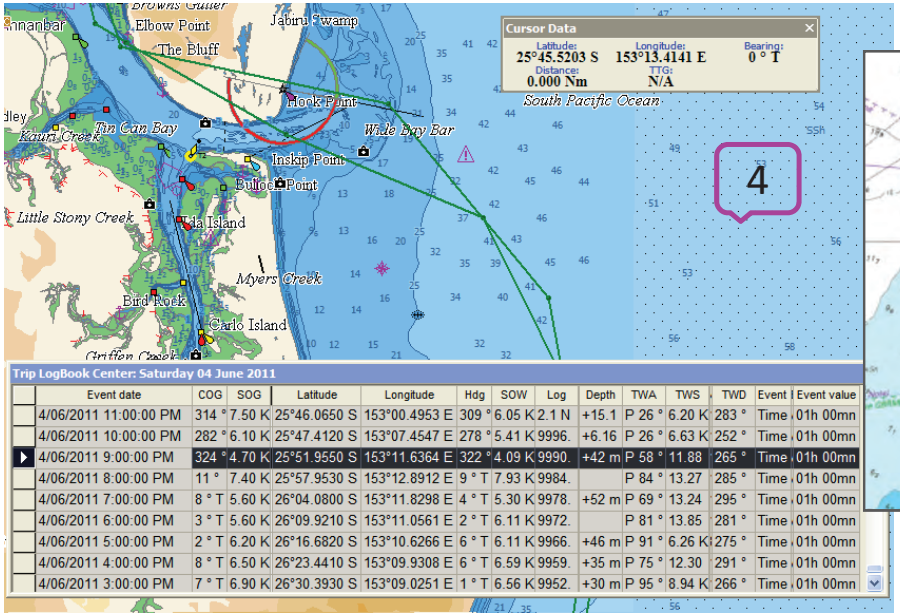
The Log Book

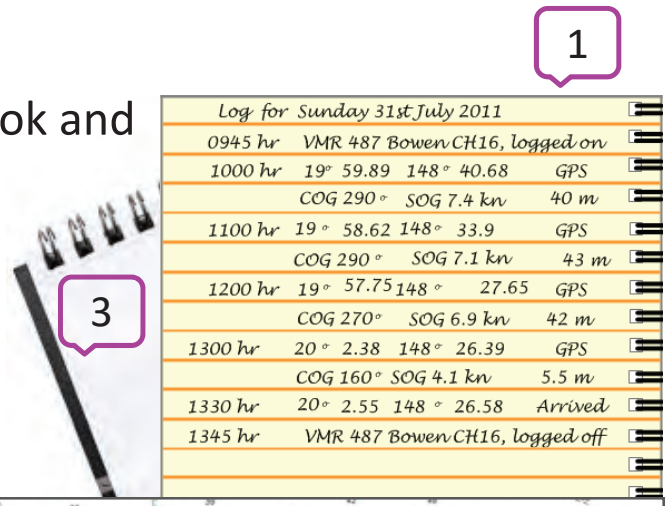
There are 2 components to a functional Log Book and 2 optional components;

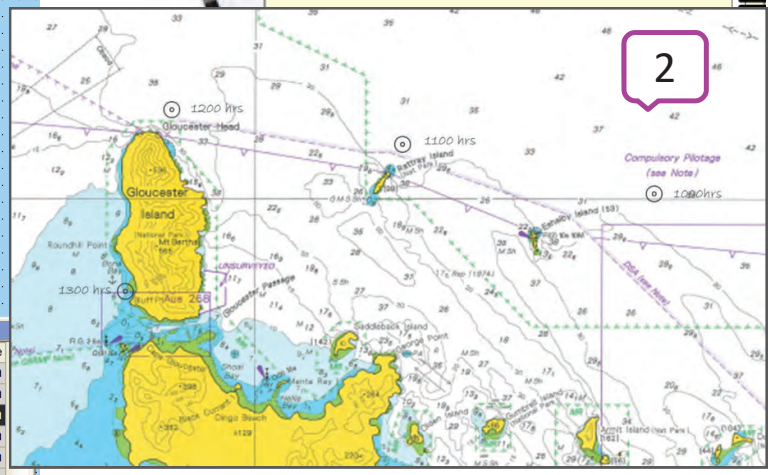
1. The Log Book, (strongly recommended)
2. The chart, (Green Book 4.06.1 OLSR)
3. The watch book, the input (as required)
4. The chart plotter log, (optional)



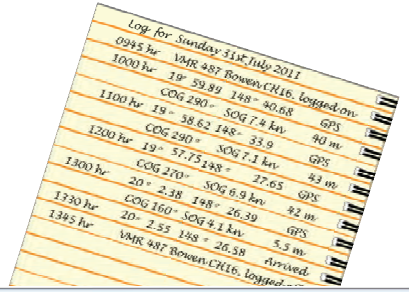
Trip LogBook Center: Saturday 04 June 2011

Event date	COG	SOG	Latitude	Longitude	Hdg	SOW	Log	Depth	TWA	TWS	TWD	Event	Event value
4/06/2011 11:00:00 PM	314 °	7.50 K	25°46.0650 S	153°00.4953 E	309 °	6.05 K	2.1 N	+15.1	P 26 °	6.20 K	283 °	Time	01h 00mn
4/06/2011 10:00:00 PM	282 °	6.10 K	25°47.4120 S	153°07.4547 E	278 °	5.41 K	9996.	+6.16	P 26 °	6.63 K	252 °	Time	01h 00mn
4/06/2011 9:00:00 PM	324 °	4.70 K	25°51.9550 S	153°11.6364 E	322 °	4.09 K	9990.	+42 m	P 58 °	11.88	265 °	Time	01h 00mn
4/06/2011 8:00:00 PM	11 °	7.40 K	25°57.9530 S	153°12.8912 E	9 ° T	7.93 K	9984.		P 84 °	13.27	285 °	Time	01h 00mn
4/06/2011 7:00:00 PM	8 ° T	5.60 K	26°04.0800 S	153°11.8298 E	4 ° T	5.30 K	9978.	+52 m	P 69 °	13.24	295 °	Time	01h 00mn
4/06/2011 6:00:00 PM	3 ° T	5.60 K	26°09.9210 S	153°11.0561 E	2 ° T	6.11 K	9972.		P 81 °	13.85	281 °	Time	01h 00mn
4/06/2011 5:00:00 PM	2 ° T	6.20 K	26°16.6820 S	153°10.6266 E	6 ° T	6.11 K	9966.	+46 m	P 91 °	6.26 K	275 °	Time	01h 00mn
4/06/2011 4:00:00 PM	8 ° T	6.50 K	26°23.4410 S	153°09.9308 E	6 ° T	6.59 K	9959.	+35 m	P 75 °	12.30	291 °	Time	01h 00mn
4/06/2011 3:00:00 PM	7 ° T	6.90 K	26°30.3930 S	153°09.0251 E	1 ° T	6.56 K	9952.	+30 m	P 95 °	8.94 K	266 °	Time	01h 00mn





The Log Book



Content and frequency need to be considered

- Content will be the base and means of estimating or fixing your next position
- Frequency is determined by events and what is safe
- Each hour on the hour is a good rule

A standard exercise book is all that is required

- Book can also serve as your passage planner

Log book is a legal document, proof of location and time

Time	Log	Depth	COG	SOG	Position (Chart)	Weather	Remarks
0700	2347	15	030 T	6	Lat/Lon (DR, EP, Fix, GPS, Radar)	NE12, 1003, Cloudy Etc.	Radio and or other events observations

