7.7 Navmaster Electronic Navigation System

There are a multitude of suppliers of software suitable for implementing an electronic navigation system, requiring only the hardware and suitable electronic charts to produce an ECDIS or an ECDIS in RCDS mode. The 'Navmaster Professional' from PC Maritime of Plymouth, UK is used as a basis for showing how the software can assist the navigator in passage planning, position logging and navigation management, providing as it does a continuous display of vessel positions received from GPS and plotted on official electronic charts. The minimum system requirements for Navmaster are: a computer operating with a Pentium 133, or better, processor; Windows 95/98/NT/2000; 10-Mbyte hard drive for minimum installation; CD-ROM and floppy-disk drives; 32-Mbyte RAM; and a monitor with 800×600 resolution with 256 colours or more. Input/output requirements are one serial and one parallel port. The software is supplied on a CD-ROM. The system uses electronic chart data, which is the copyright of various national hydrographic offices; chart data is protected by a security key that allows access to the charts only via a user PIN number.

Once the software has been loaded into the computer then starting with Navmaster the display will be similar to the one shown in Figure 7.11.

The toolbars and side panels can be moved around the screen, hidden and displayed as required. The main window contains the following.

Title bar

The title bar displays the program control icon, the activation or active image title and the standard minimize/maximize/restore/close buttons.

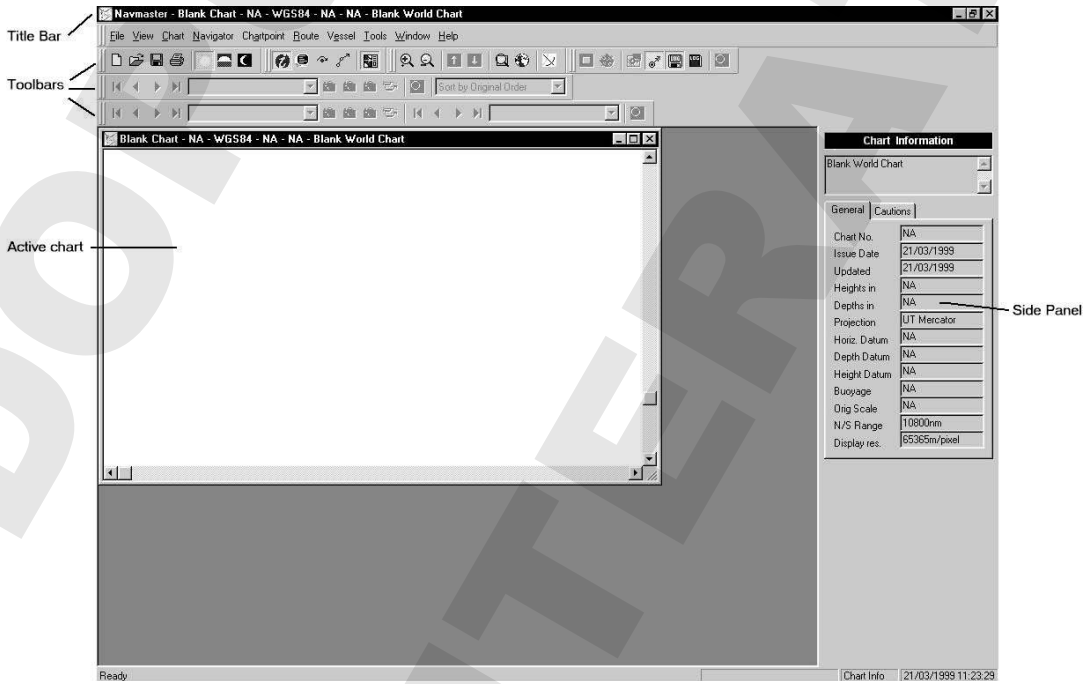

Figure 7.11 The Navmaster start-up window. (Reproduced courtesy of PC Maritime.)

Figure 7.12 Navmaster menu bar headings. (Reproduced courtesy of PC Maritime.)

Menu bar

The menu bar displays the menu headings as shown in Figure 7.12. These are as follows.

