LOSS PREVENTION

Towards Effective Navigation

SHIPOWNERS

SECURITY FOR SMALL & SPECIALIST VESSELS

The information and recommendations in this booklet are given in good faith and are meant to highlight best practices, good seamanship and common sense to reduce incidents that result in related claims. However, Members must take into consideration the guidance and regulatory requirements given by Flag states and other governing authorities when formulating policy in line with the contents of this publication.

NOT TO BE USED FOR NAVIGATION.

Foreword

The Shipowners' Club provides P&I insurance for small and specialised vessels and, as such, the majority of our vessels trade in coastal waters. The art of navigation is second nature to deep-sea mariners but it can be something of a mystery to those crews who do not need to use this particular skill very often.

Our Condition Survey Programme often highlights the fact that crews have a limited understanding of the rudiments of basic navigation and we also see claims arising where poor navigation is a main contributing factor. A better understanding of the subject will hopefully go some way in reducing the incidence of those claims.

The purpose of this booklet is to open the window on navigation in a very basic way. It is primarily aimed at those mariners who are not fully trained in the art of navigation.

This booklet is one of three publications in a series and it is envisaged that together they will help eliminate some of the difficulties that befall those not so well versed in marine navigation.

We remain forever indebted to Captain H. Subramaniam for compiling this booklet series for us. Captain Subramaniam was a distinguished member of the nautical fraternity in a career spanning over 6 decades, including over 30 years of teaching experience. Apart from this series, he also authored eight textbooks on the operation of merchant ships which continue to be used by seafarers across the globe. It was his ability to put a subject across in a nutshell that made all his books easy to understand and helpful to those these are intended for.

Contents

Chapter 1

Principles of navigation

POSITIONAL REFERENCES

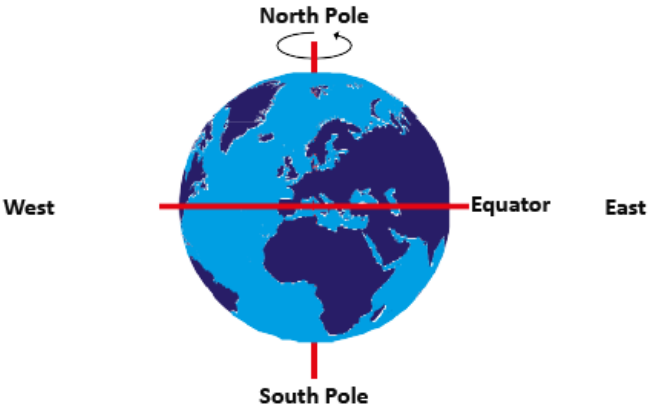


Figure 1

Axis of rotation

The Earth rotates around an imaginary line called its axis of rotation once a day from west to east as shown in Figure .

The North and South Poles

The points where the axis of rotation cuts the Earth's surface are called the poles. The one on top is called the North Pole and the one at the bottom is called the South Pole as shown in Figure 2.

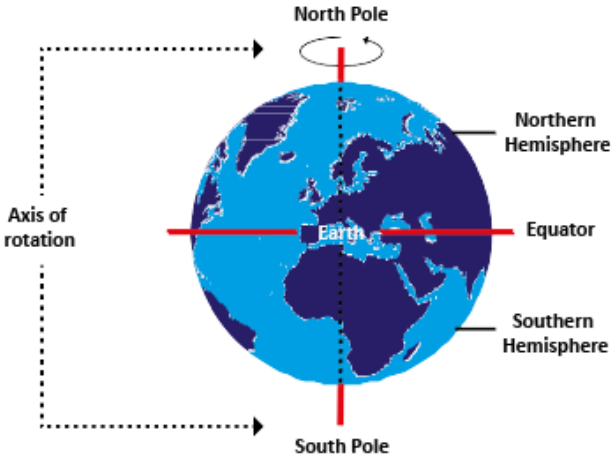


Figure 2

Equator

The Equator is an imaginary line on the Earth's surface, midway between the two poles. The Equator divides the Earth into two halves, called the Northern hemisphere and the Southern hemisphere as shown in Figure2.

Parallels of latitude

Parallels of latitude are imaginary lines on the Earth's surface that are parallel to the Equator. They are named North or South according to the hemisphere in which they lie as shown in Figure 3.

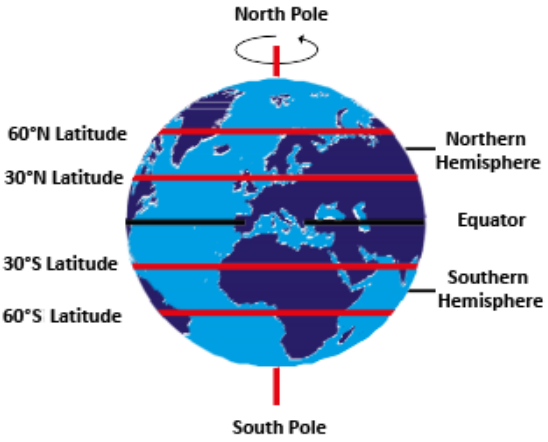


Figure 3

The Earth's surface from the Equator to each pole is divided into 90 equal parts. Each part is called a degree of latitude. The Equator is 0°. The North Pole is 90°N. The South Pole is 90°S. The minimum value of latitude is 0°. The maximum value of latitude is 90°N or 90°S.

Meridians of longitude

Meridians are imaginary lines on the surface of the Earth that go from one pole to the other by the shortest path. Meridians cross the Equator and all parallels of latitude at 90° as shown in figure 4.

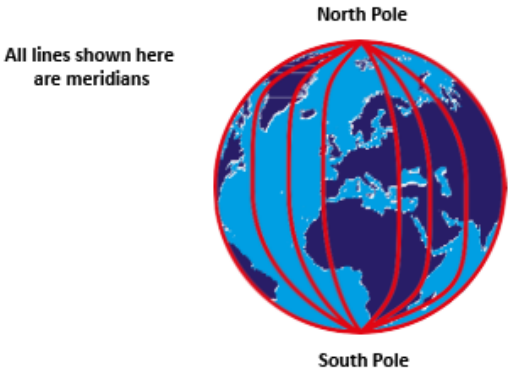


Figure 4

If you stand on any meridian, the North Pole will be exactly north of you and the South Pole will be exactly south of you. When you face north, the areas on your right will be to the east of you. The areas to your left will be west of you.

The Prime Meridian

The Prime Meridian is the meridian that passes through the Greenwich Observatory in London. The Prime Meridian divides the Earth into two hemispheres – the **Eastern hemisphere** and the **Western hemisphere** (Figures 5 and 6).

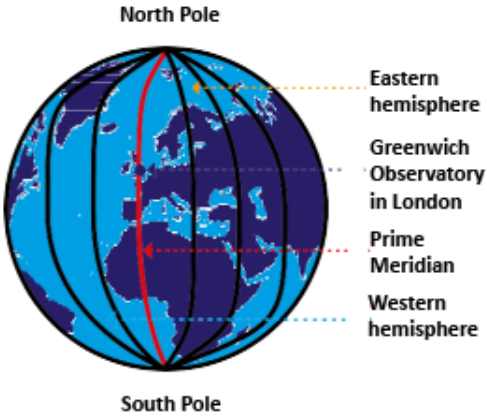


Figure 5

Longitude

Look at the Earth from above the North Pole as shown in Figure 6. The circle you see is the Equator. P is the North Pole. The centre of the Earth is directly below the P. The line P–G is the Prime Meridian, dividing the Earth into the Eastern and Western hemispheres.

Figure 6

Starting from G, divide the Equator on the Western hemisphere into 180 parts and call each a degree of **west** longitude.

In Figure 7, the line P–G is the Prime Merdian. Starting from G, divide the Equator on the Eastern hemisphere into 180 parts and call each a degree of **east** longitude.

As shown in Figure 7:

Longitude of A = 045°E
Longitude of B = 090°E
Longitude of C = 135°E
Longitude of D = 045°W
Longitude of E = 090°W
Longitude of F = 135°W.

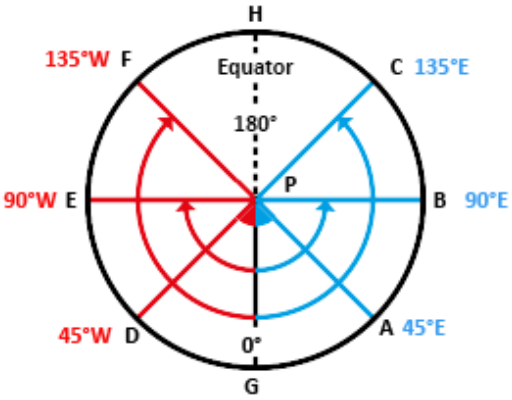


Figure 7

Notice that the line P–H is both 180°E and 180°W. Hence the meridian PH is called 180° without the E or W attached to it. The minimum value of longitude is 0°. The maximum value of longitude is 180°.

Position of a place

Each degree of latitude and longitude is divided into 60 parts, each called a minute of arc (not to be mixed up with minute of time).

The position of a place or a ship on the Earth is indicated by its latitude and longitude in degrees and minutes.

The following is an extract from Norie's *Nautical Tables*:

	Latitude	Longitude
London (UK)	51° 30'N	000° 05'W
Mumbai (India)	18° 55'N	072° 50'E
Keppel Harbour (Singapore)	01° 16'N	103° 50'E

Distance

Distances at sea are expressed in nautical miles. Abbreviation for nautical miles is NM and for metres is m.

1 NM = 1,852 m.

It is interesting to know how the value of 1 NM was arrived at. Figure 8 shows the Earth, with O at the centre and O–B as a radial line. The O–B line rotates by 360° and covers an approximate distance on the Equator of 40,000 km.

Hence 360° = 40,000 km on the Equator.

$$\text{Or, } 1° = \frac{40{,}000 \text{ km}}{360}$$

$$\text{or 1 minute of arc} = \frac{40{,}000}{360 \times 60} = 1.852 \text{ km}$$

Hence 1 NM = 1 minute of arc = 1.852 km = 1,852 m.

It has been internationally agreed that 1 NM = 1,852 m.

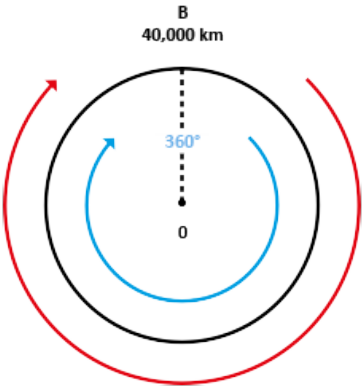


Figure 8

Also = 1.852 km = 6,076 feet = 1.15 land miles. Also 1 km = 0.54 NM.

Cable

0.10 NM (1/10 of a nautical mile) = 1 cable or 10 cables = 1 NM.

Speed

A speed of one nautical mile per hour is called a knot. It is wrong to say 'knots per hour'.

Chapter 2

Directional references

THE THREE-FIGURE SYSTEM

Directions are normally indicated in degrees clockwise from north. So, 000° is north, 090° is east, 180° is south, 270° is west and 360° (i.e. 0°) is north again as shown in Figure 9. Your ship's bridge is indicated by 0.

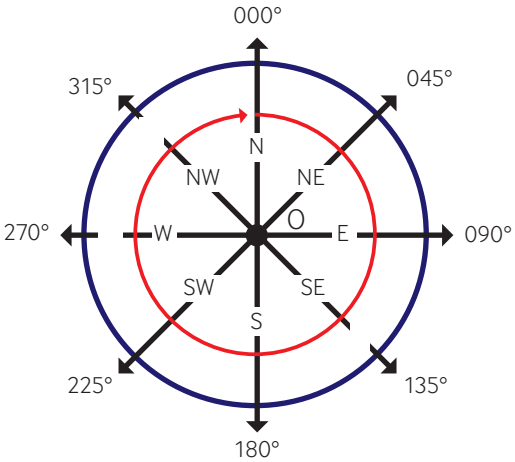


Figure 9

There are two sources for direction on board a ship: the gyro compass; and the magnetic compass.

THE GYRO COMPASS

The gyro compass is an electrically-driven mechanical instrument that works on the directional property of a wheel spinning at a very high rate.

Its principle is similar to that of a spinning top that children play with. So long as its rotational speed is above a critical level, it will maintain its direction in space (Figure 10).

Figure 10

So long as the power supply is continuous and does not fluctuate, the gyro compass will be reliable.