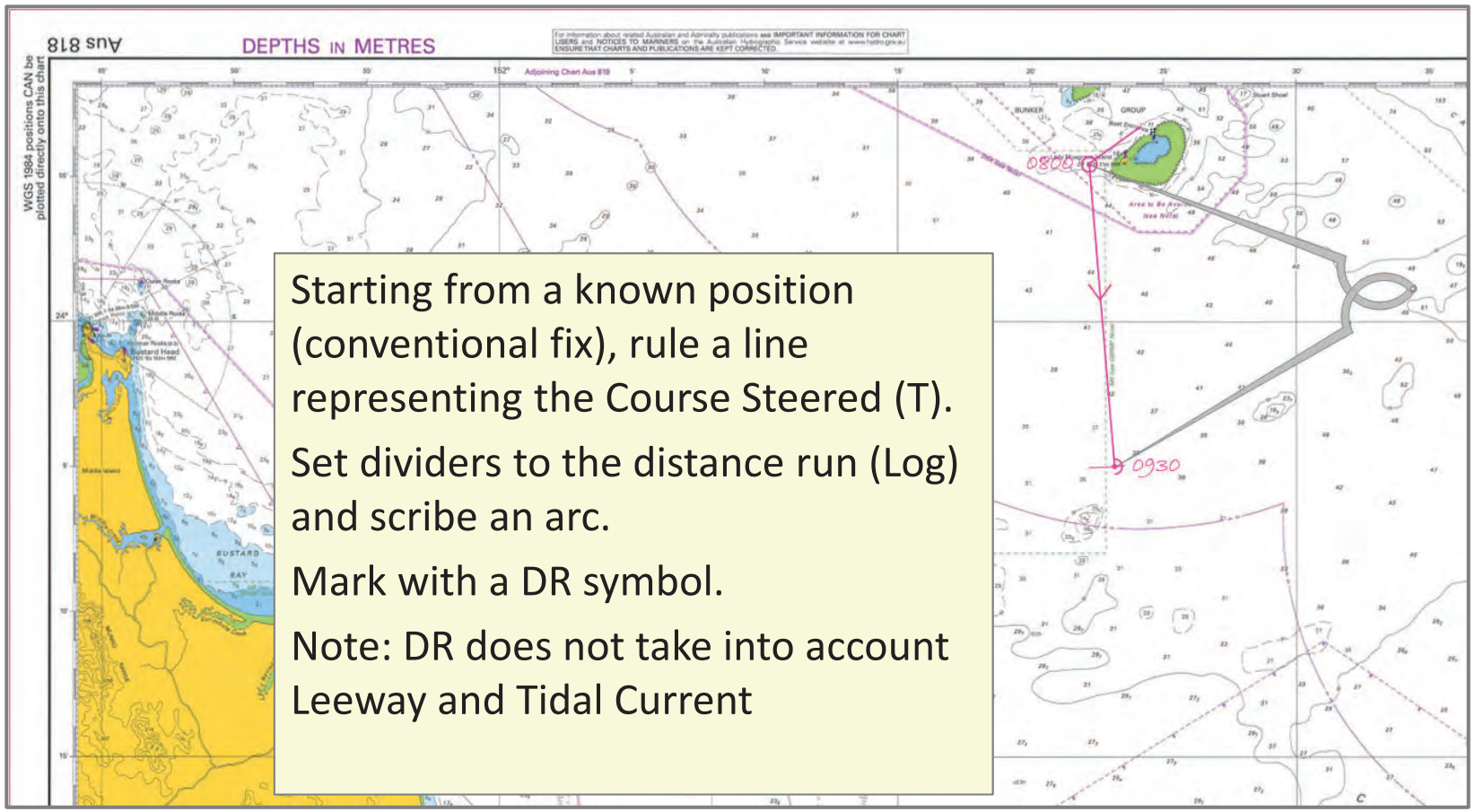
Estimating your Position

Assume you know your start position or last location and you know the speed and direction steered.

Your position can be plotted based on speed and course steered, this is known as Dead Reckoning (DR) position

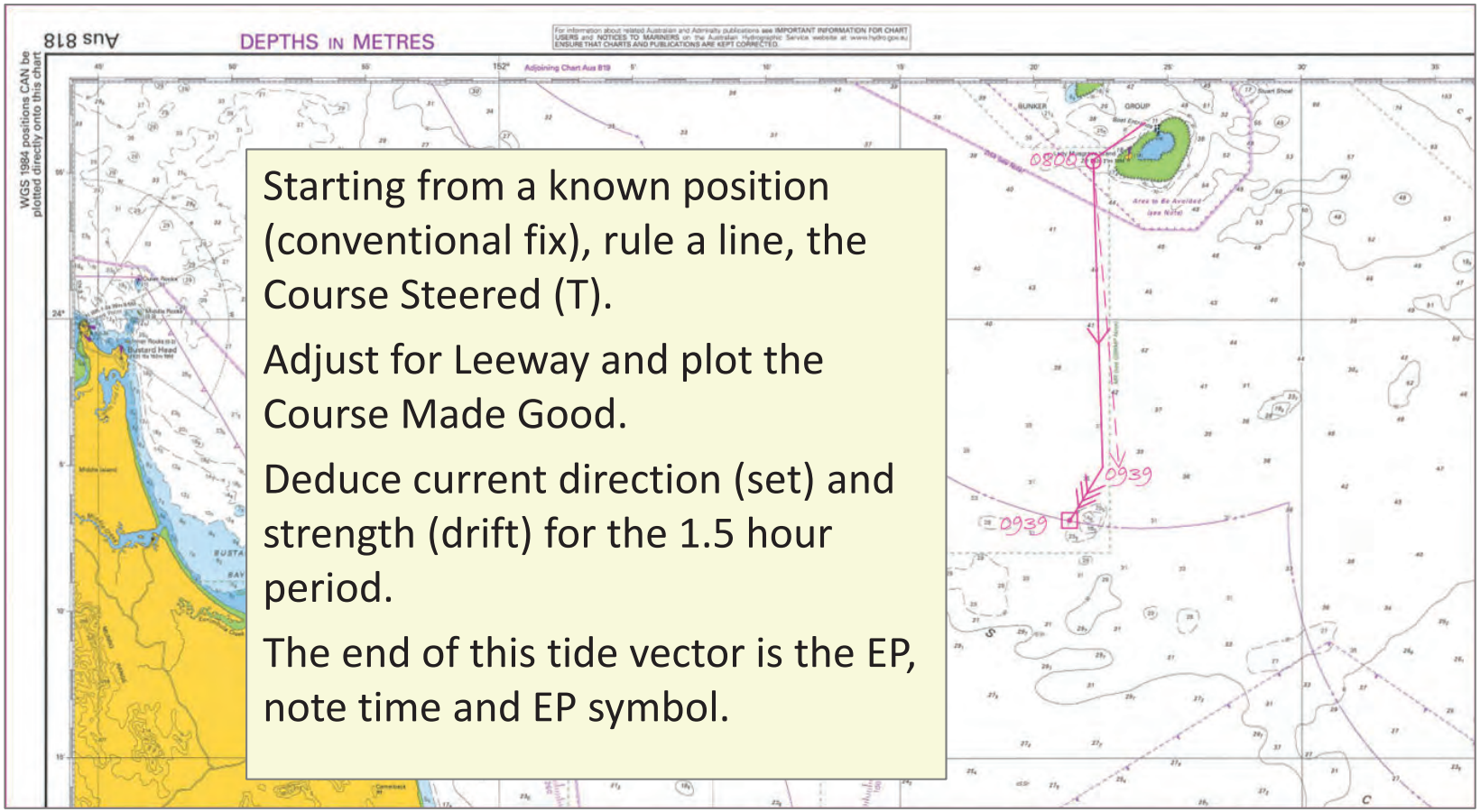
Or you can adjust for Leeway, Set and Drift, this is known as an estimated position or (EP).

Plotting a Dead Reckoning Position (DR)



To Plot an Estimated Position (EP)

Accounts for, leeway, set and drift



Starting from a known position (conventional fix), rule a line, the Course Steered (T).

Adjust for Leeway and plot the Course Made Good.

Deduce current direction (set) and strength (drift) for the 1.5 hour period.