- File. Contains standard menu commands for file management, printing and workspace, opening charts, and opening and saving chartpoint and route databases.
- Edit. Provides standard menu commands.
- View. Provides menu commands to select modes of operation, turn on or off the toolbars, side panel and status bar.
- Chart. Provides menu commands to change the chart display, install chart permits and updates, set the location of charts and updates and set chart-related options.
- Navigator. Provides menu commands to: turn position plotting on or off and set DR parameters; turn position logging on or off and make log entries; upload routes and waypoints to GPS; access diagnostic windows for equipment interfacing; open the Autoscroll monitor window; set position and navigation-related options.
- Target. Provides menu commands to Activate/Deactivate ARPA and Tender tracking and set related options.
- Chartpoint. Provides menu commands related to chartpoints.
- Route. Provides menu commands related to routes.
- Vessel. Provides menu commands to enter vessel information for use when calculating plans.
- Tools. Provides menu commands to display tidal atlas and activate the Range and Bearing tool, customize toolbars and set workspace and tidal atlas options.
- Window. Provides menu commands to manipulate windows.
- Help. Provides Help and information on obtaining technical support.

Toolbars

The toolbars provide buttons that access some of the frequently used commands in the menus. If a command is unavailable, its button appears greyed-out. Toolbars and their button functions are shown in Figure 7.13.

Side panels

These panels represent each of the main functions of the Navmaster system, i.e. monitoring position, storing chartpoints and creating and calculating routes. Switching between functions is achieved by pressing a button on the display toolbar or by selecting an item in the View menu.

1 Monitor mode. In this mode it is possible to monitor and plot the vessel's passage. The screen consists of three main areas: the chart area, the side panel and the toolbars. The chart area provides a view of the current chart, which may be manipulated as required. A typical side panel in monitor mode is shown in Figure 7.14.

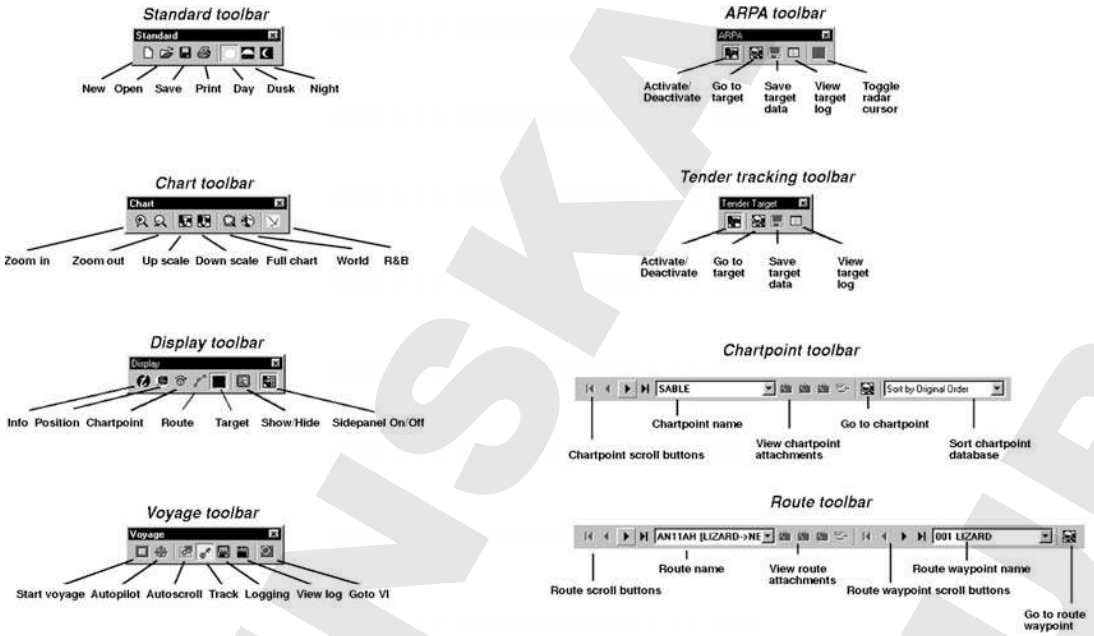

Figure 7.13 Toolbars used in the Navmaster display. (Reproduced courtesy of PC Maritime.)