In case of power failure, an alternate power supply should normally take over automatically and ensure uninterrupted power supply for several hours.

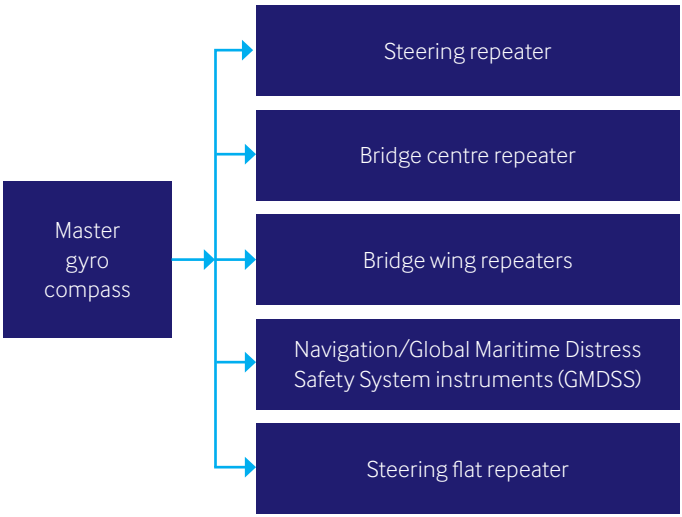


Figure 11

Gyro is not affected by external magnetic influences. When in proper running order, the gyro compass points constantly to true north. The main unit is called the master gyro and other units that get input from it are called repeaters, as depicted in Figure 11.

Gyro error

The gyro compass may have a small error which is usually between 0.0° and 0.5° but may sometimes be as much as 2.0°. This varies according to changes in latitude, course and speed of the ship.

When the gyro reading is **higher** than the true value, the error is termed **high** or **H**. Hence, to all readings of the gyro compass, the error is subtracted to get true values.

Example 1: If gyro error is 1° (H):

Gyro bearing of lighthouse	=	247° (G)
Gyro error	=	1° H
True bearing of lighthouse	=	246° (T)

When the gyro reading is **less** than the true value, the error is termed **low** or **L**. Hence, to all readings of the gyro compass, the error is added to get true values.

Example 2: If gyro error is 1° (L):

True course to steer	=	102° (T)
Gyro error	=	1° L
Gyro course to steer	=	103° (G)

Test yourself

Gyro error

You are given the true (T) and gyro (G) readings. Fill in the gyro compass error and its name:

	1	2	3	4	5
Reading (T)	275°	126°	341°	192.5°	044°
Reading (G)	276°	124°	342.5°	191.5°	044°
Error					

You are given the true reading and the gyro error. Fill in the gyro reading:

	6	7	8	9	10
Reading (T)	144°	186°	337°	000°	359°
Error	H 1°	L 2°	H 0.5°	L 1.5°	H 1°
Reading (G)					

You are given the gyro reading and the gyro error. Fill in the true reading:

	11	12	13	14	15
Reading (G)	129°	221°	343°	180°	119°
Error	H 2°	L 1°	L 0.5°	H 1°	H 1°
Reading (T)					

Answers:

Error:	**1.** 1°(H)	**2.** 2°(L)	**3.** 1.5°(H)	**4.** 1°(L)	**5.** 0°
	6. 145°	**7.** 184°	**8.** 337.5°	**9.** 358.5°	**10.** 000°
	11. 127°	**12.** 222°	**13.** 343.5°	**14.** 179°	**15.** 118°

THE MAGNETIC COMPASS

A magnetic compass rarely points to true north. Are you surprised? Normally, the error is predictable and can be corrected with reasonable accuracy. The magnetic compass is very reliable and serves as a check on the gyro compass.

Compass error

Compass error (CE) is the angle of the compass between true north and compass north expressed in degrees.

Clarification

When you stand on any meridian, the direction of the North Pole is true north. The direction indicated by the north point of the compass is called compass north (CN).

CE is named east (E) if the compass north lies to the right of true north (Figure 12A).

CE is named west (W) if the compass north lies to the left of true north (Figure 12B).

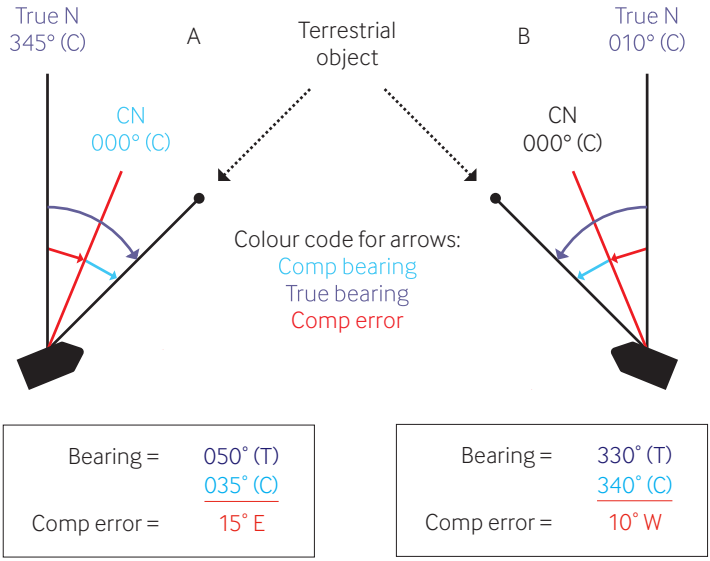


Figure 12

Figures 12A and 12B are purely theoretical. At sea, how would you know where true north is? If you can answer that question, there is no need for a magnetic compass!

At sea you can always get the compass reading at a glance and apply CE to it to obtain the true direction. This is why a magnetic compass is needed on board.

Conversion of bearings

Conversion of compass bearings to true bearings, and vice versa, becomes very easy if a rule of thumb is applied as follows:

Error **east**, compass **least**

Error **west**, compass **best**

Example 1:

If the bearing is 035°(C) and CE is 15° E, find the true bearing.

Using the rule of thumb, 'error **east**, compass **least**', you work it out as follows:

Bearing	035°(C)
CE	15° E
Bearing	050°(T)

You can verify the answer by checking Figure 12A.

Example 2:

If the bearing is 330°(T) and CE is 10°W, find the compass bearing.

Using the rule of thumb, 'error **west**, compass **best**', you work it out as follows:

Bearing	330°(T)
CE	10°W
Bearing	340°(C)

You can verify the answer by checking Figure 12B.

Test yourself

Compass error

You are given the true and compass bearings. Fill in the CE:

	1	2	3	4	5
Bearing (T)	275°	126°	001°	192.5°	044°
Bearing (C)	276°	124°	350°	201.5°	044°
CE					

You are given the true bearing and the CE. Fill in the compass bearing – Bearing (C):

	6	7	8	9	10
Bearing (T)	265°	136°	001°	182.5°	034°
CE	16°E	12°W	2.5°E	19.5°E	4°W
Bearing (C)					

You are given the compass bearing and the CE. Fill in the true bearing – Bearing (T):

	11	12	13	14	15
Bearing (C)	127°	350°	159°	261°	089°
CE	6°W	14°E	17°W	11.5°E	14°E
Bearing (T)					

Answers:

CE:	**1.** 1°W	**2.** 2°E	**3.** 11°E	**4.** 9°W	**5.** 0°
(C):	**6.** 249°	**7.** 148°	**8.** 358.5°	**9.** 163°	**10.** 038°
(T):	**11.** 121°	**12.** 004°	**13.** 142°	**14.** 272.5°	**15.** 103°

Components of compass error

The error of the magnetic compass is made up of two variables – variation and deviation.

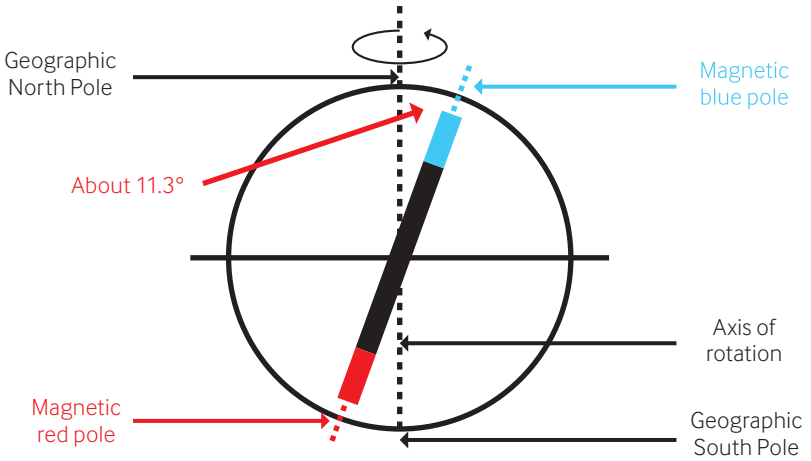


Figure 13

Causes of variation

The core of the Earth is like a bar magnet. Its magnetic axis is about 11.3° to the axis of rotation (Figure 13). The positions of the magnetic poles are not constant. They change erratically by about 8 nautical miles a year. Navigators call the magnetic poles blue and red, as shown in Figure 13.

Magnetic variations

The angular difference of the ship between true north and magnetic north expressed in degrees.

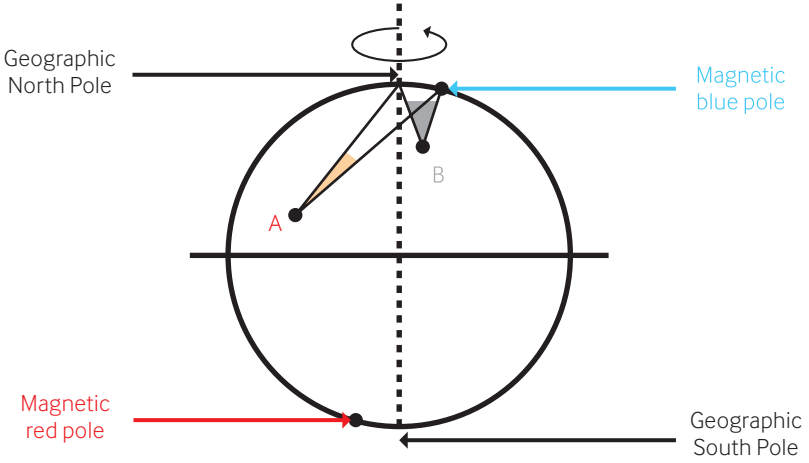


Figure 14

The value of variation depends on the position of the ship with respect to the geographic pole and the magnetic pole. Figure 14 shows the variation at positions A and B.

Value of variation

This is indicated by compass roses at various locations on navigational charts. A compass rose shows true north and degrees of directions clockwise from 0° to 360° and the magnetic north. It also shows the variation at that location, the year it was measured and the annual change in that value (Figure 15).

Annual change of variation

As explained earlier, the magnetic poles shift erratically by about eight nautical miles a year. This causes a slight change in the value of variation each year. This annual change is indicated near the value of variation. The change has to be calculated for the current year and applied to the value indicated for the year when the variation was measured (Figure 15).

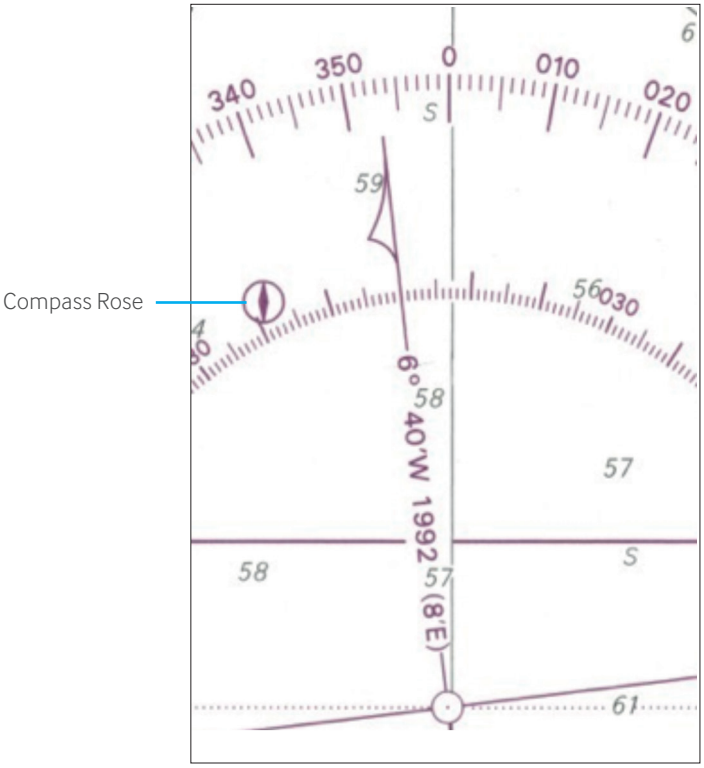


Figure 15

Sample calculation

At the location of the centre of the compass rose, the variation was 6° 40'W in 1992. The annual change is 8'E. Find the variation in 2012.

