing***: direction of a charted landmark
  - ***Compass***: the boat's magnetic connection
  - ***Compass rose*** (on the chart): includes an inner and outer circle, variation, change

Nautical Measurement (con't)

- ***Location*** **(2 ways of plotting):**
  - **Direction and distance from charted mark**
  - **Geographic coordinates**
- **Every point on the chart has a coordinate**
- **Expressed as longitude and latitude**

Nautical Measurement (con't)

- ***Distance***
  - ***Nautical mile*** = 6,076 feet (vs. 5,280)
  - ***Knot*** = 1.15 statute M.P.H.
  - ***Degree of latitude*** = 60 miles
  - ***Each minute*** = 1 mile
  - Never use longitude for measurement

Distance, Time, Speed

- Time = Distance/Speed
- 4 hours = 20 miles/5 knots

- Speed = Distance/Time
- 5kn = 20 miles/4 hours

Tools and Instruments

- Compass (binnacle and handheld)
- Course plotters and parallel rulers
- Dividers/drafting compass
- Protractors
- Pencil, sharpeners, erasers
- Timepiece/stopwatch
- Binoculars

Tools and Instruments (con't)

- Calculator
- Nautical slide ruler
- Triangle
- Depth sounder
- Maneuvering board

Publications

- National Oceanic and Atmospheric Administration (NOAA) Charts
- Coast Pilot
- Local Notice to Mariners
- Light List
- Chart #1
- Navigation Rules
- Tide and Current Tables
- Cruising Guides

Navigation Exercise

- Choose a nautical chart and find:
  - A mid-channel marker
  - Highest surrounding land
  - A lighthouse (and explain light characteristics)
  - Good features to take bearings and get a three-point fix

Navigation Exercise (con't)

- Where is this chart from?
- What's the scale?
- How old is this chart?
- How are depths measured?
- What's the variation? How much does variation change each year?
- What are some dangers, obstructions?
- Where would you go in a storm?

Navigation Exercise (con't)

- Plot a round trip outing – one day only
- Give coordinates for start, destination
- Distance round trip? Course (magnetic and true) for all legs?
- How did you choose this course?
- Did you sail the entire way?
- What other resources, instruments do you need (besides the chart)?

Direction: True, Magnetic, Compass

- *True north* – geographic pole of the Earth, axis of its rotation
- *Magnetic north* – north magnetic pole, some distance from geographic pole
- *Compass north* – Direction pointed by a particular compass while it's on a particular heading
- *Variation* – Difference between True North and Magnetic North measured at a particular position
- *Deviation* – inaccuracy due to either defects of a compass or magnetic influences on boat

Robert Barrueco

- Marine Electronics
- Compass Adjuster
- Services
- Installation

DEVIATION CERTIFICATE

Compass — Date

Ritchie's Steering

VESSEL S/V "Invictus" DR 4°39'W.

LATITUDE 25°46'N. LONGITUDE 80°08'W.

SHIPS HEAD	DEV.	STEER	SHIPS HEAD	DEV.	STEER
0-N	0	N	180-S	0	180
15			195		
30	0	030	210	0	210
45-NE			225-SW		
60	0	060	240	0	240
75			255		
90-E	0	090	270-W	0	270
105			285		
120	0	120	300	0	300
135-SE			315-NW		
150	0	150	330	0	330
165			345		

DEVIATIONS DETERMINED BY: ☑ SUN'S AZIMUTH ☐ GYRO ☐ SHORE BEARINGS

B ____ MAGNETS RED ☐ FORE ☐ AFT AT ____° FROM COMPASS CARD

C ____ MAGNETS RED ☐ PORT ☐ STBD AT ____° FROM COMPASS CARD

D ____ ☐ SPHERES ☐ CYLS AT ____° HEELING MAGNET: ☐ RED UP ____° ☐ BLUE UP

REMARKS:

Adjuster

DIGITAL BEEPER – 939-7435 HOME TELEPHONE – 667-6036

Correcting for Variation and Deviation

- **T**rue direction
- **V**ariation
- **M**agnetic Direction
- **D**eviation
- **C**ompass Direction

Worksheet:

T_____

V_____

M_____

D_____

C_____

Dead Reckoning

- Lays out where you're going and a path for getting there (pre-trip)
- Can also be used to determine where you've been and where you are (during trip)
- To lay a plot you need to know:
  - Direction steered
  - Distance traveled