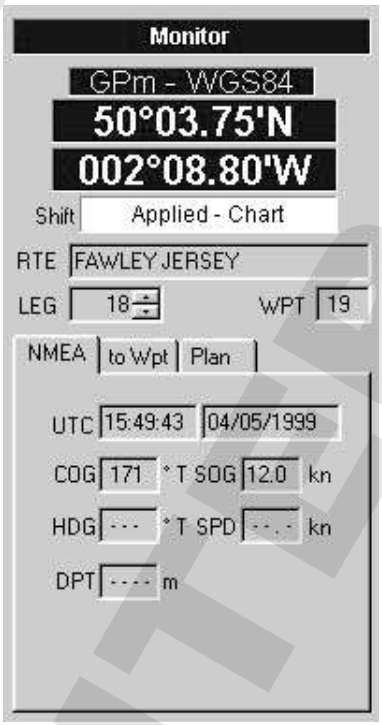

Figure 7.14 Navmaster monitor mode side panel. (Reproduced courtesy of PC Maritime.)

The panel repeats the position obtained from the GPS, provides information on any datum shift that has been applied, and displays the current route name and active leg. Three tabs provide further information:

NMEA repeats information from electronic instruments;
to Wpt provides calculated information from current position to the next waypoint in the route;
Plan repeats information for the leg from the passage plan if one has been calculated.

The Autocheck box activates/deactivates automatic leg advance.

2 Chartpoint mode. In this mode it is possible to add, delete, edit or save chartpoints. A chartpoint is the latitude and longitude of a geographical position stored in a database; a chartpoint on a chart is shown as a blue circle. Each chartpoint has database fields which allow the user to add other information which may be of assistance. Any number of chartpoint databases can be created and each database can contain any number of chartpoints. To enter chartpoint mode, the chartpoint button on the display toolbar (see Figure 7.13) is pressed and, provided side panel display is activated, the chartpoint side panel will be displayed (see Figure 7.15). The panel provides information about the current chartpoint. Each field within the panel can be edited.

Figure 7.15 Navmaster chartpoint mode side panel. (Reproduced courtesy of PC Maritime.)

Navmaster stores chartpoints in WGS-84 co-ordinates where possible and, provided a selected chartpoint is on the currently selected chart, it is possible to view and edit the chartpoint to match the local chart datum. A chartpoint can simply be used as a marker on a chart or, if used to indicate points on a route, they are known as waypoints.

3 Route mode. This mode enables the user to create new routes, edit existing routes and copy or reverse routes. A route is a sequence of waypoints built up from previously stored chartpoints or created by clicking on a chart. The route is drawn on the chart for evaluation and possible amendment. Routes are stored in databases and there can be many routes stored.

Route mode can be accessed by pressing the route button on the display toolbar (see Figure 7.13). The route side panel will be displayed, provided the side panel is switched on. Routes may be created, and edited, using waypoints from a chartpoint database or by drawing the route directly on the screen chart, or by a combination of both methods. Whatever route method is used, each waypoint in the route is inserted into the box on the route side panel and a line will connect the route waypoints on the chart. This line can be adjusted depending on whether the user adds, deletes or moves waypoints using the route side panel.

Routes are stored in a route database and any number of route databases can be created, containing any number of routes. A typical side panel in route mode is shown in Figure 7.16.