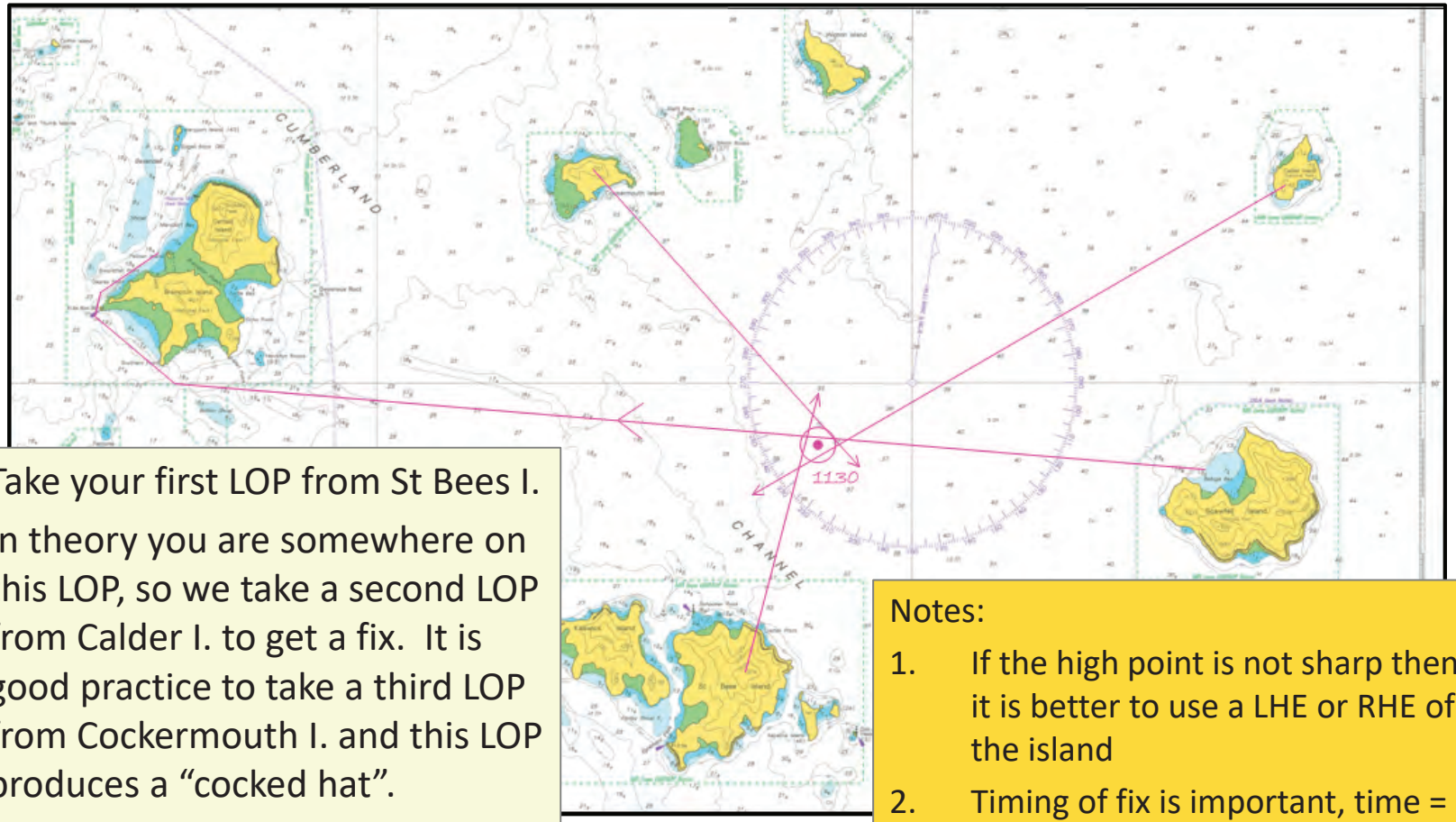
The end of this tide vector is the EP, note time and EP symbol.

Knowing Where You Are

Other than sitting beside a beacon, the most accurate method of obtaining your position in conventional navigation is a Fix.

- Basic principal is to cross check one Chart data point with another
- Normally multiple bearings known as lines of position (LOP)
- Can also include depth contours

Position by Cross Bearing Fix



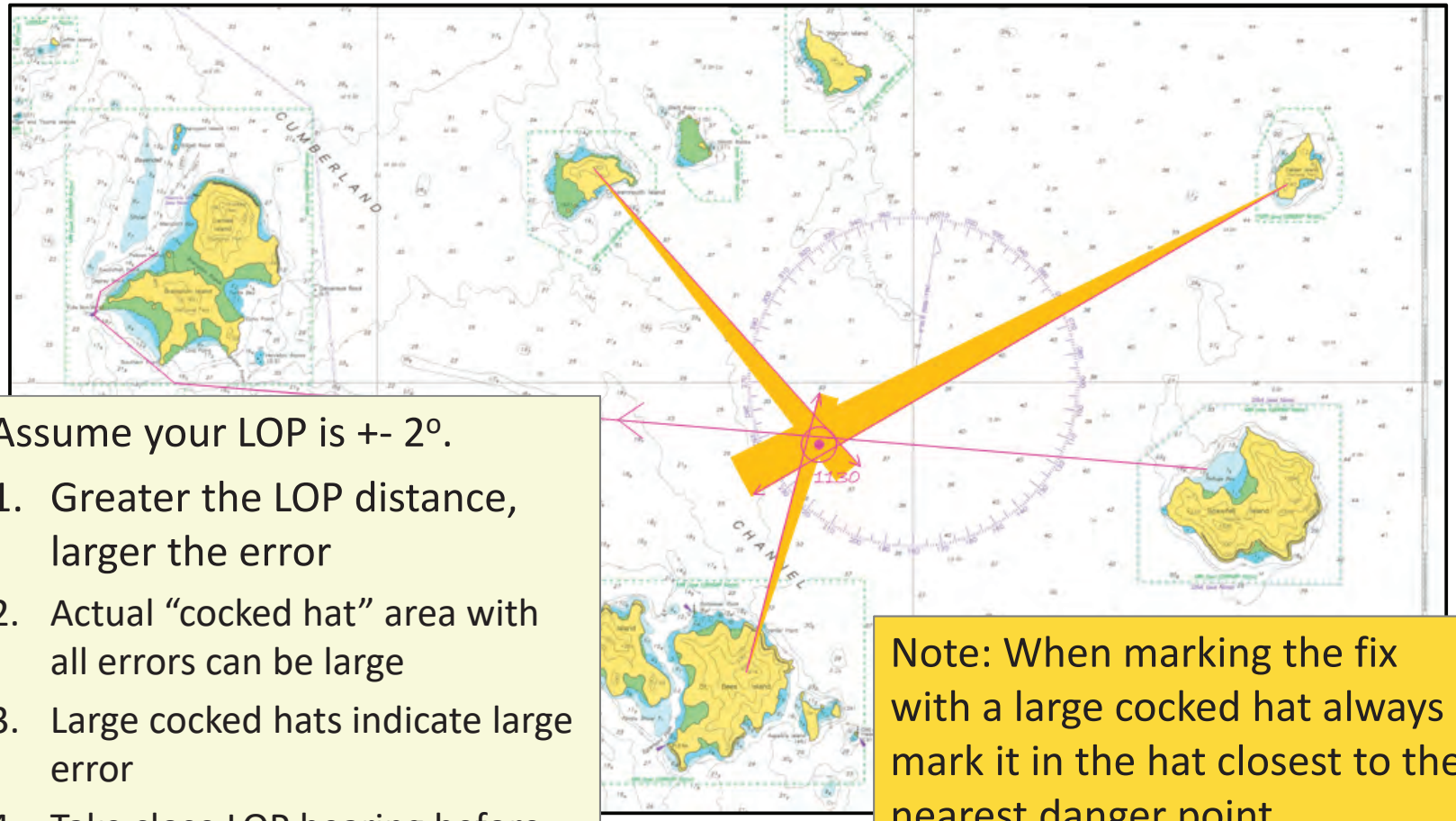
Take your first LOP from St Bees I.

In theory you are somewhere on this LOP, so we take a second LOP from Calder I. to get a fix. It is good practice to take a third LOP from Cockermouth I. and this LOP produces a “cocked hat”.

Notes:

1. If the high point is not sharp then it is better to use a LHE or RHE of the island
2. Timing of fix is important, time = distance

Notes on Lines of Position (LOP)



Assume your LOP is +- 2°.

1. Greater the LOP distance, larger the error
2. Actual "cocked hat" area with all errors can be large
3. Large cocked hats indicate large error
4. Take close LOP bearing before distant LOP bearings