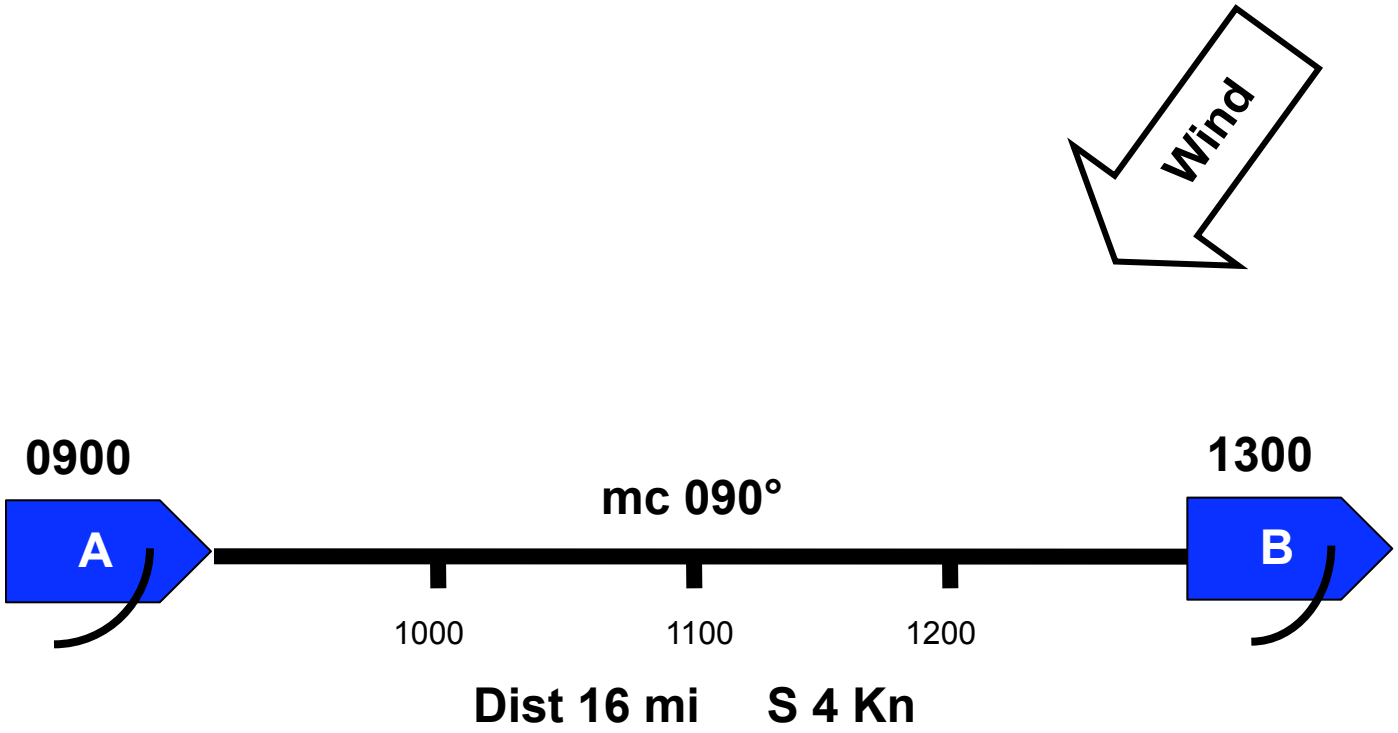
Dead Reckoning (con't)

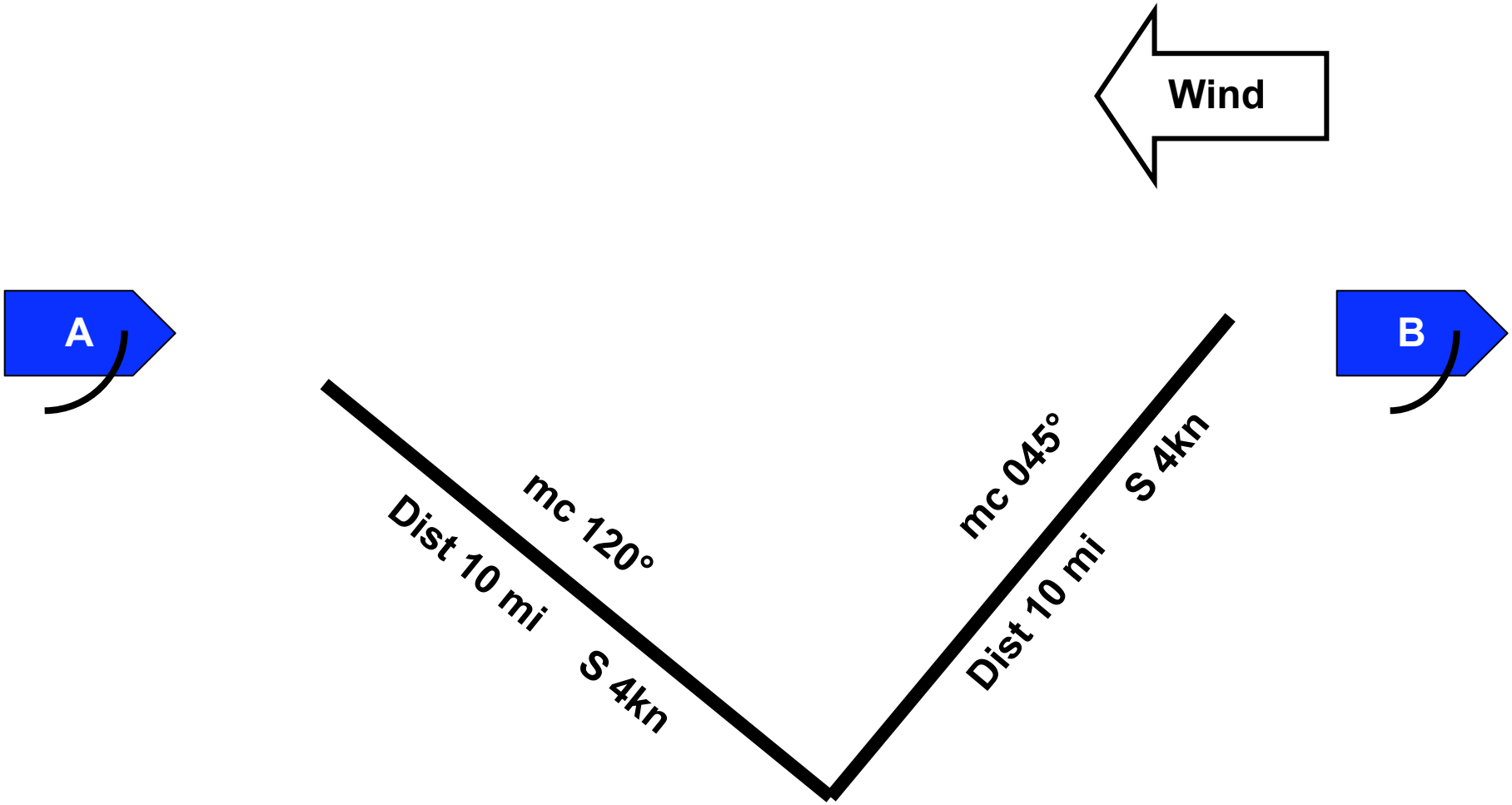
- The nuts and bolts of DR:
  - Draw the course line
  - Measure direction
  - Measure distance
  - Anticipate speed
  - Note all of these on course line