Variation in 1992	=	6° 40'W
Change = 8 x 20	=	2° 40'E
Variation in 2012	=	4° 00'W

Conversion of magnetic bearings

Conversion of magnetic bearings (M Brg) to true bearings (T Brg) and vice versa becomes very easy if a rule of thumb is applied as follows:

Error **east**, magnetic **least**.

Error **west**, magnetic **best**.

Example 1:
If the bearing is 047°(M) and variation is 8°E, find the true bearing.

Using the rule of thumb, 'error **east**, magnetic **least**', we work as follows:

Bearing	047°(M)
Variation	8° E
Bearing	055°(T)

The answer can be verified by checking Figure 16.

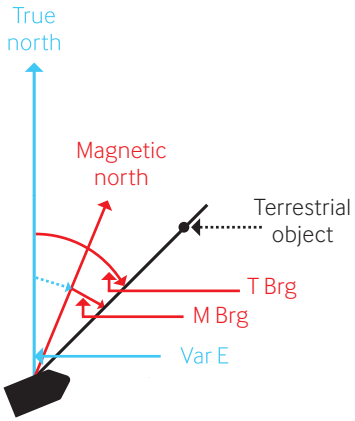


Figure 16

Example 2:
If the bearing is 052°(T) and variation is 6°W, find the magnetic bearing:

Using the rule of thumb, 'error **west**, magnetic **best**', we work as follows:

Bearing	052°(T)
Variation	6°W
Bearing	058°(M)

The answer can be verified by checking Figure 17.

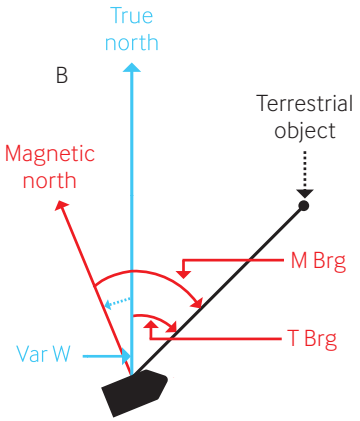


Figure 17

Test yourself

Variation

You are given the true and magnetic bearings. Fill in the variation:

	1	2	3	4	5
Bearing (T)	245°	116°	002°	182.5°	065°
Bearing (M)	246°	114°	350°	195.5°	065°
Variation					

You are given the true bearing and the deviation. Fill in the magnetic bearing – Bearing (M):

	6	7	8	9	10
Bearing (T)	275°	147°	004°	142.5°	039°
Variation	15°E	12°W	6.5°E	15.5°E	05°W
Bearing (M)					

You are given the magnetic bearing and the deviation. Fill in the compass bearing - Bearing (C):

	11	12	13	14	15
Bearing (M)	120°	352°	169°	260°	099°
Variation	8°W	15°E	17°W	11.5°E	15°E
Bearing (T)					

Answers:

Var:	**1.** 1°W	**2.** 2°E	**3.** 12°E	**4.** 13°W	**5.** 0°
(M):	**6.** 260°	**7.** 159°	**8.** 357.5°	**9.** 127°	**10.** 044°
(T):	**11.** 112°	**12.** 007°	**13.** 152°	**14.** 271.5°	**15.** 114°

Deviation for the ship's head

Deviation is the angle of the compass between the magnetic north and the compass north. It is expressed in degrees and minutes of arc.

Deviation is named east if the compass north lies to the right of the magnetic north (Figure 19). Deviation is named west if the compass north lies to the left of magnetic north (Figure 20). Deviation is caused by the magnetic influence of the ship's steel and iron structure.

The value of deviation and its name – east or west – depends on the compass course of the ship.

Deviation of the compass is caused by the magnetic properties of the ship's structure. The compass would point in a direction slightly away from the magnetic north.

If we were on a wooden boat with no iron or steel structure, there would be no deviation. The compass would point to the magnetic north.

The value of deviation depends on the ship's head. The value and name of deviation can be obtained at a glance from a document called the deviation card illustrated in Figure 18.
Note: To avoid clutter, many horizontal lines have not been shown.

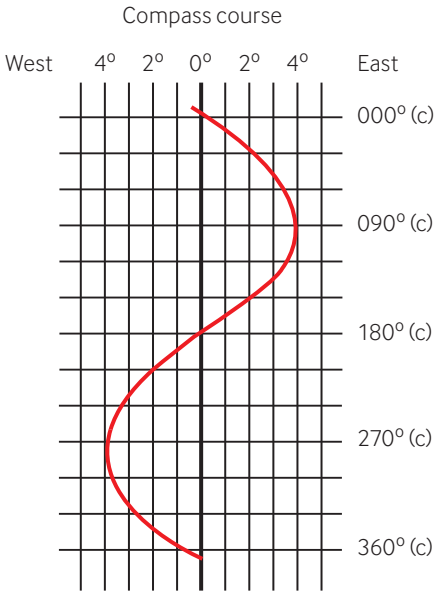


Figure 18

If the bearing of an object is 135°(C) while steering 200°(C), the deviation should be taken out from the card for 200°(C) **not** 135°(C). **The value of deviation depends on the ship's head not on the compass bearing**. From the deviation card shown in Figure 18, deviation = 1°W and not 3°E.

Conversion of bearings

Conversion of compass bearings (C Brg) to magnetic bearings (M Brg) and vice versa becomes very easy if a rule of thumb is applied as follows:

Error **east**, compass **least**.

Error **west**, compass **best**.

Example 1:

If the bearing is 022°(C) and deviation is 5°E, find the magnetic bearing.

Using the rule of thumb, 'error **east**, compass **least**', we work as follows:

Bearing	022°(C)
Deviation	5° E
Bearing	027°(M)

The answer can be verified by checking Figure 19.

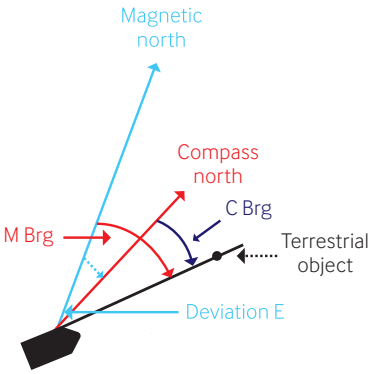


Figure 19

Example 2:

If the bearing is 045° (M) and variation is 7° W, find the magnetic bearing.

Using the rule of thumb, error **west**, magnetic **best** we work as follows:

Bearing	045°(M)
Deviation	7°W
Bearing	052°(C)

The answer can be verified by checking Figure 20.

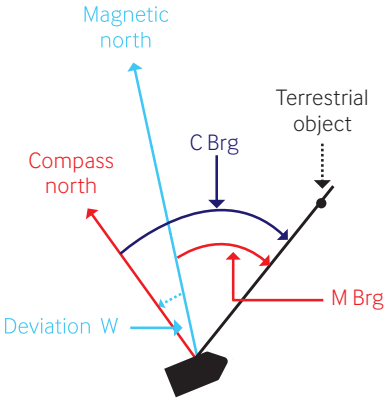


Figure 20

Test yourself

Deviation

You are given the compass and magnetic bearings. Fill in the deviation:

	1	2	3	4	5
Bearing (C)	205°	120°	358°	178.5°	035°
Bearing (M)	203°	124°	359°	175.5°	035°
Deviation					

You are given the true bearing and the variation. Fill in the magnetic bearing – Bearing (M):

	6	7	8	9	10
Bearing (C)	265°	147°	003°	122.5°	038°
Deviation	5°E	2°W	3.5°E	4.5°E	5°W
Bearing (M)					

You are given the magnetic bearing and the variation. Fill in the true bearing – Bearing (T):

	11	12	13	14	15
Bearing (M)	110°	342°	165°	270°	180°
Deviation	4°W	5°E	2°W	1.5°E	4°E
Bearing (C)					

Answers:

Deviation	**1.** 2°W	**2.** 4°E	**3.** 1°E	**4.** 3°W	**5.** 0°
Bearing (M)	**6.** 270°	**7.** 145°	**8.** 006.5°	**9.** 127°	**10.** 033°
Bearing (C)	**11.** 114°	**12.** 337°	**13.** 167°	**14.** 268.5°	**15.** 176°

Compilation of compass error

CE is the combination of deviation and variation. Tabulate the values and names and obtain the CE, using the rule of thumb as shown below.

Rule of thumb:

If deviation and variation are of the **same name**, **add** and retain the name. If they are of **opposite names**, **subtract** the smallest number from the larger and retain the name of the larger one as shown below:

Deviation	3°E	6°E
Variation	14°E	10°W
CE	17°E	4°W

CE	8°E	8°W
Variation	10°E	12°W
Deviation	2°W	4°E

Test yourself

Compilation of CE

You are given the deviation and variation. Fill in the CE:

	1	2	3	4	5
Deviation	5°E	4°E	2°W	2°E	4°W
Variation	16°W	12°W	3°E	3.5°E	3°W
CE					

You are given the CE and the variation. Fill in the deviation:

	6	7	8	9	10
CE	15°E	11°W	1°E	2.5°W	3°W
Variation	3°E	6°W	3°W	5°W	4°W
Deviation					

Answers:

CE:	**1.** 11°W	**2.** 8°W	**3.** 1°E	**4.** 5.5°E	**5.** 7°W
Deviation	**6.** 12°E	**7.** 5°W	**8.** 4°E	**9.** 2.5°E	**10.** 1°E

Relative bearing

The relative bearing of an object is the angle of the observer between the ship's head and the line of sight of the object, measured clockwise from 0° to 360°. Figure 21 shows the various terms used in relative bearings.

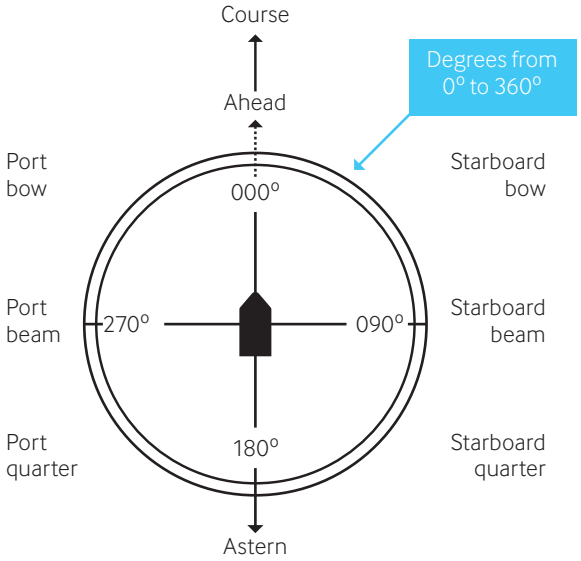


Figure 21

Relative bearings are fairly simple to understand as all objects are as you see them while driving a car – in front is ahead, behind is astern, right and left sides are relative to you. This is unlike a chart where everything is north up. Relative bearings are important as collision avoidance rules are based solely on relative bearings – the direction of other ships from your ship's head.

Figure 22 shows an object whose relative bearing = 245°.

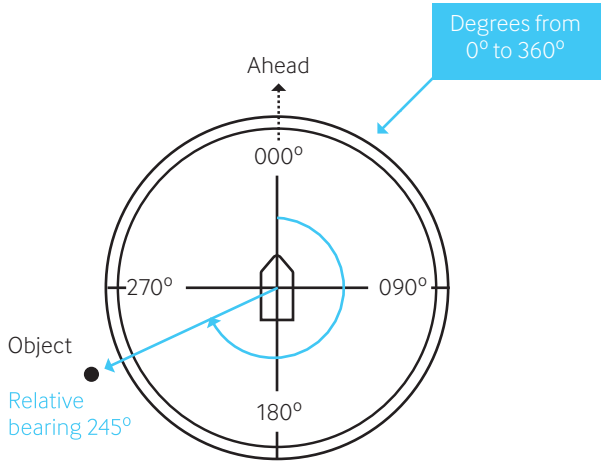


Figure 22

Conversion of bearings

A simple formula can be applied to find this:

Relative bearing (Rel Brg) + true course (T Course) = true bearing (T Brg)

To convert relative bearings to true bearings, just add the relative bearing to the true course. If the total exceeds 360°, subtract 360 from the total as shown in Example 1.