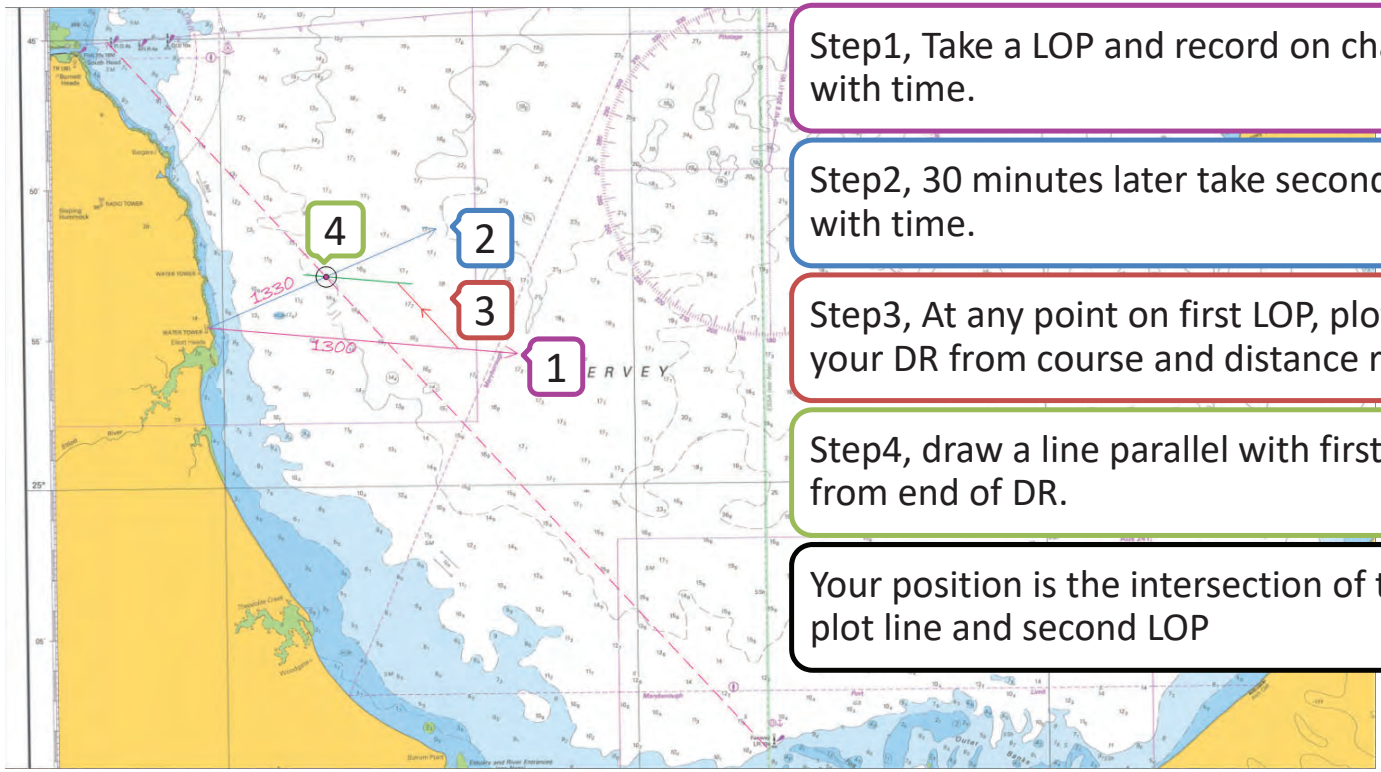
Note: When marking the fix with a large cocked hat always mark it in the hat closest to the nearest danger point

The Running Fix

Sometimes there is only one object available to determine your position and determining the range from the object is difficult to impossible.

- The solution is a running fix.
- It should always be treated as a rather blunt navigation tool and should not be used where strong tidal flows are present.
- It can be used to double check an estimated position (EP).

Plotting the Running Fix



Step1, Take a LOP and record on chart with time.

Step2, 30 minutes later take second LOP with time.

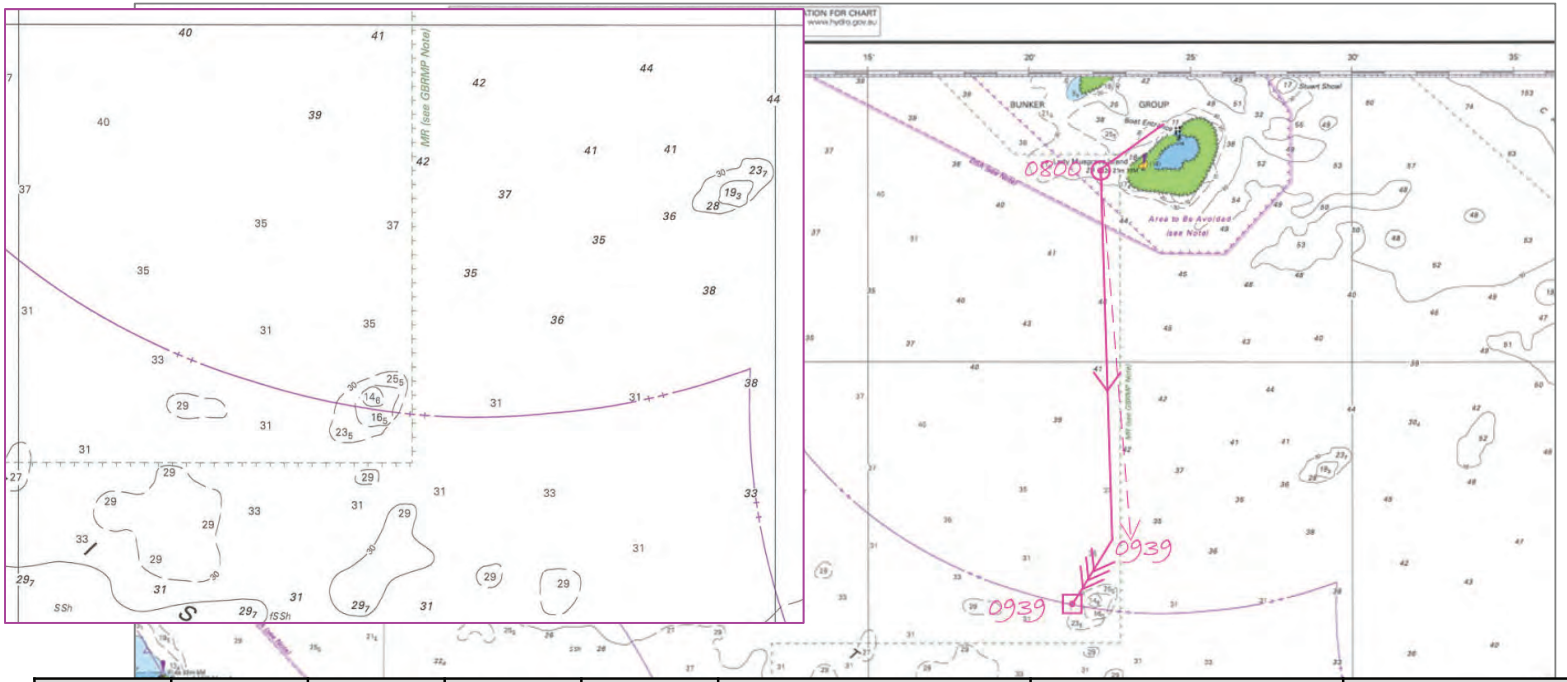
Step3, At any point on first LOP, plot your DR from course and distance run

Step4, draw a line parallel with first LOP from end of DR.

Your position is the intersection of this plot line and second LOP

Depth as a Navigation Aid

Can EP accuracy be improved?



Time	Log	Depth	Course	SOG	Position (Chart)	Weather	Remarks
0800	2347	23	165 C	6	23° 54S 152° 22E	SE12, 1003, clear	Departed Lady Musgrave
0939	2356	14	165 C	6	24° 07S 152° 21E	SE15, 1003, clear	~~EP~~ Fix Depth

Buoy Hopping as a Navigation Aid

In good visibility, buoy hopping is a very accurate method of navigating difficult or busy seaways.