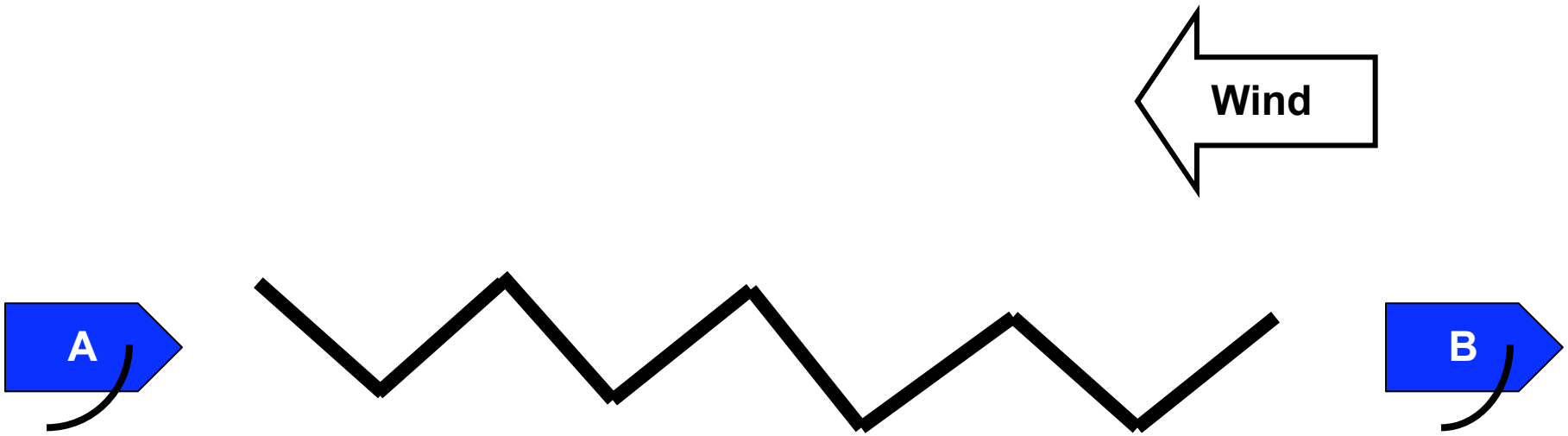
Navigation/Piloting Notation

- Use 24-hour clock (e.g., 0825)

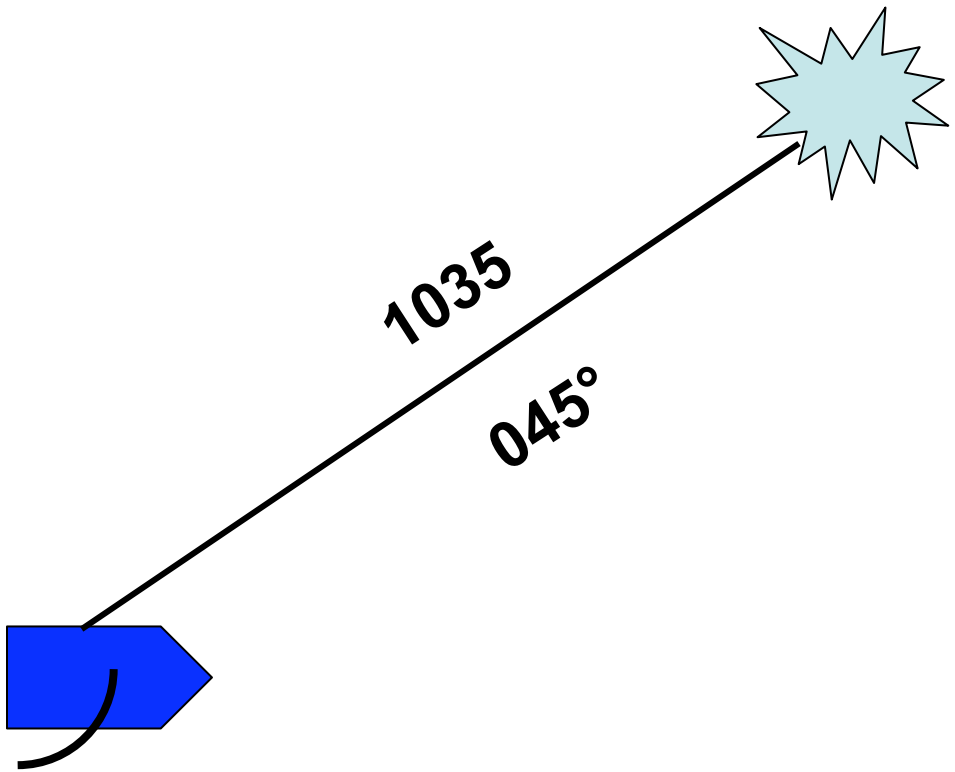
- Standard chart plotting labels
  - C = course (t = true; m = magnetic)
  - D = distance (to nearest 0.1 nm)
  - S = speed (to nearest 0.1 kn)