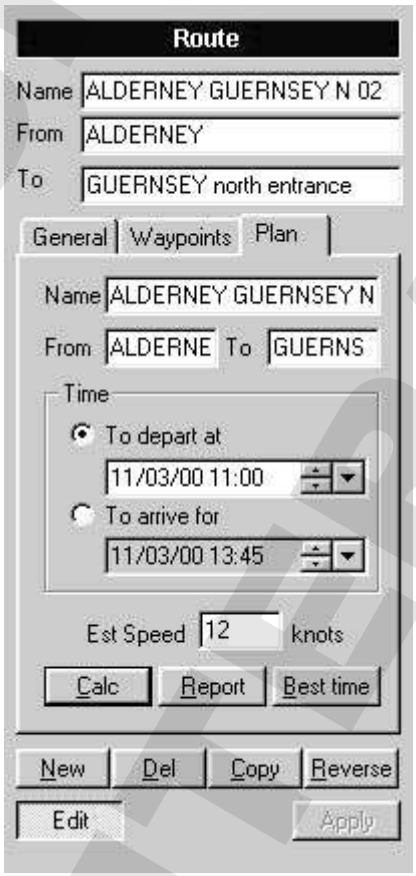

Figure 7.16 Navmaster route mode side panel. (Reproduced courtesy of PC Maritime.)

Three tabs provide further information:

General	enables the user to enter and display a textual note relating to the route;
Waypoints	lists the waypoints in the route and provides a means to select waypoints for amendment or deletion or to locate a new waypoint;
Plan	gives the ability to calculate a passage plan based on the route which the user can print or view on the screen.

Other side panels, which are available but not illustrated, are Target Tracking, which provides information on ARPA and Tender targets, and Information which gives information on the selected chart.

7.7.1 Installing charts

Navmaster supports the UKHO ARCS and the Australian Hydrographic Office Seafarer charts and will support ENC charts by the end of 2000. To install these charts the user needs:

- the floppy disk containing a licence file and chart permit file
- one (or more) chart CD-ROM
- one update CD-ROM with the latest chart corrections.

Each chart CD-ROM contains all the charts available for a particular region. A chart permit is a code that unlocks a specific chart. Charts can be installed from the chart permit disk or by entering the chart permit number manually. The user PIN number must be entered before a chart can be loaded or installed. When Navmaster loads a chart it also applies any chart updates at that time. A chart can be displayed without its update but a warning will be displayed indicating the fact that corrections are missing.

The ARCS or Seafarer chart is supplied as two, independent images namely a low-resolution (LR) image and a high-resolution (HR) image. The LR image provides an overview of the chart while the HR image is the one recommended for navigation and is updated with Notice to Mariner corrections. Navmaster provides further zooming in and out of the LR and HR images to give five levels of display for each chart.

The chart can be manipulated so that it is centred on a selected cursor position and the chart can be panned by using the scroll bars at the sides of the chart window.

Table 7.6 The five levels of display for each chart

Resolution	*Zoom level*	*Warning*
Low resolution	Zoom out (LR-out)	Underscale
	Normal (LR)	Underscale
High resolution	Zoom out (HR-out)	Underscale
	Normal (HR)	None
	Zoom in (HR-in)	Overscale

7.7.2 Using Navmaster

When using Navmaster the recommended sequence to follow is:

- create chartpoints
- create a route
- calculate a plan
- monitor by plotting track, viewing data in the Navigation Monitor panel and comparing progress with the plan.

Navmaster is a multi-window application. Charts, the log, waypoint lists etc. all have their own window and windows can be tiled, cascaded or kept in the background as required. Turning on Autoscroll opens a dedicated window which displays the vessel's position in the centre of a chart. For safety reasons the Autoscroll window cannot be minimized so that the user is fully aware of the vessel's position. However, the window can be resized to allow more room for other charts, or it can be covered by a maximized window.

If the Autoscroll window is closed then Autoscroll is turned off. The remaining windows give complete flexibility to organize the charts to suit the task in hand. For example, new chart windows could be opened to:

- look ahead by displaying the vessel's position on a smaller scale chart than the Autoscroll chart
- view charts for other segments of the route
- view the approaches or harbour charts for intended destination
- plan new routes or chartpoints.

While the above is going on it is still possible to view a continuously updating vessel position on the largest scale chart available.

The maximum number of chart windows that can be opened is limited to three plus the Autoscroll window. The number can be increased but the default value of three is chosen to prevent users inadvertently opening too many windows.

The Chart Information panel in Navmaster displays information on the selected chart and indicates the following.