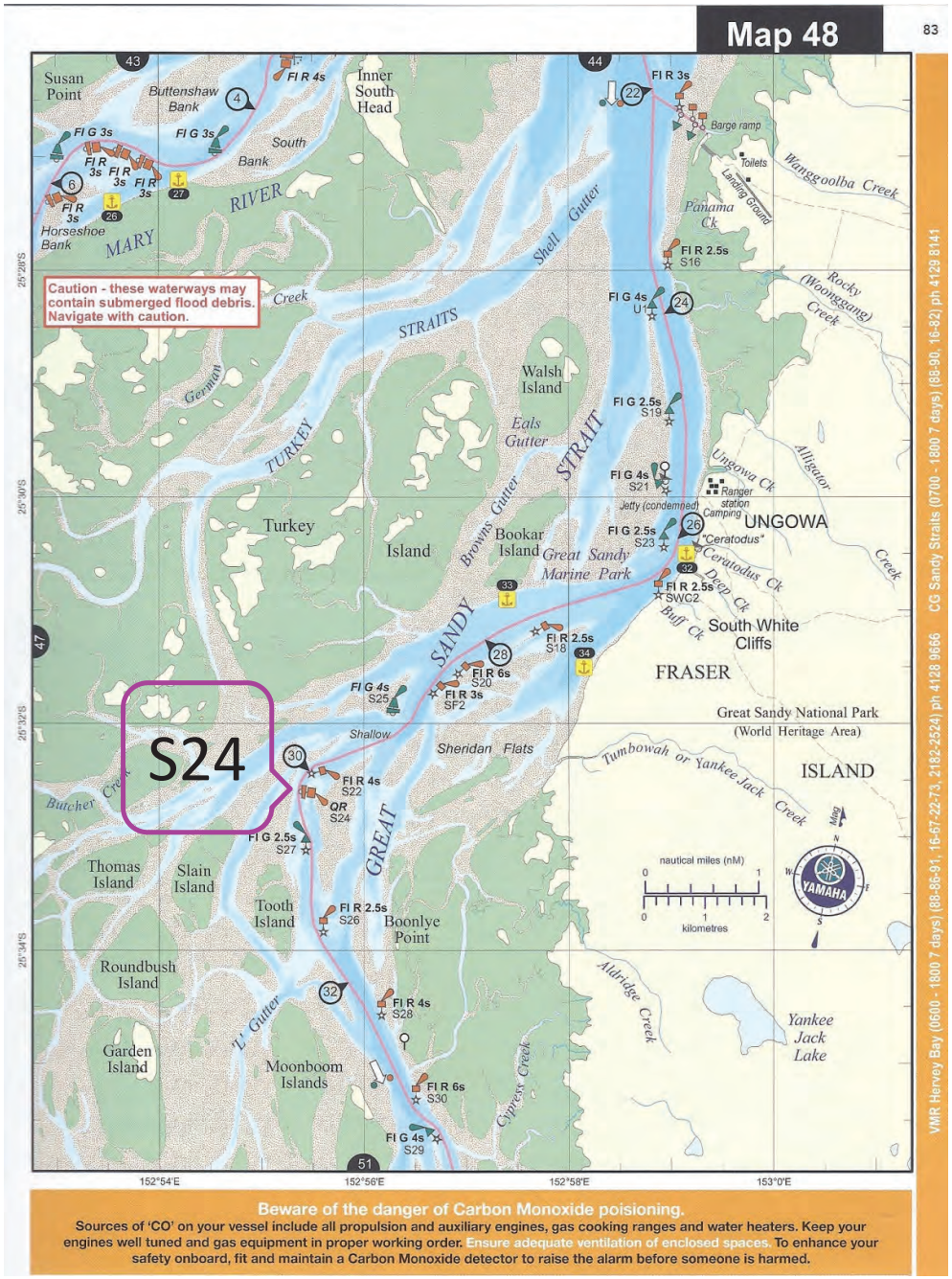
This is the technique of following a seaway by Buoys and or Beacons.

However you do require a ready backup should you miss one and not see the next.

Within Queensland there are three examples;

- Moreton Bay
- Great Sandy Straits
- Hinchinbrook Channel

Beacon to Beacon (Tweed Heads to Yepoon) is a great navigational document to assist with buoy hopping within its scope.



Buoy Hopping through the Great Sandy Straits

Buoy hopping through the GSS is simple so long as you have good visibility and take you time to identify the next and correct mark.

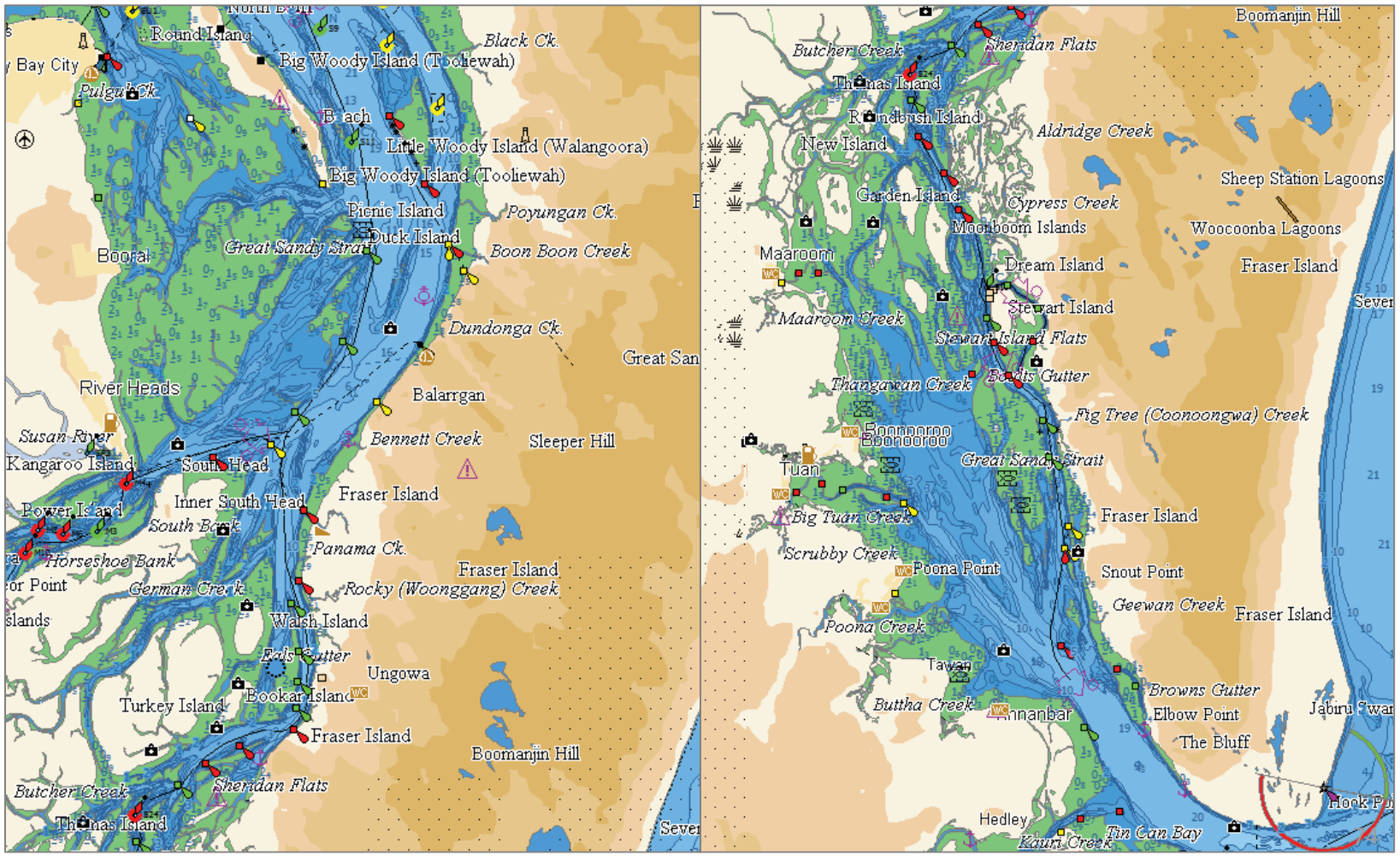
All are beacons with the exception of S24.

Do not assume S24 to be in the position as marked on the chart.

S24 is a moored buoy and is constantly moved to follow sand movement within the channel.

Mark the buoys off in your Log as you proceed with time and number.

Great Sandy Straits



Communicating Your Position

On occasions you will be asked to communicate your position, to friends, Marine Rescue/VMR and others. There are two options;

1. Latitude Longitude
   - 33^{o} 35.2S 151^{o} 25.4E
2. Range and bearing
   - Specified as range and bearing from land mark; always specify as you would give flight directions to a pilot searching for you;
   - “my position from Barrenjoey Light is 95 degrees, 4.7 miles”.
   - Where he should start, the direction to fly and distance to fly. Default bearing is always T, if M specify.

Electronic Navigation Aids

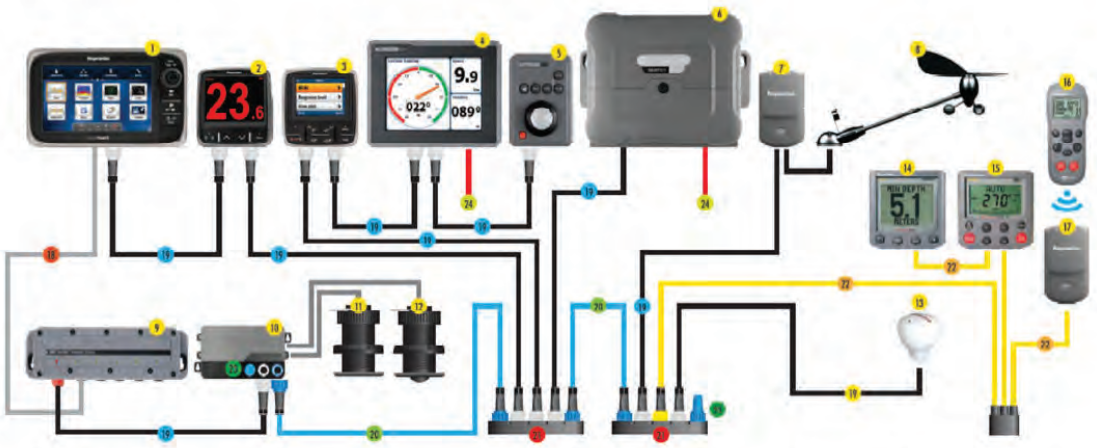
In this section we will review Electronic Navigation Instruments (GPS receivers, chart plotters, ships instruments and radars) what information they provide, how to use this information and do we require backup.