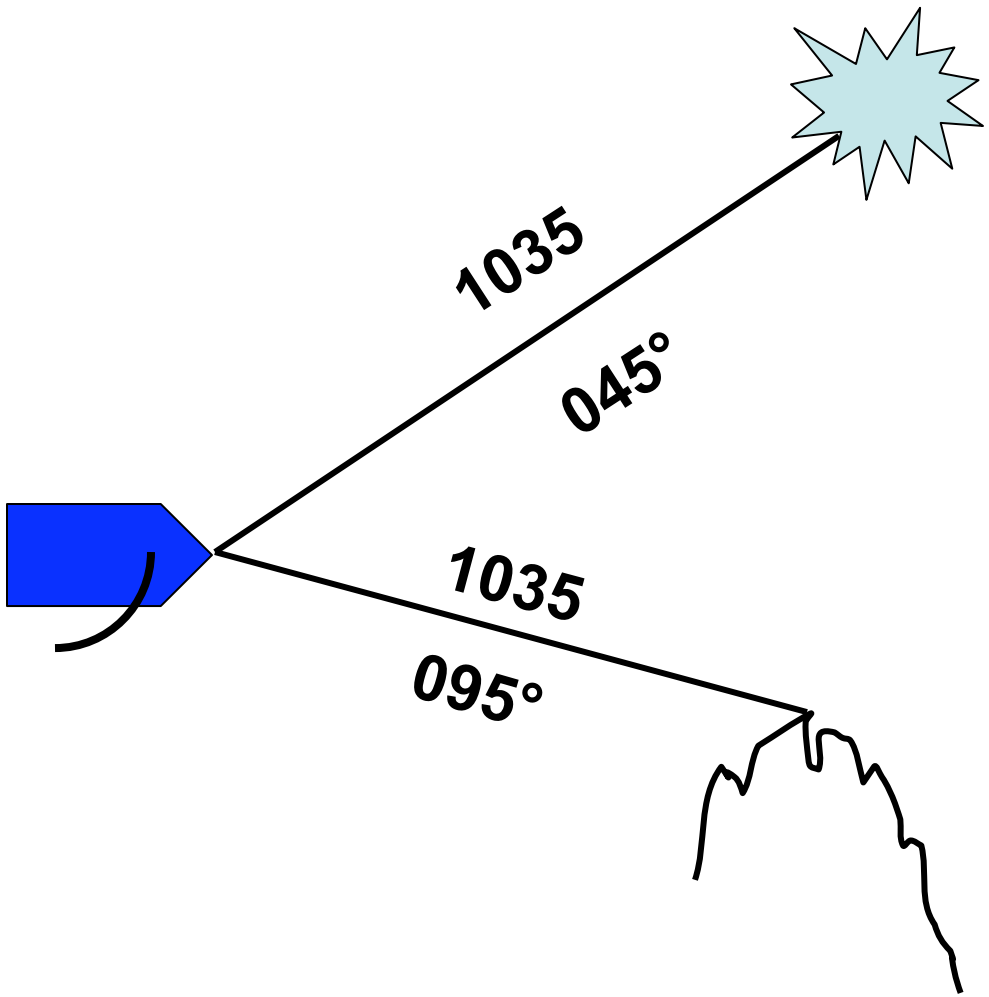




Line of Position (LOP)

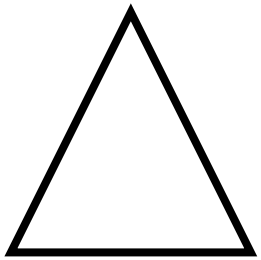


Visual Fix (2-point)

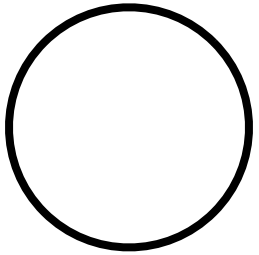


Positions

Estimated position (EP)



Electronic fix (GPS)