Rel Brg	200°
T Course	260°
T Brg	460°
	-360°
T Brg	100°

Example 1

To convert true bearings to relative bearings, subtract true course from true bearing. If not possible, add 360 to the true course and then subtract as shown in Example 2.

T Brg	100°	460°
T Course	260°	260°
Rel Brg		200°

Example 2

Test yourself

Relative bearings

You are given the relative bearing and the true course. Fill in the true bearing:

	1	2	3	4	5
Rel Brg	300°	090°	316°	280°	000°
T Course	200°	100°	210°	200°	189°
T Brg					

You are given the true bearing and the true course. Fill in the relative bearing:

	6	7	8	9	10
T Brg	300°	040°	310°	000°	000°
T Course	200°	100°	069°	090°	180°
Rel Brg					

Answers:

(T Brg):	**1.** 140°	**2.** 190°	**3.** 166°	**4.** 120°	**5.** 189°
(Rel Brg):	**6.** 100°	**7.** 300°	**8.** 241°	**9.** 270°	**10.** 180°

THE QUADRANTAL SYSTEM

The quadrantal system of naming courses is useful, especially in calculations involving courses, distances and positions.

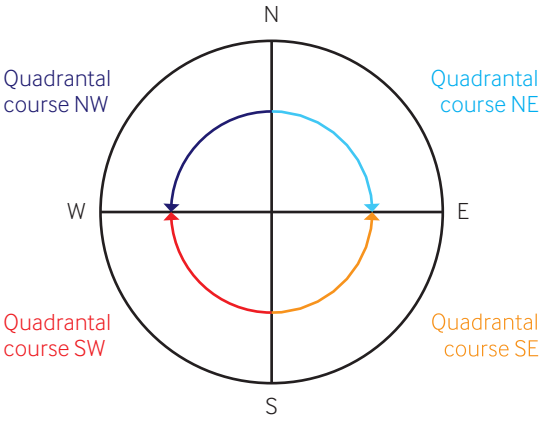


Figure 23

In Figure 23, 000° (T) is called N, 090° is called E, 180° is called S and 270° is called W.

All other values of courses in three-figure notations are converted into the two-figure quadrantal system as follows:

- All courses from 000° to 090° (T) are called NxxE (example: 078° = N78°E).
- Values of courses from 090° to 180° (T) are subtracted from 180° and are then called SxxE (example: 157° = S23°E).
- Values of courses from 180° to 270° (T) are decreased by 180° and are then called SxxW (example: 224° = S44°W).
- Values of courses from 270° to 360° (i.e. 000°) (T) are subtracted from 360° and are then called NxxW (example: 358° = N02°W).

Why do we use the quadrantal system in plain sailing?

- You have angles less than 90° thereby making calculations easy.
- You obtain the name of difference in latitude (d'lat) and difference in longitude (d'long) directly by the name of the course.

Example:
Convert 243° (T) to quadrantal course.

Since it is in the SW quadrant, we subtract 180° from it and then name the balance SW.

So 243°–180° = 63°. Hence the quadrantal course is S63°W, as illustrated graphically in Figure 24.

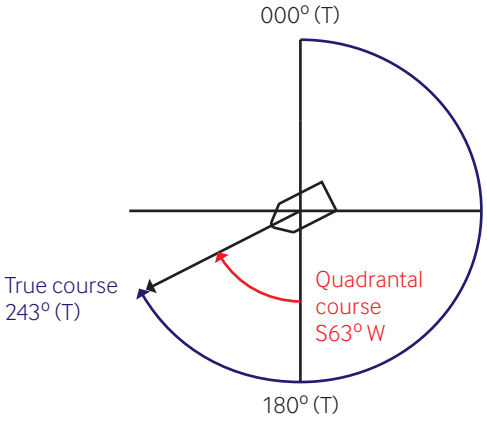


Figure 24

Test yourself

Quadrantal courses

Fill in the quadrantal course (Quad):

	1	2	3	4
T Course	275° (T)	126° (T)	001° (T)	192° (T)
Quad				

Fill in the true course (T Course):

	5	6	7	8
Quad	N62°W	SO7°E	N02°W	S42°W
T Course				

Answers:

Quad:	**1.** N85°W	**2.** S54°E	**3.** N01E°	**4.** S12°W
T Course	**5.** 298°	**6.** 173°	**7.** 358°	**8.** 222°

Chapter 3

Introduction to charts

MERCATOR CHARTS

For convenience in navigation, you need a two-dimensional, flat chart representing the three-dimensional, curved surface of the Earth. Mercator charts solve this problem. Figure 25 illustrates how it is done.

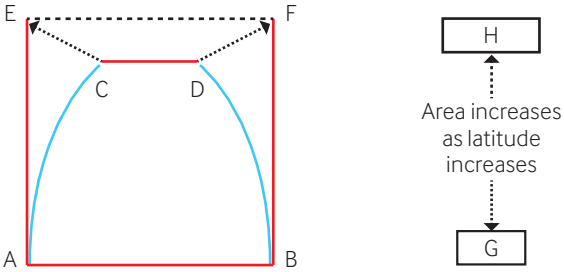


Figure 25

In Figure 24:

- C and D are places in the same latitude on a globe.
- C–A and D–B are their meridians on the globe.
- A–B is part of the Equator.
- A–B is the difference of longitude between the meridians of C and D.
- C–D is the distance between them in nautical miles.
- Mercator projection has pulled C to E and D to F.
- The meridians are now parallel to each other.
- The parallel latitudes of C and D have moved away from the Equator to E–F.

Figure 25 also shows what happens to the size of an area on a mercator chart. Area G at the Equator increases gradually in length and breadth as you go away from the Equator. In the latitude of C and D, it looks as big as H.

However, directions are maintained. In this case, the diagonals of G and H are parallel. On a mercator chart, directions are maintained despite a change in size.

Properties of a mercator chart

1. Though areas appear larger at higher latitudes, directions are correct.
2. The Equator appears as a straight line.
3. All meridians appear as straight lines parallel to one another.
4. The distance between consecutive meridians is constant at all latitudes.
5. All meridians cross the Equator at right angles.
6. All meridians and all parallels of latitude cross at right angles.
7. Parallels of latitude would appear as straight lines parallel to one another.
8. The distance between consecutive parallels increases as latitude increases.
9. One minute of longitude is the same size in all parts of the chart (see point 4 above).
10. One minute of latitude increases in size steadily as we go away from the Equator (see point 8 above).

Measurement of distance on a mercator chart

On a mercator chart, distances measured in any direction, using minutes of the latitude scale of the chart, are in nautical miles.

Since the size of one minute of latitude on a mercator chart increases as latitude increases, you should use the chart dividers against the latitude in which the distance lies.

For example, if place A is in latitude 24°N longitude aaa°, and place B is in latitude 26°N longitude bbb°, you should place one leg of the chart divider on A, the other on B and the spread of the divider represents the distance AB on that chart.

To read off the value of the distance, you should place the divider N-S along the latitude markings on the chart such that the centre of the divider lies on latitude 25°N.

Now read off the value of the distance, contained between the legs, in minutes. Suppose the value of the distance so obtained is 136', the distance AB is 136 nautical miles.

NATURAL SCALE OF A CHART

The natural scale of a chart is the ratio of the distance between two points on the chart to the actual distance between them on the surface of the Earth.

For example, if the natural scale of a chart is stated to be 1:30,000, it means that 1cm on the chart represents an actual distance of 30,000cm on the Earth.

Since on a mercator chart the size of a nautical mile changes with latitude, the natural scale mentioned in a mercator chart would be for the specified latitude mentioned next to it. The natural scale mentioned would, therefore, be valid only at that latitude.

TYPES OF NAVIGATIONAL CHARTS

There are three types of navigational charts in common use at sea:

1. Ocean charts.
2. Coastal charts.
3. Plan charts.

Ocean charts

These cover large areas of the Earth's surface. They are useful in planning ocean voyages. They are unsuitable for plotting positions at small intervals such as one hour or fractions of an hour.

Furthermore, since the area covered is very large, ocean charts do not show any details of dangers such as shoals. Ocean charts have a natural scale from 1:600,000 to 1:14,000,000.

Coastal charts

These charts are used for coastal navigation. They show detailed information regarding navigational aids, soundings, shoals, tidal flow and features suitable to help navigation.

Coastal charts which have a natural scale of 1:150,000 to 1:600,000 are called general coastal charts.

Coastal charts which have a natural scale of 1:50,000 to 1:150,000 are used for coastal navigation close to the shore and are generally referred to as inshore charts.

Plan charts

These charts show small areas such as harbours, ports and docks. They display details of jetties, berths, docks, ports, canal, rivers and harbours. They facilitate navigation in narrow, confined waters.

Their natural scale may be from 1:50,000 down to about 1:12,500.

CHARACTERISTICS OF NAVIGATIONAL CHARTS

Chart number

Every chart has a distinct number which is usually mentioned in three places.

1. On the bottom right corner outside the margin (Figure 26).

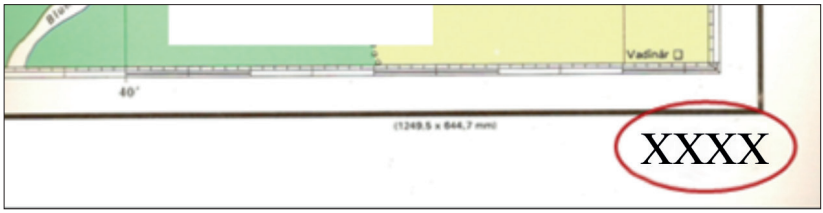


Figure 26

2. On the top left corner outside the margin (Figure 27).

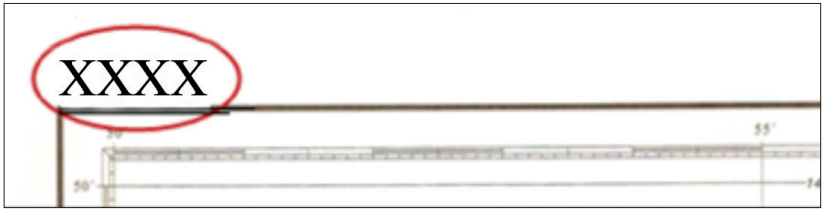


Figure 27

3. On the outside centre of the nearer edge so that it is visible after folding the chart (Figure 27). The title of the chart is also mentioned next to it.

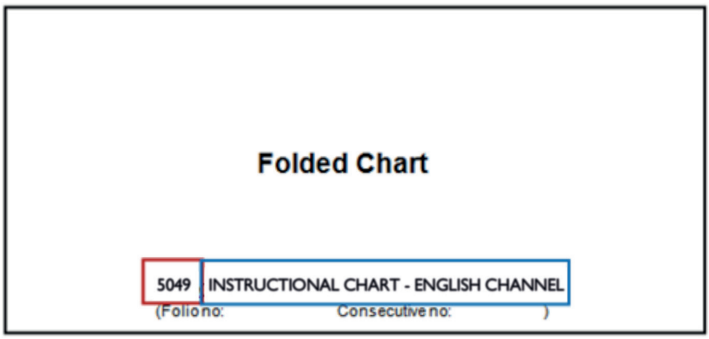


Figure 28

TITLES OF CHARTS

The title of the chart refers to the area covered by the chart. This is given in two places:

1. On the outside centre of the nearer edge so that it is visible after folding the chart (Figure 27). The number of the chart is also mentioned here.
2. Within the chart in an area where it will not affect the use of the chart (Figure 28).

Figure 29

Natural scale
This is stated under the title inside the chart (Figure 29).

Publishing authority
This is stated at the bottom centre outside the margin (Figure 30).