Modern electronics are highly functional, accurate, reliable and priced to fit most budgets.

So it makes sense that nearly every cruising yacht has a set of electronic navigation instruments.

Several questions come immediately to mind;

- What unique information do they provide?
- What is the navigational meaning of this information?
- To what extent can we and should we rely on electronics?
- What part should they play in our navigation strategy and methodology?



Note: Imagery for illustrative purposes only. Product images shown in suggested system diagrams are not to scale

Typical Basic SeaTalk^{ng} System:

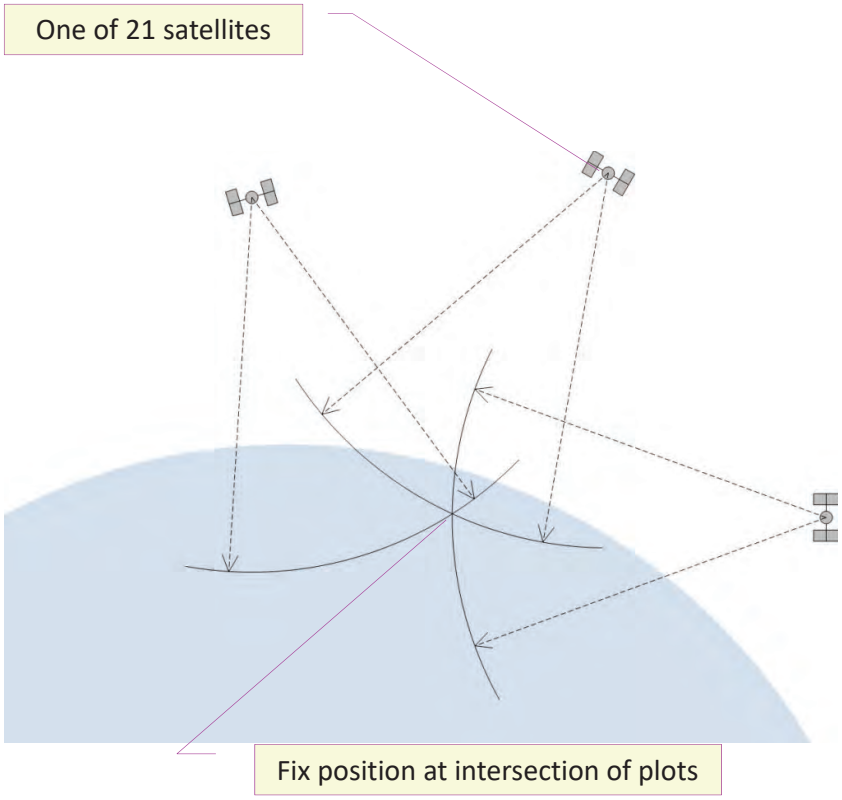
1. New e Series **2.** i70 Instrument **3.** p70/p70R Autopilot **4.** ST70 Plus Instrument **5.** ST70 Plus Autopilot Keypad **6.** SPX Course Computer **7.** Pod **8.** Wind Transducer **9.** Network Switch **10.** iTC-5 **11.** Speed Transducer **12.** Depth Transducer **13.** RS130 GPS Sensor **14.** ST60+ Instrument **15.** ST6002 Autopilot **16.** SmartController **17.** Pod **18.** RayNet Cable **19.** SeaTalk^{ng} Spur **20.** SeaTalk^{ng} Backbone **21.** 5-Way SeaTalk^{ng} Connector **22.** SeaTalk **23.** Terminator **24.** Power Supply

Here we have a typical installation, many components sharing reams of information, simple to understand, and no single point of failure, 100% availability, etc. right?

"It is found that anything that can go wrong at sea generally does go wrong sooner or later, so it is not to be wondered that wise sailors prefer the safe to the scientific" (marine version of Murphy's Law).

A very good question is; how to exploit this highly functional technology, while practicing a secure and reliable navigation methodology?

Global Positioning System



A network of 21 orbiting satellites, owned by the US military, who make periodic adjustments, including accuracy.
Has proved extremely accurate, reliable and easy to use.
20-30m at 95% of fixes, 300m at 5% of fixes

Each satellite transmits a sphere of position, satellite location, identification, and transmission time.

The GPS receiver picks at least three signals and derives a location (horizontal and vertical) based on satellite location and signal propagation delay.

Requires an accurate clock in the GPS receiver, in fact this clock is continuously synchronised with the satellites.

GPS

Basic Operation

Basic receivers have a standard set of functions and features, operation varies significantly so reference to Instruction Manual is a MUST.

Initial setup

Distance:

nautical miles, speed = knots

Direction:

(T) When transferring information with chart.

(M) Option for transferring real time information to helm.

CAUTION know what system you are operating, **some say (T) always**.

Position:

Latitude and Longitude in degrees , minutes and decimals.

Horizontal datum:

Set to chart datum, normally WGS84, check your Paper Chart.

Time:

Set to local time with UTC offset.

GPS Basic Functions

Location:

- Latitude and Longitude, the most basic function.

Direction:

- Can be called course(CRS), track (TRK) or course over ground (COG), this is the direction the GPS is moving relative to the ground and based on a series of position fixes.

Speed:

- Can be called speed (SPD), velocity (VEL) or speed over ground (SOG), this is the speed the GPS is moving relative to the ground.

A Clock:

- As a by-product of calculating location, a GPS is a very accurate time peace, more accurate than any clock you may have on the boat.

Not a Compass:

- In most cases the GPS is not a Compass, so will not show the direction you and or your boat are pointing. However some hand held units do have a fluxgate compass.

Not a Log:

- Likewise it does not measure the speed you are travelling through the water.

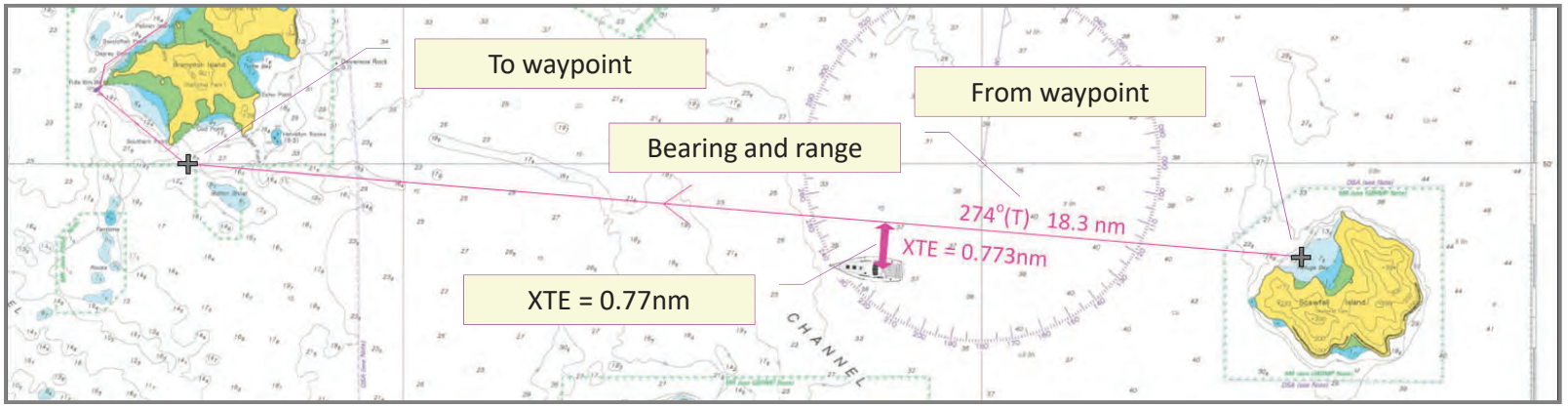
Data Fields:

- Customise data fields displayed to suite your navigation methodology.