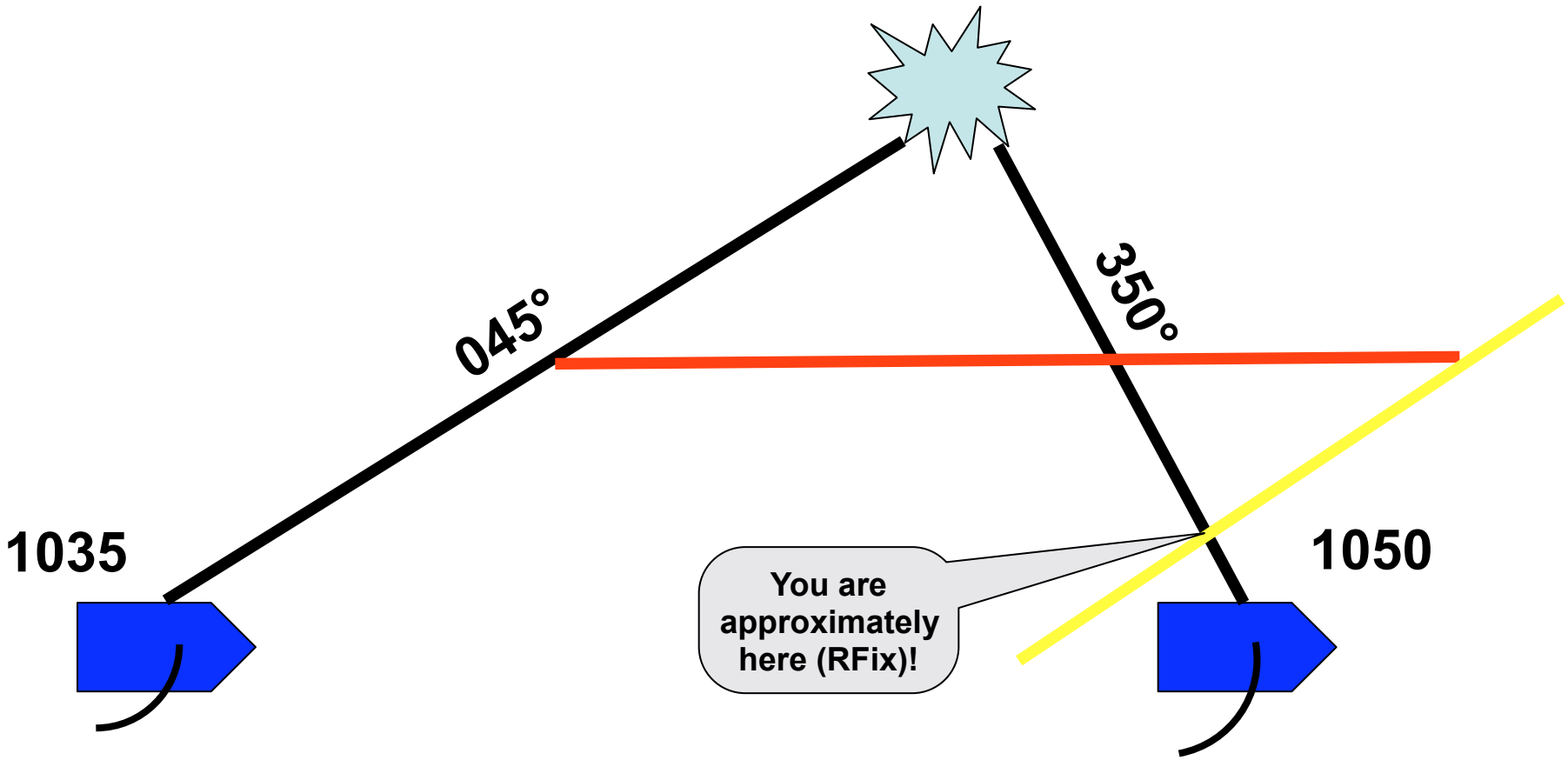


Running fix (RF)

Running Fix

- Only one object available for position
- Plot a single LOP
- Run distance and plot 2nd LOP
- Plot DR using course and distance run between two LOPs (from anywhere on first LOP)
- From DR, plot line parallel to first LOP through second LOP (transferred LOP)
- Intersection with 2nd LOP - RFix

Running Fix



Correcting for Current/ Leeway

- Course – Intended direction of travel
- Track (CMG) – Actual path of the boat
- Heading – Direction to steer or pointing to stay on course line

Correcting for Current/ Leeway (con't)