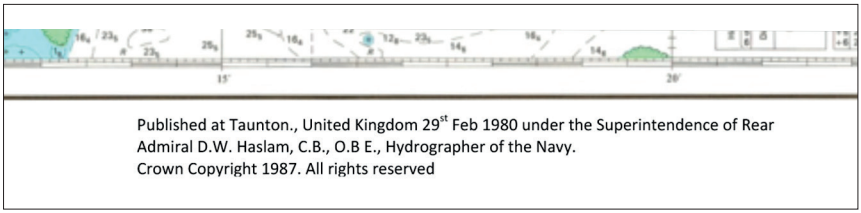
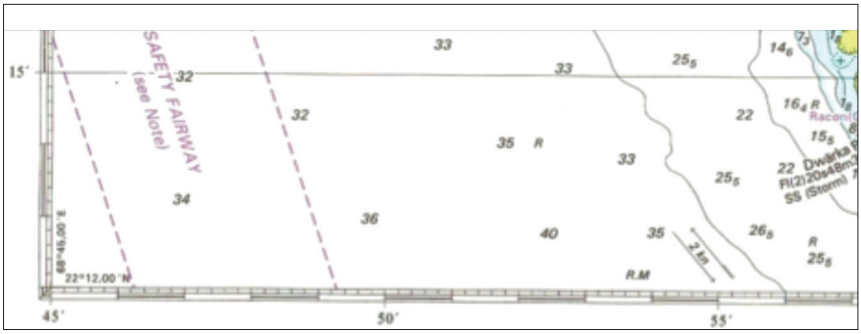


Figure 30

Date of publication
This is stated at the bottom centre, outside the margin along with the name of the publishing authority (Figure 30).

Date of new edition
This is stated outside the bottom margin of the chart (Figure 31).



Customer information Edition number: 3 Edition date: 17th April 2008	Notices to Mariners **2008**-3497-5112- **2009**-73-4802-6798- **2010**-371-847 **2011**-258-341

Figure 31

Small corrections

Small corrections are entered at the bottom margin, next to the date of the new edition (Figure 31).

The notations indicate that this chart has been corrected:

- In the year 2008: for notice numbers 3497 and 5112.
- In 2009: for notice numbers 73, 4802 and 6798.
- In 2010: for notice numbers 371 and 847.
- In 2011: for notice numbers 258 and 341.

Dimensions of chart

The dimensions of the chart refer to the inner margins of the chart. This is stated in the bottom right outside the margin of the chart (Figure 32).

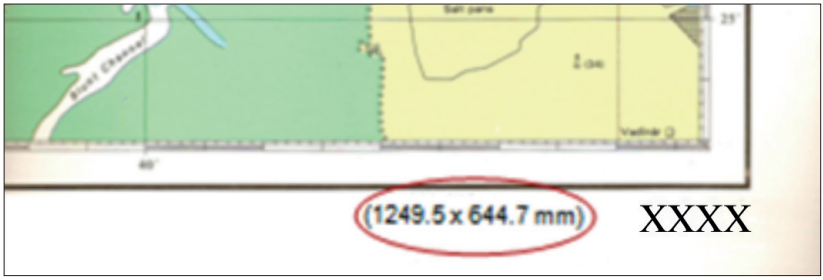


Figure 32

DATUM FOR DEPTHS AND HEIGHTS ON CHARTS

Depths and heights are illustrated by the examples below. Figure 33 shows the cross section of a swimming pool.

All depths are measured from the designated water level downwards as illustrated in the two areas of the swimming pool – the adult area and the children's area. All heights are measured from the ground level upwards. A similar system is followed on charts.

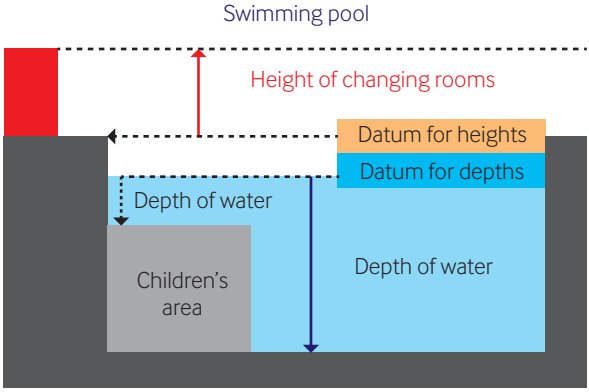


Figure 33

Chart datum

Chart Datum (CD) is the water level at which all the depths shown on the charts would be correct. This is the lowest level of water expected in that area and is usually the level at lowest astronomical tide (LAT) or mean low water springs (MLWS) (Figure 34).

Tide tables would take this level as zero and any height of tide calculated would be above this CD.

If at a particular location the charted depth is 5m, and the height of tide was calculated to be 1.2m, the actual depth of water at that location, at that time, would be 6.2m.

Chart height datum

Chart Height Datum (CHD) is the level of water from which all heights of objects are marked on the chart. It is the highest level of water expected in that area and is usually the level at highest astronomical tide (HAT) or mean high water springs (MHWS). See Figure 34 where CHD is shown by a light green dotted line.

If at a particular location the charted height of an object is 15m, and the height of tide was calculated to have fallen below CHD by 0.8m, the actual height of that object visible at that time would be 15.8m.

Drying heights

The part of the coast that lies between the CD and CHD is called a drying bank (Figure 34).

The rock marked X in the sketch is said to be awash – it is at the water level at CD.

The rock marked Y in the sketch has 0m height above CHD but 1.4 m of it is visible above water at CD. Such a rock will be marked on the chart as 'Dries 14' or 'Dries 1.4'.

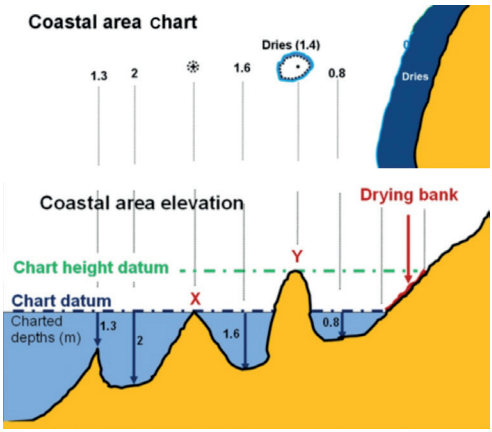


Figure 34

CHART SYMBOLS

Symbols are used on charts to depict locations of various navigational marks or hazards.

Chart no: INT 5011, published by the United Kingdom Hydrographic Office (UKHO), contains 'Symbols and abbreviations' used on charts.

Some important symbols:

1. Rocks

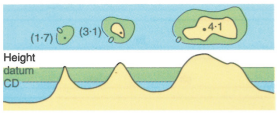
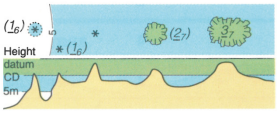
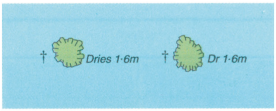
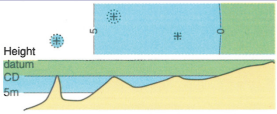
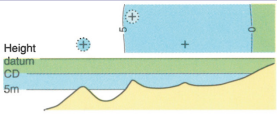
International symbols	Description	International symbols
	*Rock which does not cover, height above height datum*	
	*Rock which covers and uncovers, height above Chart Datum, where known*	
	*Rock awash at the level of Chart Datum*	
	*Underwater rock over which the depth is unknown, but which is considered dangerous to surface navigation*	

Figure 35

1. Rocks (continued)

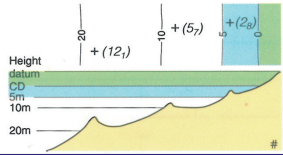
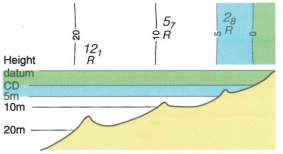
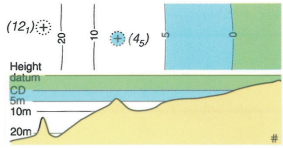
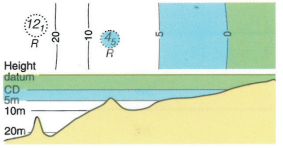
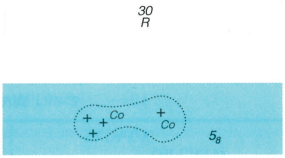
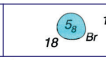
International symbols	Description	International symbols
	Dangerous underwater rock of known depth:	
	*inside the corresponding depth area*	
	*outside the corresponding depth area*	
	*Underwater rock not dangerous to surface navigation* *Coral reef which is always covered*	
 	*Breakers*	
	Discoloured water	*Discol* † *Discold*

Figure 36

2. Wrecks

International symbols	Description	International symbols
	*On large-scale charts, wreck which does not cover, height above height datum*	
	*On large-scale charts, wreck which covers and uncovers, height above Chart Datum*	†  † 
	*On large-scale charts, submerged wreck, depth known*	† 
	*On large-scale charts, submerged wreck, depth unknown*	† 
	Wreck showing any part of hull or superstructure at the level of Chart Datum	
	Wreck of which the mast(s) only are visible at Chart Datum	
	*Wreck over which the depth has been obtained by sounding but not by wire sweep*	

Figure 37

2. Wrecks (continued)

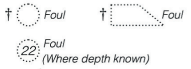
International symbols	Description	International symbols
	*Wreck which has been swept by wire to the depth shown*	
	*Wreck, depth unknown, which is considered dangerous to surface navigation*	*On modern Admiralty charts (post 1968), with the exception of those which have been produced initially by, or in co-operation with, other nations, this symbol is used when the depth over the wreck is thought to be 28 metres (15 fathoms) or less. For further details, see **Note** below IK29.*
	Wreck, depth unknown, which is not considered dangerous to surface navigation	*On modern Admiralty charts (post 1968), with the exception of those which have been produced initially by, or in co-operation with, other nations, this symbol is used when the depth over the wreck is thought to be more than 28 metres (15 fathoms). For further details, see **Note** below.*
	*Wreck over which the exact depth is unknown, but which is considered to have a safe clearance at the depth shown*	
	*Remains of a wreck, or other foul area, no longer dangerous to surface navigation, but to be avoided by vessels anchoring, trawling, etc*	
	Lighted wreck	

Figure 38

3. Obstructions

International symbols	Description	International symbols
Obstn Obstn	*Obstruction or danger to navigation the exact nature of which is not specified or has not been determined, depth unknown*	
Obstn Obstn	*Obstruction, depth known*	
Obstn Obstn	*Obstruction, which has been swept by wire to the depth shown*	
Obstn #	*Stumps of posts or piles, wholly submerged*	
#	*Submerged pile, stake, snag, well or stump (with exact position)*	
	Fishing stakes	

Figure 39

4. Offshore installations, cables and pipelines

International symbols	Description	International symbols
	Name of oilfield or gasfield	
Z-44	*Platform with designation/name*	
	Limit of safety zone around offshore installation	
	Limit of development area	
	Limit of oilfield or gasfield	
Oil Gas Chem Water	*Submarine cable* *Supply pipeline: unspecified, oil, gas, chemicals, water*	Pipeline

Figure 40

CHART CATALOGUES AND FOLIOS

Chart catalogue

A chart catalogue is a list of charts and publications available.

A chart catalogue is published by an office authorised by the government of a country:

- In the USA, it is the National Oceanic and Atmospheric Administration (https://www.noaa.gov/).
- In the UK, it is the United Kingdom Hydrographic Office (www.gov.uk/government/organisations/uk-hydrographic-office).
- In India, it is the National Hydrographic Office (www.hydrobharat.nic.in).

Chart catalogues are updated and published annually to cover a calendar year.

Contents of chart catalogues

Chart catalogues give information on:

- Comprehensive reference in textual and graphical form of charts and publications available.
- Details of electronic charts available.
- Full details of each chart – title, number, scale, coverage, and price.
- Full details of each publication – title, number, area covered, and price.
- Regional listing for easy reference with a composite index.
- List of distributors worldwide.
- Contact details of hydrographic offices in various countries, availability of *Notices to Mariners* and consultancy services offered.

Chart folio

A chart folio is a group of charts kept together usually in a canvas or cloth cover. Chart folios may be grouped either according to their distinct numbers or according to their sequence of use along a coast.

By distinct numbers

Publishers and suppliers of charts may find it convenient to group charts by their distinct numbers so that they can be easily found when required. However, it is possible that chart numbers 845 and 846 do not cover adjacent areas. They may be in different parts of the world!

By sequence of use

Ships' officers prefer to store charts according to geographic location and in a possible sequence of use. Since paper charts are heavy, more than 50 charts in a folio would make it bulky and inconvenient.

Usefulness to navigators

Ships' folios contain only charts of ports and areas in which the ship is expected to ply. They do not contain all the charts available in that region. For example, if a ship expected to ply from Singapore to Manila, charts covering ports en route, such as those on the western coast of Borneo or the eastern coast of Vietnam need not be on board. Unnecessary charts on board will increase the cost of acquisition and will burden the navigating officers with keeping them correct and up-to-date. All charts on board must be kept correct and up-to-date, though priority must be given to charts that would be used in the immediate passage. The officers may name the folios in a way that is convenient for their trading areas so that handling of the folios is easy.