GPS Derived Data

GPS Data	Description
Lat Lon	Position
BRG (BTW)	Bearing to a selected waypoint
XTE	Cross Track Error (distance nm, and direction off the course line)
DIST (DTW)	Distance to waypoint in nautical miles
COG	Course over ground = Track
SOG	Speed over ground
DTG	Distance to go = DIST = distance to WP
ETA	Estimated time of arrival at waypoint
HDOP	Horizontal Dilution of precision (accuracy)

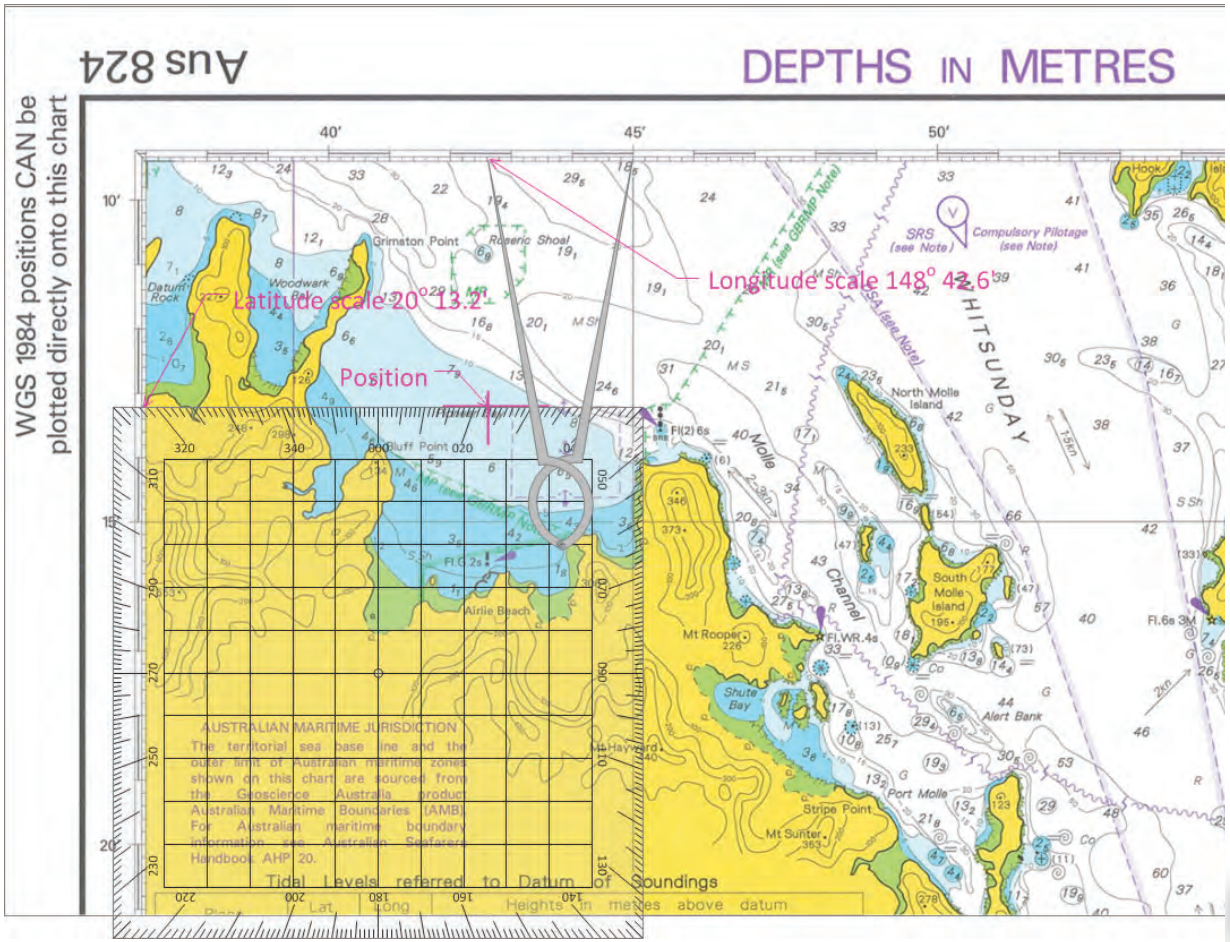
GPS Next Level Features



Feature	Description
Waypoints	A number of fixed positions called waypoints, components of a higher order of GPS functionality known as routes.
GoTo	Ability to “go to” from your current position to a set waypoint. This function provides a range and course to steer or bearing from current location to the defined waypoint.
XTE	This must be the most significant time saver for a navigator. Once underway the GPS will provide a continuous update of how far you are off the original bearing or rhumb line as distance and direction to correct. A real time combined leeway, set and drift correction.
MOB	Most GPS receivers have a MOB button that when pressed records the current position, interrupts all other navigation and displays a course and distance to MOB position.

Plotting GPS Position On Chart

Method 1, Latitude and Longitude



Plotting GPS Position On Chart

Method 2, Range and Bearing

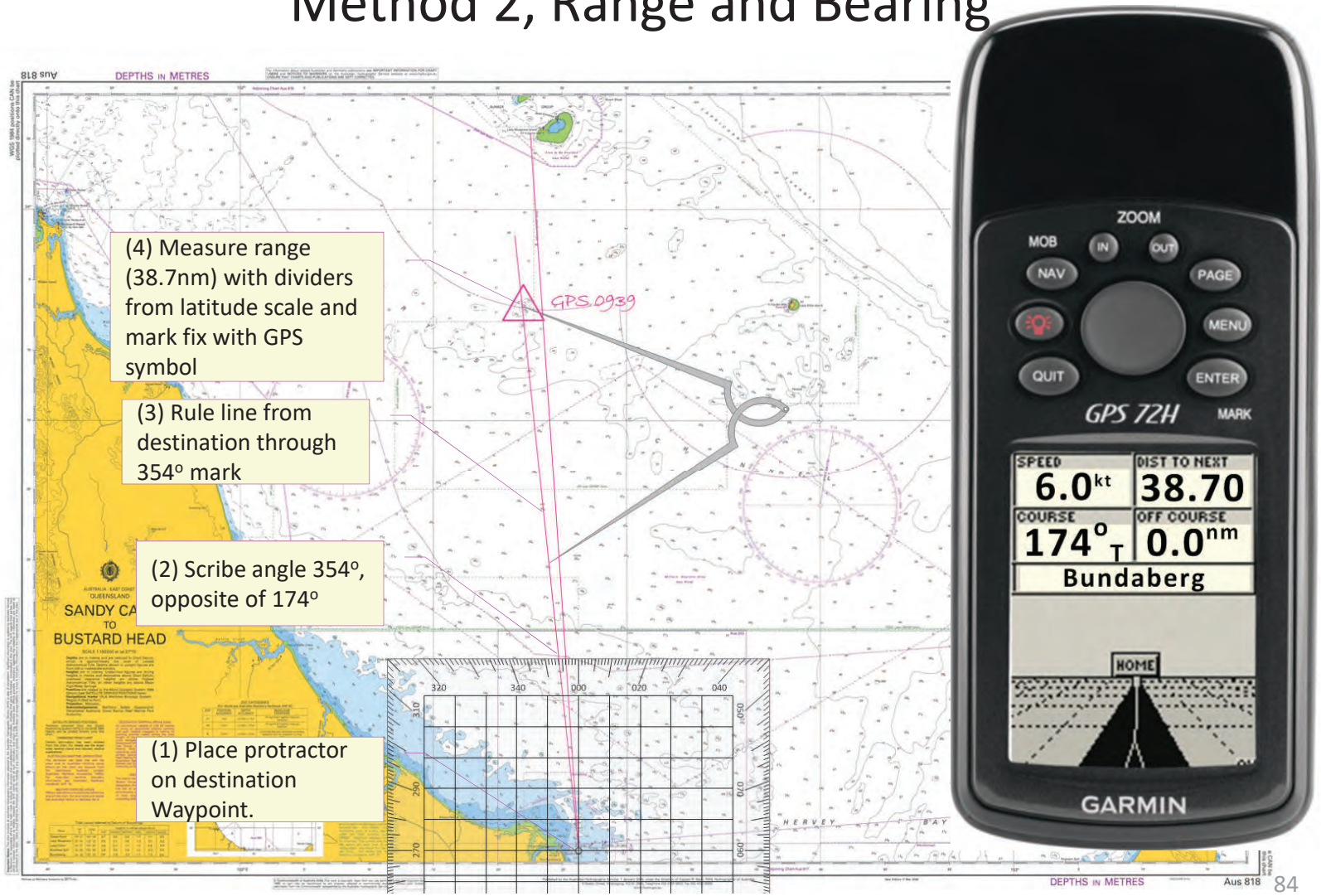


Chart Plotters

The ultimate electronic navigation aid, in a vast range of sizes, functionality and prices.

They present the ship on a moving chart with many options and data.

To maximise the operational functionality and accuracy, the user must read the User Manual.

Key is understanding the exact meaning of instrument settings, data including its source.