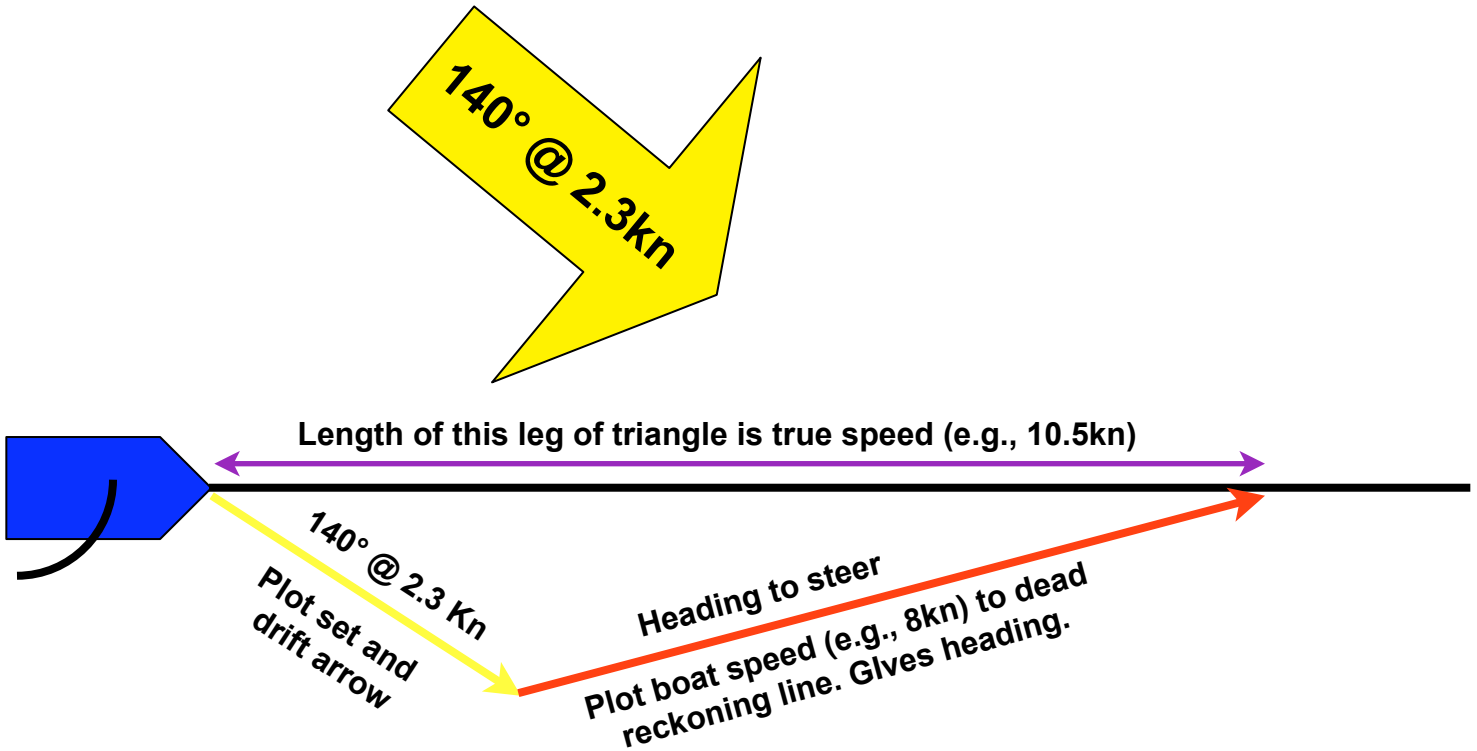
- Set – Direction towards which the current flows
- Drift – Speed of current in knots
- Boat speed – Speed on knot meter
- True speed (SMG) – Actual speed with effect of current