When voyage orders are received, the navigating officer only has to pull out the concerned folio and ensure that the required charts are on board and also correct and up-to-date.

Chapter 4

Introduction To ECDIS

An Electronic Chart Display and Information System (ECDIS) is a computer-based electronic navigation system that uses a screen to show the position of the vessel superimposed on a chart image to assist with route planning and monitoring. The display is both, dynamic and automatic in that it changes as the ship moves along its track on the chart, without any intervention by the navigating officer.

An ECDIS needs to comply with the International Maritime Organisation (IMO) Performance Standards and when provided with adequate back up arrangement as per the requirements of the Flag Administration, can be used as an alternative to paper nautical charts.

Electronic Charts

There are two types of electronic charts:

1. Raster charts -

These charts are exact scanned, digital copies of paper charts used for marine navigation, produced in a raster (bitmap) format. The user may be allowed to zoom in and out of the raster chart where possible. However, due caution must be exercised when zooming in, as raster charts may be images of small scale charts and relevant data as required by the large scale chart of that area may not be reflected in the small scale raster chart.

2. Vector charts –

These charts are digitally constructed and contain varied navigational information such as coastal features, objects on land, soundings and depth contours, navigational buoys, racons, lights and wrecks etc. Each of these pieces of information are stored in separate databases with each such database available as an individual overlay on the basic chart.

Electronic Navigation Charts (ENC)

ENCs are vector charts that meet the criteria specified by IMO and International Hydrographic Organisation (IHO) for use on an ECDIS.

Electronic Chart Systems (ECS)

ECS is the generic name for digitised charts that do not meet the IMO Performance Standards prescribed for ECDIS. These can include terrestrial Global Positioning Systems (GPS) sets that have been fitted before the IMO specifications came into force and are therefore not approved for marine navigation. The use of these systems is not

recommended.

Although IMO standards require that ECDIS must work on ENCs, they may operate in a Raster Chart Display System (RCDS) mode in locations of the world not covered by ENCs, provided that the RCDS meet the standards prescribed by the IHO.

Salient features of an ECDIS:

- Real time availability of vessel's position, course, heading and speed.
- Bespoke display picture can be set up upon an operator's preference by 'on-demand' display of additional chart layers.
- Seamless transfer between charts.
- Textual information related to navigation and other chart symbols is available. Information on charted objects can be obtained by clicking them.
- Alarms or indication with respoect to the information diaplyed or malfunction of the equip
- Alarms or indications with respect to the information displayed or malfunction of the equipment are provided.
- Own vessel's symbol commensurate with the scale in use. On small scale charts, or when large scale charts are zoomed out, the symbol for own vessel would be as shown below in fig 1 with the centre indicating the conning position. On large scale charts, or when small scale charts are zoomed in, the symbol for own vessel would be as shown in fig 2.

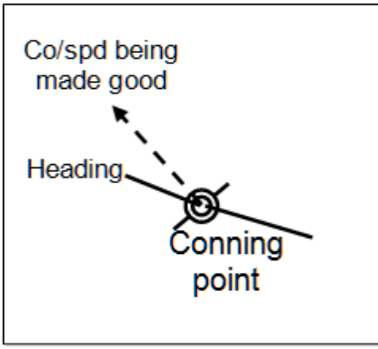


Figure 1

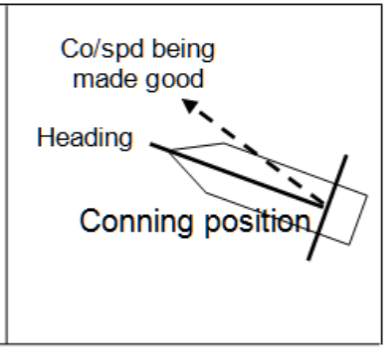


Figure 2

Advantages of using an ECDIS:

- With real time availability of position, course, heading and speed, progress of own vessel along an intended track can be monitored continuously and corrective action taken with minimal delay.
- An ECDIS is useful for voyage planning and for scanning the intended route for possible hazards and dangers. Admiralty List of Radio Signals.
- An ECDIS may also display additional navigation related information from relevant nautical publications, such as Sailing Directions, Port Approach Guides and relevant maritime safety information from sources like Navtex, when integrated and compliant to relevant standards.
- An ECDIS compiles and coherently presents navigational data; however, it is not designed to be a standalone collision avoidance instrument as it usually does not indicate Closest Point of Approach (CPA), Time of Closest Point of Approach (TCPA) and trial manoeuvres etc. These aspects are available on a Radio Detection and Ranging (RADAR) / Automatic Radar Plotting Aid (ARPA). Nonetheless, many modern ECDIS receive integrated feeds from compliant RADAR/ARPAs in additional to information from Automatic Identification System (AIS).
- ECDIS also include an important feature of voyage recording. This data can be useful in an incident investigation as well as for internal training purposes.
- ECDIS are most useful with regard to the 'Anti-grounding' function that has parameters that can be set as follows:
    - **Safety depth –** A safe depth based on the vessel's draft and a safe under keel clearance. The ECDIS will highlight spot soundings on the display equal to or less than the set value.
    - **Safety contour –** A safety contour to generate an anti-grounding alarm. The safety contour effectively works as an outline which marks the division between safe and unsafe waters.
    - **Time warning before grounding -** The interval to sound an alarm before which the vessel will cross into water shallower than the safety contour.

Chapter 5

Nautical publications

Important nautical publications

In addition to the chart catalogue, navigational charts, *Nautical Almanac* and nautical tables, the important nautical publications on a ship's bridge are:

- *Admiralty Sailing Directions.*
- *Admiralty List of Lights and Fog Signals.*
- *Admiralty List of Radio Signals.*
- *Admiralty Tide Tables.*
- *Mariner's Handbook.*
- *Ocean Passages for the World.*
- *Admiralty Distance Tables.*

The chart catalogue, explained in the previous chapter, gives details of each of these publications.

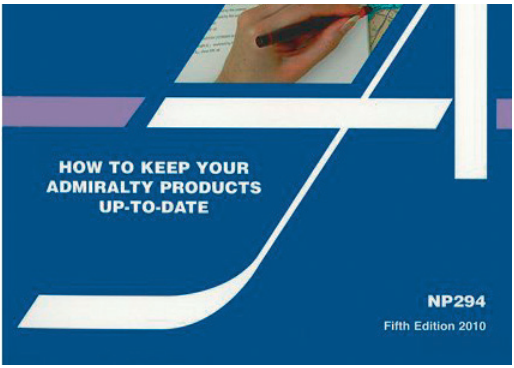


Figure 41

The UK Admiralty publishes a booklet called *'How to Keep Your Admiralty Products Up-to-Date'* which gives detailed instructions (Figure 41).

Admiralty Sailing Directions

Admiralty Sailing Directions, also called 'British Admiralty Pilot Books' or 'Pilot Books,' are published by the UKHO.

There are 75 volumes covering all navigable areas in the world. Each volume covers a different geographic area and is given a distinctive number and name.

For example, Figure 42 shows the area of coverage of each pilot volume:

- NP33 – Philippine Islands Pilot.
- NP021 – Bay of Bengal Pilot.

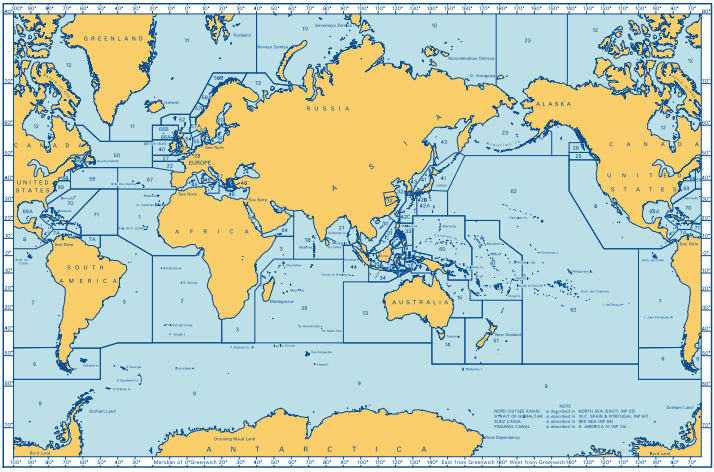


Figure 42

Purpose

Pilot Books provide complete information on navigational hazards, buoyage systems, pilotage, local regulations, general notes on countries, port facilities, seasonal currents, ice and climatic conditions. Before planning a passage, and also while on passage, you must consult Pilot Books, other navigational publications, and the navigational charts of the relevant areas.

Updates

Section IV of the weekly editions of *Admiralty Notices to Mariners (WANM),* include any corrections, if any, of immediate importance for each volume of the Pilot Books.

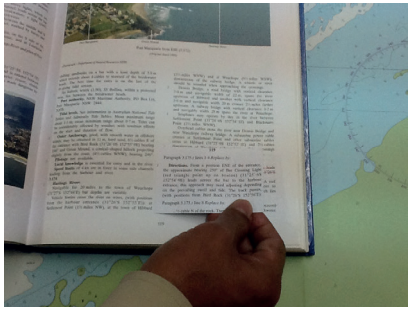


Figure 43

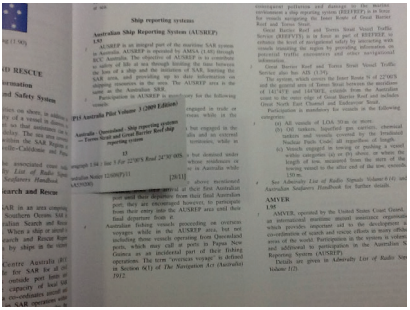


Figure 44

The Admiralty recommends that you cut out the correction from the *WANM* and paste it in the relevant page of the Pilot Book. It is then called a 'paste up'. The reference number of the notice should be entered near the paste up. The pasting is usually done in a way that does not obscure the original words of the book. One end of the 'paste up' is stuck on the margin of the page so that it is like a flap (Figures 43 and 44). The superceded lines of the original text are scored out in pencil and the reference number of the correction stated next to it.

Minor corrections can be written in by hand but notation of the *WANM* number must be entered in the margin alongside. You have to maintain a record (as shown in Figure 45), of each correction made, on the inside cover of the Pilot Book for verification by various authorities.

NP 44

RECORD OF AMENDMENTS

The table below is to record Section IV Notices to Mariners amendments affecting this volume.

Sub-paragraph numbers in the margin of the body of the book are to assist the user when making amendments to this volume Weekly Notices to Mariners (Section IV)

2009		2010		2011
Wk05/09 Page 189		Wk25/10 Page 264		Wk03/11 Page 124
Wk27/09 Page 223		Wk27/10 Page 69		
Wk31/09 Page 298				

Figure 45

When a large number of corrections are necessary, the Admiralty publishes supplements which are small booklets. Each supplement cancels the previous one. For example, when supplement no. 2 is received, supplement no. 1 is to be discarded after writing 'Obsolete' on its cover.

New editions are published when necessary and intimation is given through the *WANM*.

Admiralty List of Lights and Fog Signals

The *Admiralty List of Lights and Fog Signals (ALLFS)* consists of 14 volumes covering all navigable areas in the world. Each volume covers a different geographic area and is given a distinctive alphabet A to P (there is no I and O) and a name. For example, see Figure 47 – *Volume E: West Mediterranean*.

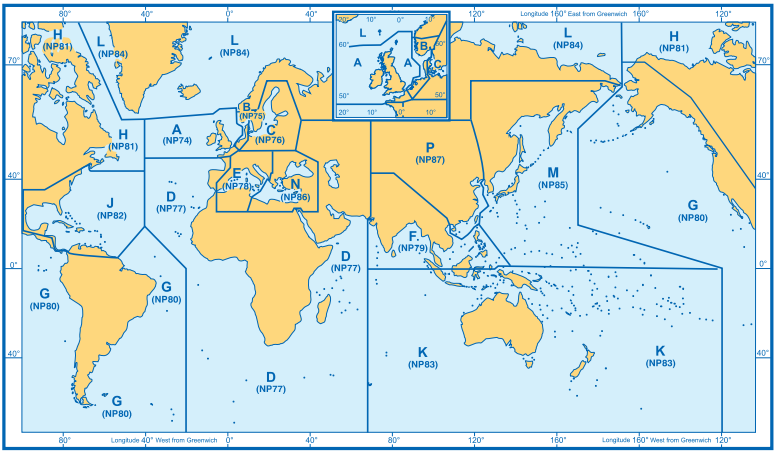


Figure 47

Purpose

These volumes provide extensive information on all lighthouses, lightships, lit floating marks (over 8m in height), fog signals and other lights of navigational significance. Each publication also gives the characteristics of lights and fog signals, together with the equivalent foreign language descriptions of lights. Tables are included to calculate the geographical and luminous ranges of lights (this will be explained later). Details for all lights listed include the international number, location and/or name, geographical co-ordinates, characteristics and intensity, elevation in metres, range in nautical miles and description of structure.