- Chart Description. The Hydrographic Office description of the chart.
- Chart No. The Hydrographic Office chart number.
- Orig Scale. The scale of the paper version of the chart.
- Edition Date. The date the chart was first issued.
- Updated. The date of the last update.
- Heights In. The units of height used.
- Depths In. The units of depth used.
- Projection. The type of projection used in the production of the chart.
- Horiz Datum. The geodetic datum of the chart. EG OSGB36 – The Ordnance Survey of Great Britain (1936) datum.
- Depth Datum. The datum to which depths are referred.
- Height Datum. The datum to which heights are referred.
- Buoyage. The buoyage system in use on the chart.
- N/S Range. The vertical distance in nautical miles of the portion of the chart currently displayed in the chart window.
- Display Resolution. The number of metres represented by each pixel on the computer display, which will alter depending on the zoom level of the chart.

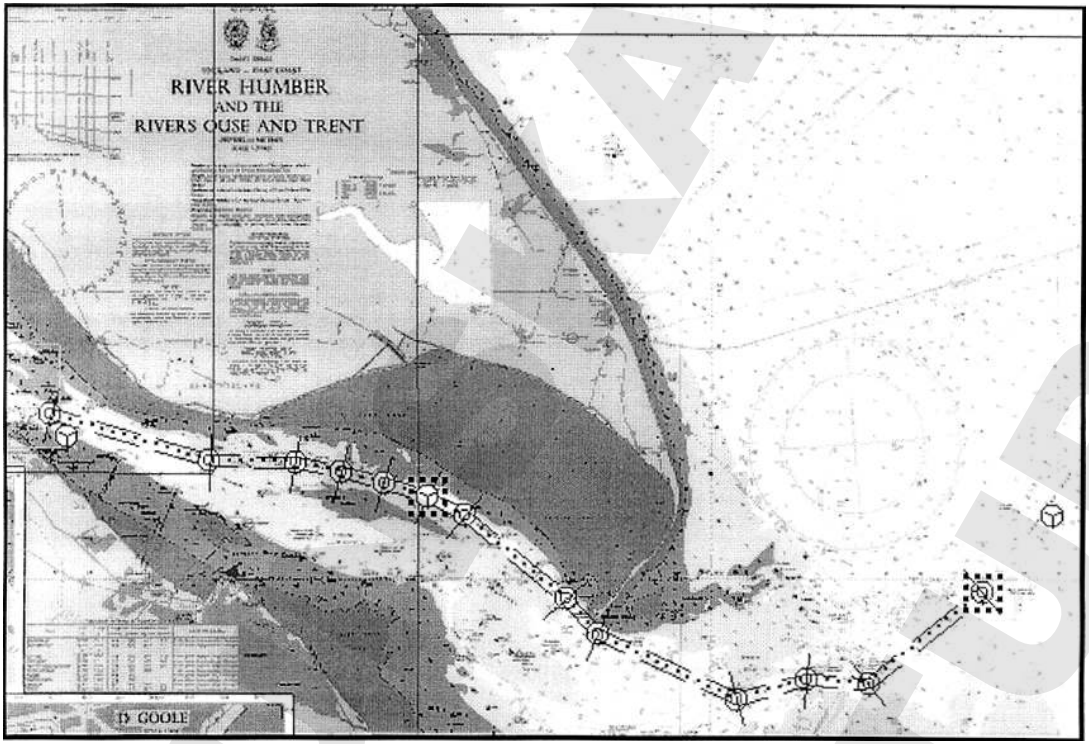

Figure 7.17 ARCS chart 109, River Humber and the Rivers Ouse and Trent OSGB36. (Reproduced courtesy of PC Maritime.)

Passage plans

Having created a route, the user can enter estimated speed, desired departure/arrival times and calculate for each leg of the route:

- course to steer, allowing for variation, deviation and tidal stream (if required)
- distance
- estimated time.

The user can view the plan on screen, change variables as required and then print a copy of the plan. As an example of a chart overlaid with a route Figure 7.17 shows ARCS chart 109, with a route approaching the Humber River, illustrating waypoints entered for the planned route.

Route monitoring options can be chosen so that it is possible to:

- automatically increment route legs as the vessel passes through waypoints so that Navmaster calculations on range and bearing to the next waypoint are relevant, and up-to-date information is sent to the Autopilot
- monitor the vessel's progress against the planned route.