Sunday, March 21, 2010

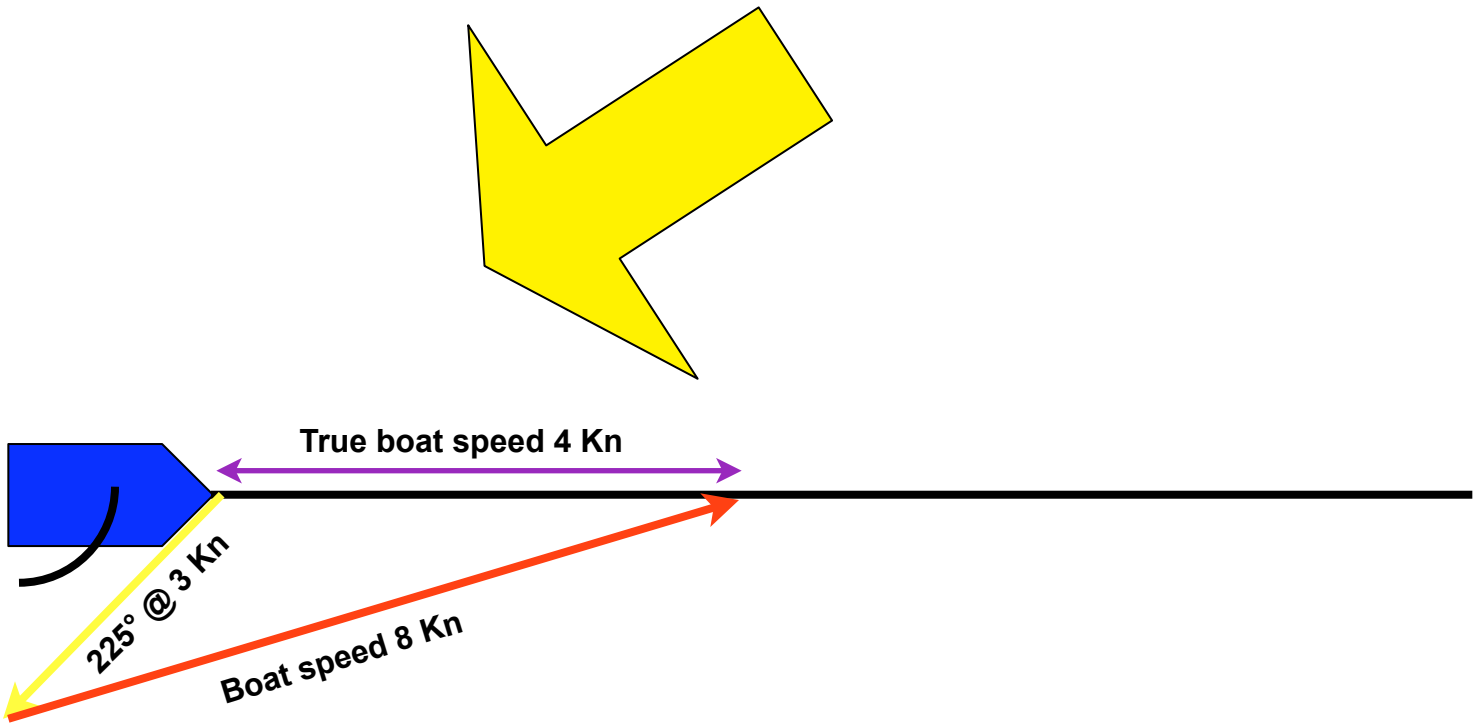
Calculating Heading to Steer

- Plot DR course
- From departure point plot set and drift ("current") arrow
- From outer end of current arrow plot boat speed, swinging to DR course
- Direction of boat speed arrow is heading to steer
- Length of line between departure point and line intersection is speed