Updates

Corrections are given in Section V of the *WANM* and the procedure for correction and record-keeping is exactly the same as for Pilot Books. Since many changes occur in the contents, new editions are published at intervals of 12 months, one volume every month and intimation is given in Section I of *WANM*.

Admiralty List of Radio Signals

The Admiralty List of Radio Signals (ALRS) provides comprehensive information on all aspects of maritime radio communications. The data is organised into six volumes, some divided into several parts for ease of handling. Each of the six volumes is presented in a user-friendly format with full colour photographs and figures.

The six volumes are:

- ***Volume 1*** *– (Parts 1 and 2) – Maritime Radio Stations.*
- ***Volume 2*** *– Radio Aids to Navigation, Differential GPS (DGPS), Legal Time, Radio Time Signals and Electronic Position Fixing System.*
- ***Volume 3*** *– (Parts 1 and 2) – Maritime Safety Information Services.*
- ***Volume 4*** *– Meteorological Observation Stations.*
- ***Volume 5*** *– Global Maritime Distress and Safety System (GMDSS).*
- ***Volume 6*** *– (Parts 1–8) – Pilot Services, Vessel Traffic Services and Port Operations.*

Purpose

The contents of *ALRS* range from a complete listing of stations handling maritime public correspondence to a full range of products and services essential for compliance with the Global Maritime Distress and Safety System (GMDSS). The volumes also feature radio stations broadcasting weather services and forecasts and a detailed explanation of the complexities of Global Satellite Position Fixing Systems. *ALRS* are presented in a user-friendly format.

Updates

ALRS volumes are updated through Section VI of the WANM and the procedure for correction and record-keeping is exactly the same as for Pilot Books. New editions are published annually containing all changes up to the date of publication.

Admiralty Tide Tables

Admiralty Tide Tables (ATT) contain tidal information of all ports in the world. They are published in eight volumes (Figure 48):

- ***Volume I*** *– United Kingdom and Ireland (including European Channel Ports)*
- ***Volume 2*** *– North Atlantic Ocean and Arctic Regions*
- ***Volume 3*** *– Indian Ocean (including Tidal Stream Tables)*
- ***Volume 4*** *– South Pacific Ocean (including Tidal Stream Tables)*
- ***Volume 5*** *– South China Sea and Indonesia (including Tidal Stream Tables)*
- ***Volume 6*** *– North Pacific Ocean (including Tidal Stream Tables)*
- ***Volume 7*** *– South West Atlantic Ocean and South America*
- ***Volume 8*** *– South East Atlantic Ocean, West Africa and Mediterranean (including Tidal Stream Tables)*

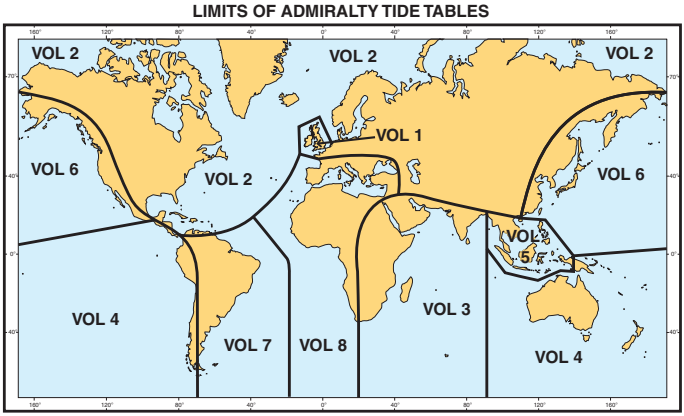


Figure 48

Purpose

Tide tables are useful when it is necessary to calculate the actual depth of water available at a place to ensure safe passage of your ship over that area.

Updates

Tide tables are published for each calendar year, a few months before 1 January. Any corrections to the volumes are given in *WANM* no. 1 of that year.

Note: Pilot Books, *ALLFS* and *ATT* consist of a considerable number of volumes each. All ships do not carry all the volumes. Each ship carries only those volumes that cover its anticipated area of trade. This will avoid unnecessary costs and also save efforts in correction of volumes that are not going to be used by that ship.

Each volume is divided into three parts:

Part I covers important ports in that area designated as standard ports. The daily times and heights of High Water (HW) and Low Water (LW) and details for calculating intermediate times or heights are also provided.

Part II covers a large number of less-important ports in that area designated as secondary ports. A number of secondary ports are based on a standard port nearby and the times and heights of HW and LW are obtained by applying a time and height difference to those at the standard port.

Part III contains 'harmonic constants' for tidal prediction by simplified harmonic method.

Mariner's Handbook

The Mariner's Handbook (MHB) is a compendium of essential maritime information on: charts; operations and regulations; tides; currents and characteristics of the sea; basic meteorology; navigation in ice; hazards and restrictions to navigation and the *International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA)* Buoyage System.

Purpose

The *MHB* serves as a reference book for concise information about various matters concerning navigation.

Updates

The *MHB* is updated through Section IV of the WANM and the procedure for correction and record-keeping is exactly the same as for Pilot Books. When necessary, supplements are issued. Each supplement cancels the earlier one.

New editions are published every five years or so.

Ocean Passages for the World

Ocean Passages for the World is written for use in planning ocean passages. It contains notes on winds, weather, climate, seasonal factors, currents, swell, ice hazards, and other factors that affect passages. It also contains directions for a number of selected commonly used routes and distances and dangers affecting these routes.

The routes are generally based on ships of moderate draft (12m).

Power-driven vessels are in two classes: high-powered (15 knots and more) and low-powered (less than 15 knots).

Chapter 1 gives general information on route planning that includes: coverage of Pilot Books and *ALLFS*; meteorological and oceanographical information and route planning.

Chapters 2 to 7 describe climatic conditions and recommended routes for high-powered vessels.

Chapters 8 to 10 give details of routes recommended for low-powered vessels and vessels hampered by damage or towing.

Purpose

This book serves as a guide which navigating officers should refer to before planning an ocean passage. They should be familiar with the general information given, long before they have to draw up a passage plan for a specific voyage.

Updates

This book is updated through Section IV of the *WANM* and the procedure for correction and record-keeping is exactly the same as for Pilot Books. When necessary, supplements are issued. Each supplement cancels the earlier one.

New editions are published when necessary.

Admiralty Distance Tables

These tables, sub-divided by region, give the shortest distances in nautical miles between positions and chief ports in the world. These distances may differ from those used in *Ocean Passages for the World* which, though longer, takes advantage of favourable climatic conditions and currents.

There are supporting figures and text as well as links to tables for places not in the same or adjacent table.

Volume 1 – Atlantic Ocean covering North Atlantic Ocean, South Atlantic Ocean, worth-west Europe, Mediterranean Sea, Caribbean Sea and Gulf of Mexico.

Volume 2 – Indian Ocean covering Indian Ocean and part of the Southern Ocean from South Africa to New Zealand, Red Sea, Persian Gulf and Malay Archipelago.

Volume 3 – Pacific Ocean covering the Pacific Ocean and the seas bordering it.

All important ports are listed in alphabetical order on the Y-axis in the left margin and also on the top of the page along the X-axis. The cell of intersection of the departure port and the arrival port contains the distance in nautical miles (Figure 40). Where two plausible alternate routes exist, each is mentioned clearly. Example: The distance from New York in the USA to Lisbon (Lisboa) in Portugal is 2,934 nautical miles.

Purpose

Distance tables serve as a quick reference for calculating passage times and fuel oil needed long before a voyage plan is made.

For example, your ship is approaching Brisbane on the east coast of Australia to load a full cargo of coal. The charterer wants to know how long it would take you, after loading, to take the cargo to Chennai (on the east coast of India) and how much fuel oil you need. The most important factor for both these calculations is the distance, which is easily available at a glance on the distance tables.

Updates

The information contained in distance tables is not variable. However, if and when necessary, corrections to *Admiralty Distance Tables* will be included in Section I of the *WANM*. New editions are published when there is a substantial increase in the contents.

TRANS-NORTH ATLANTIC

E SHORE

PLACE	GALWAY	Gijon	Gironde, La	Horta	Huelva	*INISHTEARAGHT (5° W of)	INISHTRAHULL (5° W of)	Kénitra	KIRKWALL	Las Palmas	Leixões	Lisboa	Loire, La	Lorient
*GALLEONS PASSAGE	3544	3473	3665	2394	3302	3456	3660	3273	3902	2763	3285	3208	3653	3624
Georgetown (Guyana)	3652	3532	3725	2475	3321	3561	3777	3276	4030	2740	3331	3241	3721	3694
GUADELOUPE (Pointe-à-Pitre)	3313	3283	3477	2197	3149	3227	3422	3136	3654	2658	3108	3044	3453	3418
Halifax (Nova Scotia)	2181	2451	2573	1603	2587	2124	2237	2657	2397	2491	2382	2418	2509	2460
Hamilton Inlet (Rigolet)	1730	2132	2205	1552	2379	1696	1740	2464	1834	2453	2114	2190	2128	2078
Hatteras, Cape (20° ESE of)	2939	3185	3320	2233	3263	2882	2996	3319	3157	3052	3093	3107	3260	3212
Hudson Strait (E entrance)	1860	2320	2362	1909	2634	1836	1851	2723	1929	2787	2337	2436	2282	2231
Jacksonville	3358	3599	3737	2627	3663	3300	3415	3714	3576	3418	3502	3511	3678	3629
*MARTINIQUE-SAINT LUCIA CHANNEL	3376	3329	3520	2244	3181	3289	3488	3161	3724	2670	3150	3081	3503	3470
*MONA PASSAGE	3417	3461	3643	2376	3377	3338	3512	3382	3720	2941	3305	3260	3612	3572
Mugford, Cape (10° E of)	1766	2217	2267	1727	2305	1742	1757	2590	1835	2618	2220	2308	2187	2136
Nantucket Shoals	2532	2789	2916	1886	2898	2474	2589	2962	2750	2746	2709	2735	2855	2806
New Haven (Connecticut)	2696	2953	3081	2051	3062	2639	2753	3126	2914	2911	2874	2899	3019	2970
Newport (Rhode I.)	2635	2893	3020	1990	3001	2578	2692	3065	2854	2850	2812	2838	2959	2909
New York	2731	2988	3115	2086	3097	2674	2788	3161	2949	2945	2908	2934	3054	3005
*NORTH EAST PROVIDENCE CHANNEL	3399	3576	3732	2549	3589	3335	3465	3625	3628	3276	3458	3448	3682	3636
Nuuk (Godthåb)	1653	2113	2155	1777	2430	1629	1644	2519	1723	2619	2131	2231	2075	2025

Figure 49

Chapter 6

Notices to Mariners and chart correction

Notices to Mariners

Notices to Mariners (NM) are the means of official communication of safety information to mariners. They are available in paper and digital formats.

Why mariners need *Notices to Mariners*

All charts and publications on board must be kept up-to-date with the latest information available. Ships must **not** enter any waters for which the latest editions of charts and publications are not available or are not correct and up-to-date. Corrections to charts and publications are given in the *NM*.

Publishers of Notices to Mariners

The UKHO issues *Admiralty Notices to Mariners (ANM)*. Local governments who publish their own charts and publications issue their own NM.

Important:

Admiralty charts and publications must be corrected **only** by *ANM*. Charts and publications of local governmental agencies must be corrected **only** by *NM* issued by them.

Focus on Admiralty publications and *Admiralty Notices to Mariners*

Since the Admiralty charts and publications cover the entire navigable world, whereas local hydrographic offices cover only areas within their region, we will concentrate on Admiralty charts and publications and *ANM*.