Once used you will want to discard the traditional navigation tools and techniques. In fact many cruising sailors do rely exclusively on this aid, dangerous.

It is an electronic aid and therefore fallible.

Prerequisite to use, is an understanding of traditional chart navigation.

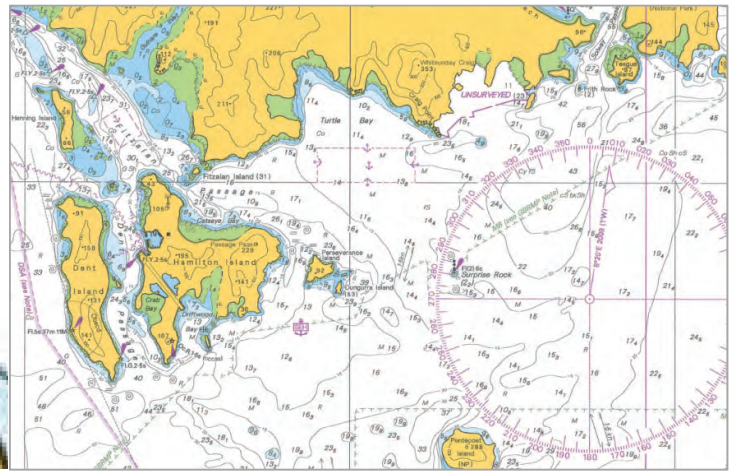
Some Chart Plotters have integral GPS receivers, others rely on external GPS receivers.

All Electronic Navigation Aids communicate via an information bus, sometimes proprietary (SeaTalk), others use an open standard such as NMEA0183 /2000.

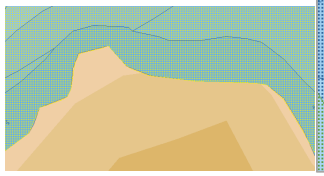
Electronic Charts

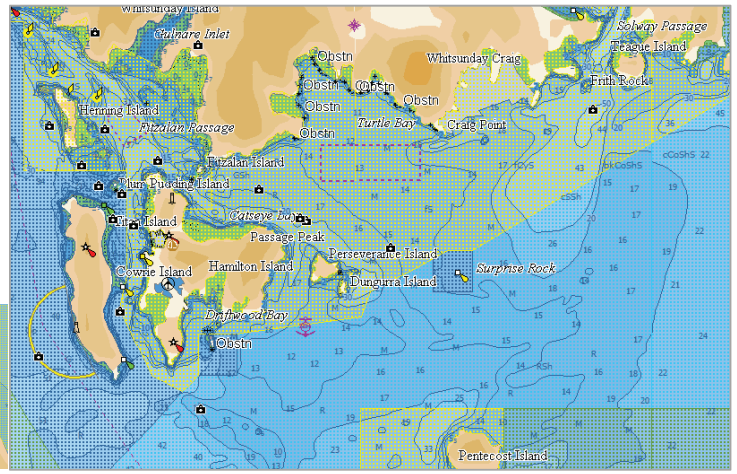
There are two categories

Raster charts: are images of the original paper chart digitised for loading into a computer. As you zoom in you do not get extra data just pixels. They are cheap however memory intensive. The one advantage is you do not loose chart detail as you zoom.

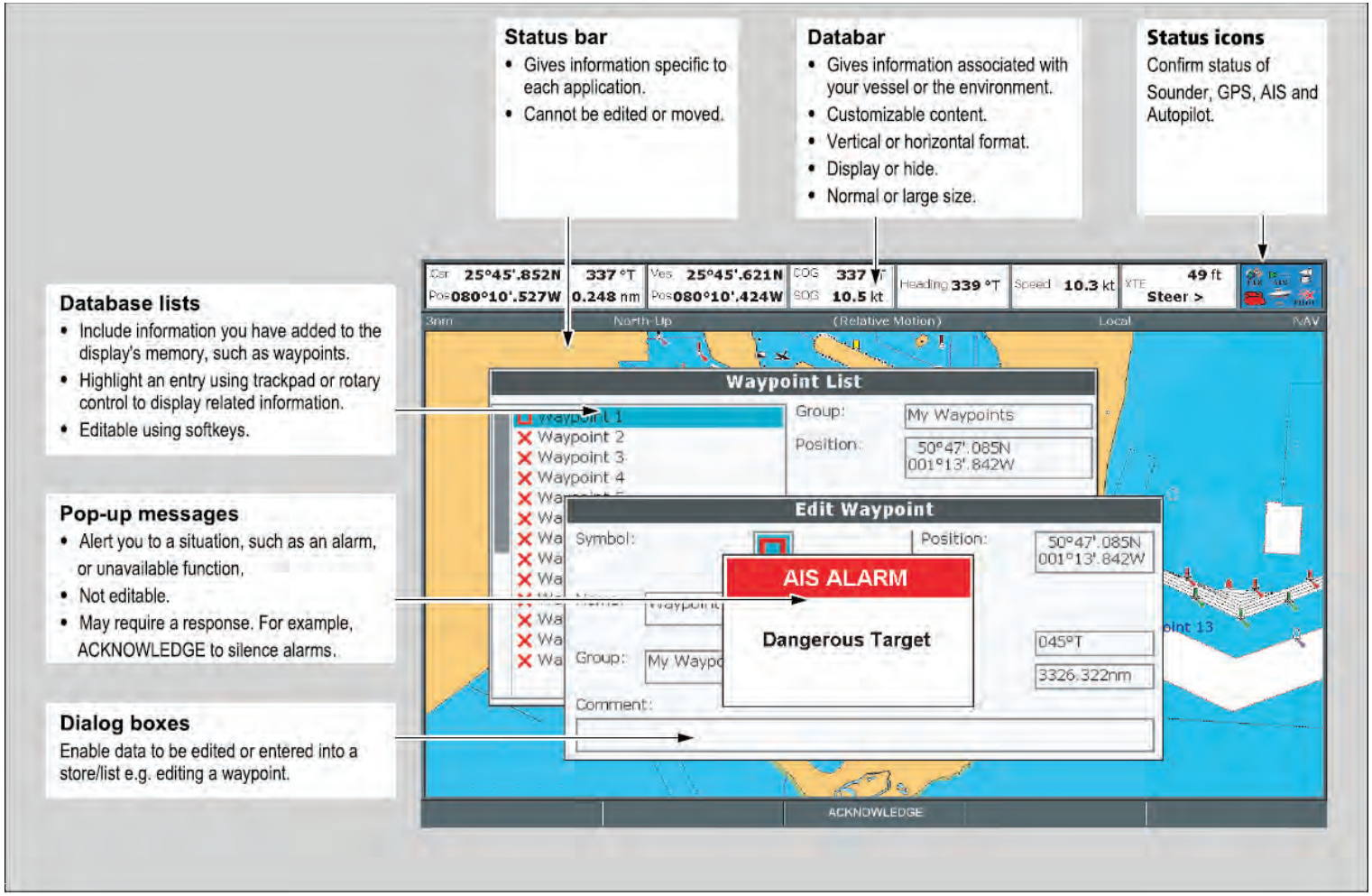


Vector charts: are copies of gazetted charts, drawn from scratch with short line segments and symbols and are arranged in layers enabling details to be turned on and off as you zoom, both a positive and a risk. This is the most popular chart type used on plotters.





Typical Chart Plotter Screen



Basic Chart Plotter Functions

Function	Description
Find Ship	To centre chart under ship position as defined by GPS
Ship position	Sips Lat/Lon and data such as SOG, COG and instrument data
Cursor position	Cursor Lat/Lon, range and bearing and time from ship to cursor
Zoom/Pan Chart	Change chart scale/**layers** and pan chart
Setup	Set required parameters and units
Waypoints	Define library of named Lat/Lon positions as waypoints
Routes	Define routes made up of waypoints from Waypoint library
Range & Bearing	Range and bearing from ship to waypoint or end, TTG and ETA
Track	Display and record your track, time and or distance (rice trail)
Chart Up	North-Up, heading course up. If HDG up chart will move continuously
Ship's Log	Log ships data (Lat Lon, time, SOG, COG etc) at time/distance
Split Screen	Display chart radar or different chart scales
Man Overboard	If pressed, a WP is set and bearing and distance displayed

Chart Plotter Operation

Chart will appear following power on.

Chart displayed will be the previous view or random, select “**Find Ship**” function to centre chart under ship.

As you sail the ship will move towards the chart edge, some chart plotters automatically centre the ship others will require a repeat of “Find Ship”.

A window along the top will display vessel position and or cursor position.

Sometimes both, sometimes dynamic

Split Screens

Two scales of chart or chart and Radar