Calculating Heading to Steer



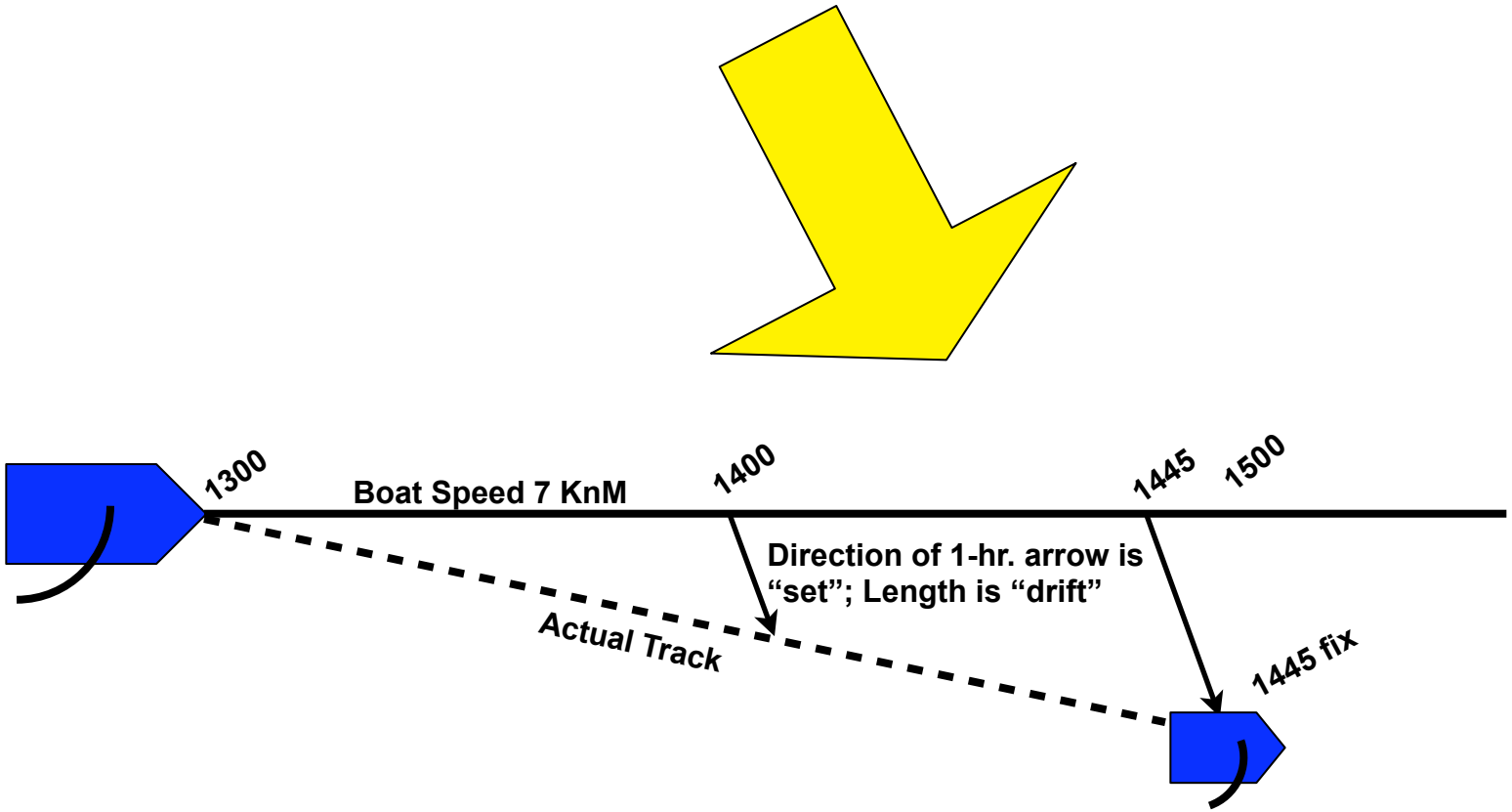
Calculating Heading to Steer



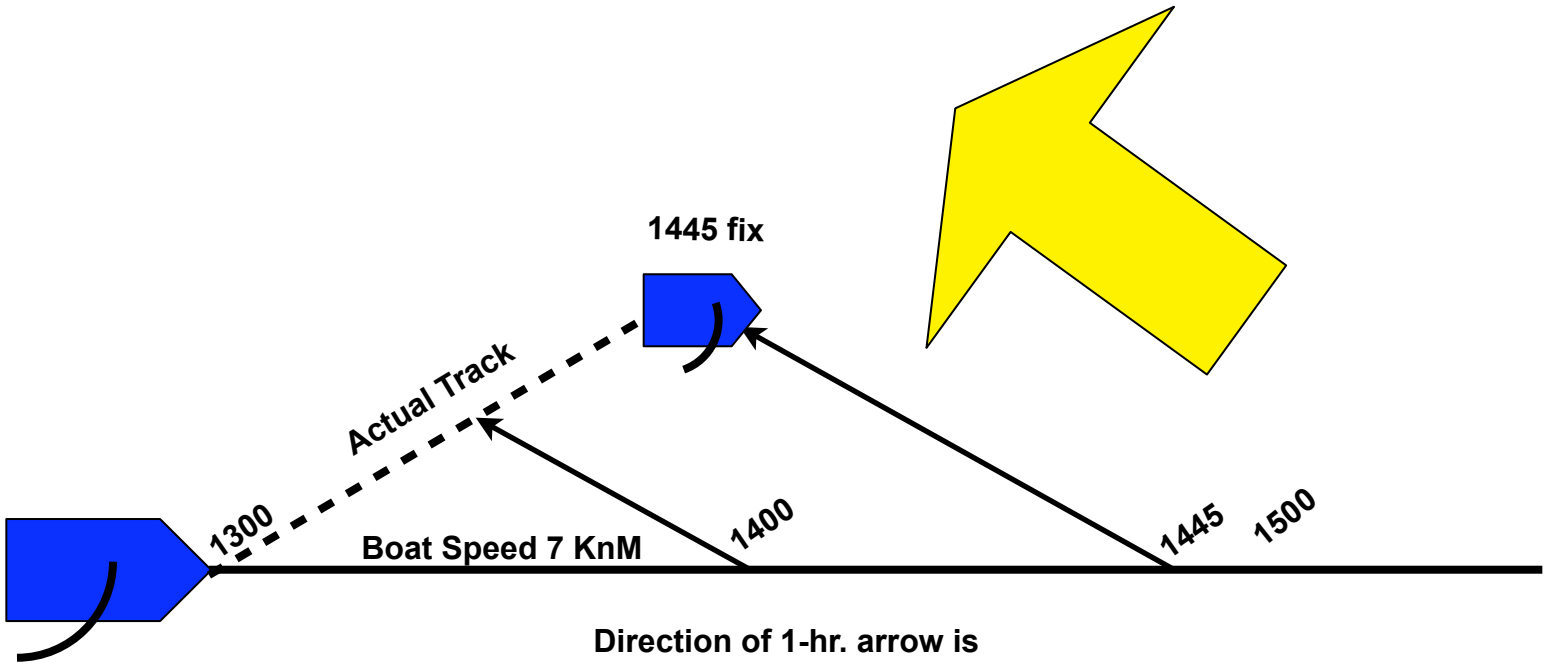
Determining Set and Drift

- Plot two DR positions:
  - DR position for time of fix
  - DR position for first hour
- Plot actual track
- Draw line from DR position to fix then draw parallel from first hour position to plotted track line
- Set of current is direction of DR to fix line
- Drift is length of "1-hour" line

Determining Set and Drift



Determining Set and Drift

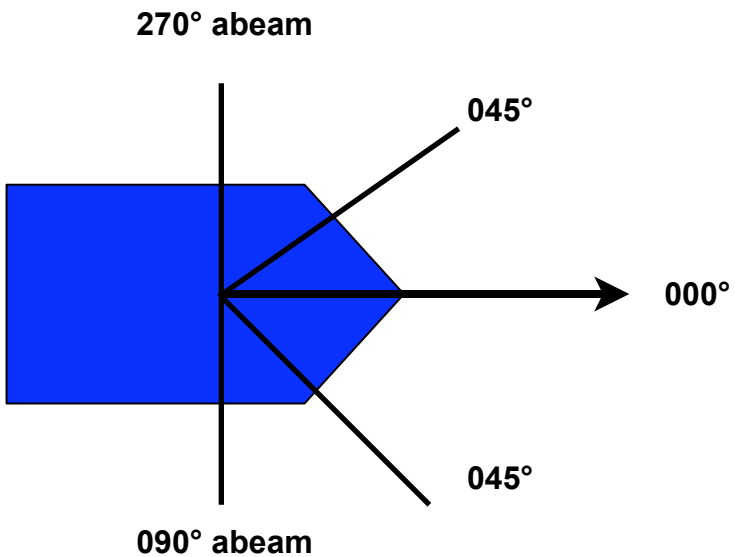


Direction of 1-hr. arrow is
"set"; Length is "drift"

Special Bearings

- Relative bearings off bow
- Danger bearings
- Doubling the angle on the bow
- Bow and beam bearings
- Turn bearings

Determining Set and Drift



Danger Bearing