How mariners receive *Admiralty Notices to Mariners*

ANM are available from accredited chart agents the world over, in paper form, as priced publications. Some companies have an annual contract with a designated chart agent to send *ANM* on board their ships wherever they are, as soon as practicable. *ANM* are available in digital form, free of cost, online as *Admiralty Notices to Mariners Online (ANMO)*.

Intervals at which *ANM* are published

ANM Weekly Edition (WANM)

The ANM Weekly Edition (or WANM) is published every week (Figure 50).

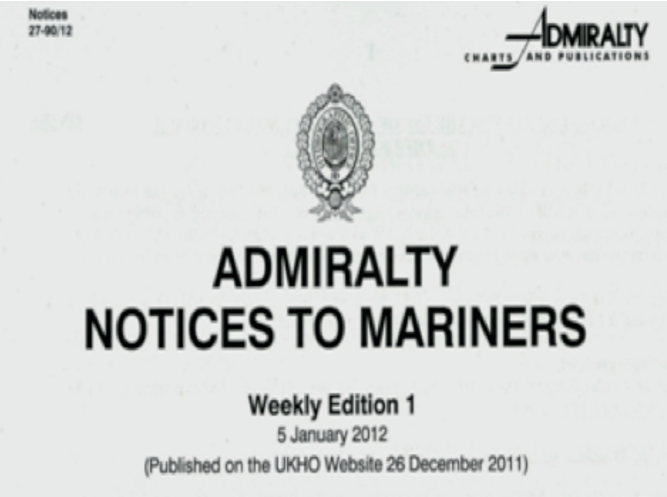


Figure 50

However, very urgent matters are broadcast as radio navigational warnings which are received on board ship by a Navtex receiver.

Cumulative List of ANM

This is published in January and July each year (Figure 51). It contains a complete list of all Admiralty nautical charts available and a complete list of ANMs affecting them during the previous two years (extract of a page is shown in Figure 52 which is meant for illustration only and not for use at sea).

Figure 51

Chart no:	Edition	Notices to Mariners
2	July 2009	**2009 (33)** 4305 **(36)** 4716 **2010 (2)** 175 176 **2011 (11)** 1181 **(39)** 4386 **(48)** 5485
3	Mar 1998	**2010 (38)** 4573

Figure 52

Annual Summary of ANM

This is published every January in two parts:

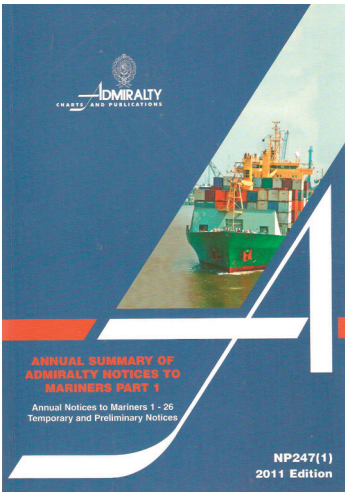


Figure 53

Part 1: Annual Notices to Mariners, Temporary and Preliminary Notices. Temporary and Preliminary notices will be explained later in this chapter.

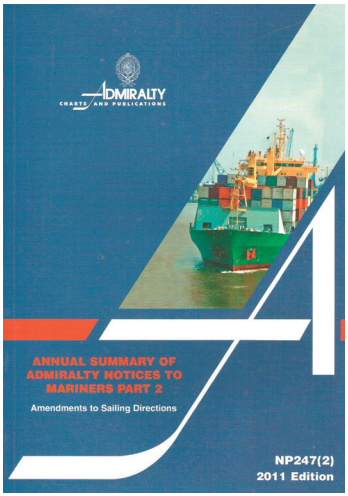
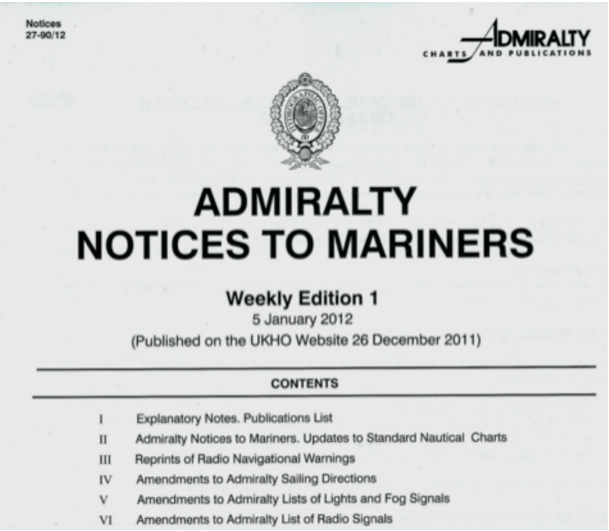


Figure 54

Part 2: Amendments to Sailing Directions.

The contents of the *WANM*

The contents of the *WANM* are shown in Figure 55.



Notices
27-90/12

ADMIRALTY
CHARTS AND PUBLICATIONS

ADMIRALTY NOTICES TO MARINERS

Weekly Edition 1
5 January 2012
(Published on the UKHO Website 26 December 2011)

CONTENTS

Figure 55

Section I: Explanatory notes. Publications list. This contains:

- Notes and advice on the use, update and amendments of charts and publications.
- Lists of new charts, new editions of charts and navigational publications that have been published; any charts withdrawn during the week.
- New charts, new editions or withdrawals scheduled to take place in the near future.
- Every month, Section IA is added which contains a list of (T) and (P) notices (explained later in this chapter), issued in the past and which of them has been cancelled during the month and which are still in force.
- Every quarter – at the end of March, June, September and December – the *WANM* contains a list of the current editions of Pilot Books and their latest supplements, *ALLFS, ALRS, ATT* and digital publications.

Section II: *ANM*. Updates to Standard Nautical Charts. This contains:

- A geographic index, indicating the page where each region affected by the notices contained in that *WANM* can be found.
- An index of charts affected by the notices contained in that *WANM*.
- Notices for chart correction. These fall into three categories:

Permanent notices	The information contained herein is to be marked permanently on the chart.
Temporary notices	A temporary notice, abbreviated to (T)NM, is issued when the information is valid for a limited period.
Preliminary notice	A preliminary notice, abbreviated to (P)NM, is issued when some changes are expected or become permanent later. For example, harbour development, construction of a bridge over the seaway.

How chart correction is done

All charts and publications on board must always be kept corrected up to the latest *ANM* received. If the latest *WANM* has not been received, you must make efforts to obtain it.

While correcting charts, your first priority should be charts that will be used in the immediate future, then charts in that geographic area and lastly, all other charts on board.

You have to make permanent corrections, and also temporary and preliminary corrections.

Permanent corrections

Information given in *WANM* for permanent corrections may be of three types:

1. Those that you make directly on the chart by hand, giving the latitude and longitude.

- Use a draughtsman's type pen with violet-coloured permanent (waterproof) ink (Figure 56).
- Violet is preferred to black as it is distinct from the black printed matter on the chart.
- Red ink is undesirable as it becomes invisible in the red coloured light of the chart table.
- Use a 0.18mm nib to insert information and a 0.25mm nib for deletions.

Figure 56

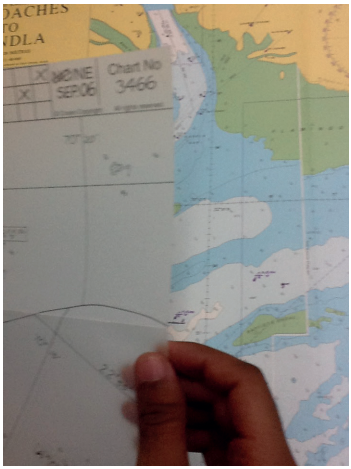


Figure 57

2. Those that you make on the chart through tracings provided (Figures 57). This is done where several spots have to be marked near one another. The information to be inserted will be in a box with each exact position marked by a dot with a circle around it. The tracing is positioned carefully over the part of the chart, aligning it with:

- The latitude and longitude lines.
- Prominent marks.
- Other marks such as soundings and other prominent features.

You mark each position on the tracing using a hard pencil. The depression created on the chart is the desired position of the insertion to be entered by hand.

3. Tracings you cut out (called a chart block) are pasted over a part of the chart so that they permanently cover the area underneath (Figures 58 and 59). This is done where the corrections are too many in a small area or where the changes are difficult to explain in words. The adhesive used should not be water-based as moisture may result in distortion.

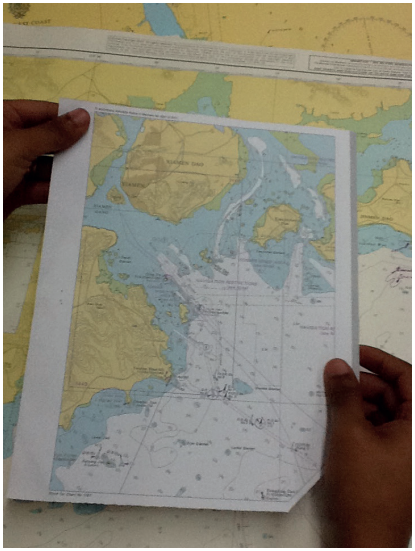
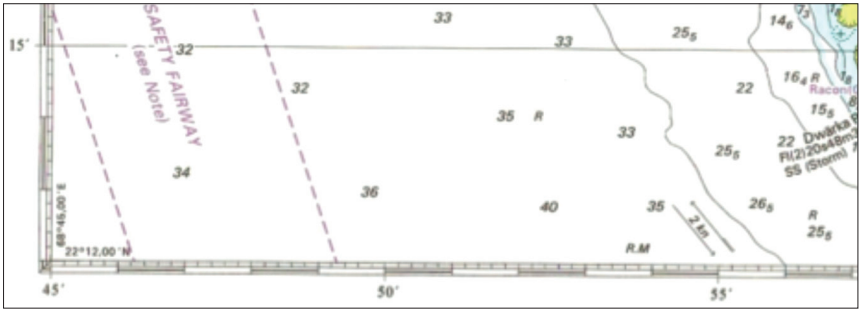


Figure 58

Figure 59



Customer information	Notices to Mariners **2008**-3497-4411-4412-5112-**2009**-73-4802-6497-6798-**2010**-371-847
Edition number: 1 Edition date: 17th April 2008	

Figure 60

Precaution before correcting a chart

The entry at the bottom of a chart must be a continuous record of all corrections made (Figure 60). So, before you make a fresh entry, you must make all the interim corrections, if any, in correct sequence and record their entries. Each new correction in the NM has the last update mentioned next to it (Figure 61). You may use the latest *Cumulative List of ANM* and then refer to all *WANM* issued thereafter to locate all corrections needed.

572 Singapore Strait – Johor Southwards – Wrecks, Buoyage.
Source: Marine Department Peninsular Malaysian Notice 95(T)/10 and Singaporean Notice 1/5/11

Chart 2043 [Previous update 6074/2010] WSG84 Datum Insert

5½ Wk 1° 26.10'N 104° 24.41'E

Figure 61

Temporary and preliminary notices

You should make the correction in pencil and write the number (T)NM or (P)NM next to it.

A record of (T)NM and (P)NM corrections made is to be entered in pencil at the bottom of the chart (Figure 62). The pages containing the (T)NM and (P)NM should be detached from the *WANM* and kept in a designated file.

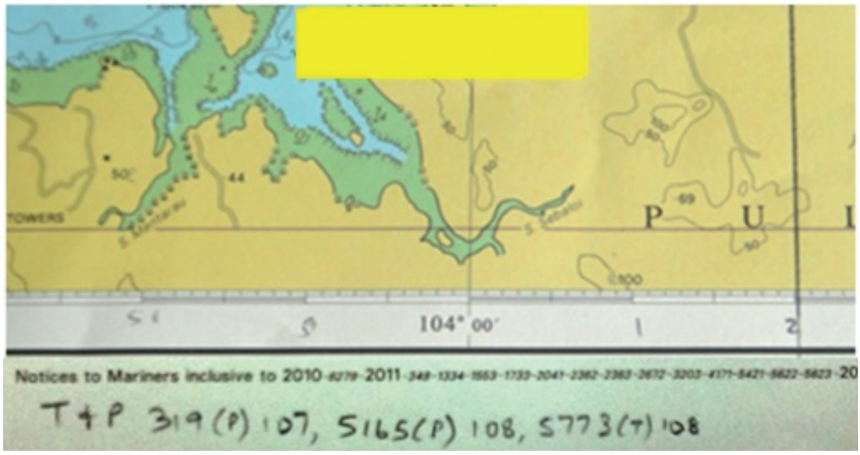


Figure 62

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