Other options include the following.

- Automatic leg advance. Choosing this option allows the route legs to increment automatically as the vessel passes through the waypoint detection parameters set by the user.

- Waypoint detection. Choosing this option and setting a radius for the route leg to increment to the next leg when vessel position enters the circle. On entry a warning is given. The position and time of entry, and waypoint name are recorded in the log. See Figure 7.18.
- Passing perpendicular. Choosing this option allows the route leg to increment to the next leg when vessel position crosses a line drawn at right angles to the current leg. On passing, a warning is given. Position, time of entry and waypoint name are entered in a log. See Figure 7.18.
- Limits of deviation. Choosing this option allows a deviation limit to be set. If the vessel position exceeds this limit a warning message is displayed and remains until the vessel returns inside the

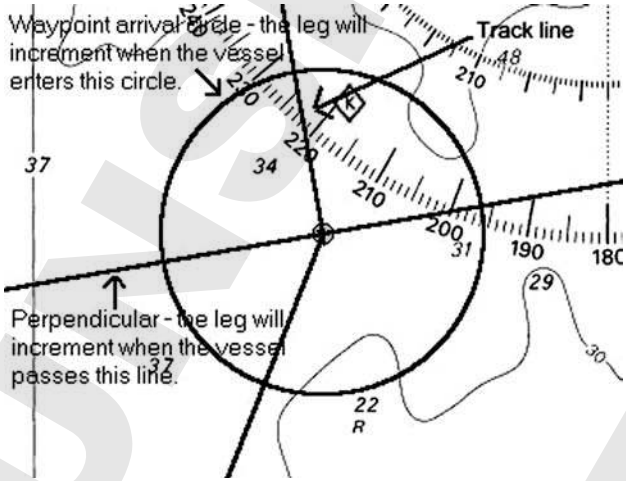

Figure 7.18 Use of waypoint arrival circle and passing perpendicular. (Reproduced courtesy of PC Maritime.)

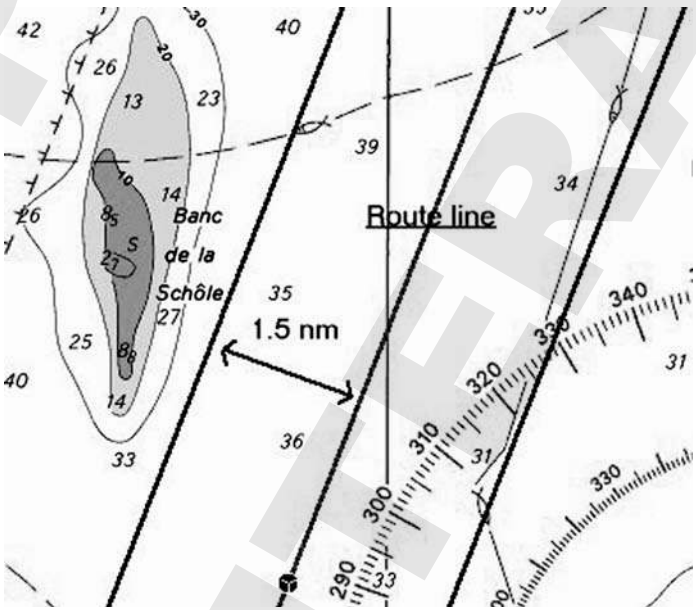

Figure 7.19 Use of limits of deviation. (Reproduced courtesy of PC Maritime.)

Your Company Name

Your company logo

Passage Plan Report

FROM : SPURN APPROACHES
TO : IMMINGHAM

Vessel :
Estimated speed : 5.0 knots
Passage distance : 18.0 nm
Passage time : 000:03:35
Route name : HARBOUR ENTRY

Options : Tides [Off]
Variation [Off]
Deviation [Off]
Calculated : 11:52:13 / 6/24/00
Viewed : 12:16:52P 24/06/2000

Rte Wpt No	Datum	Time	Elap Time (ddd:hh:mm)	Name	Position	Crse (°T)	Leg (nm)	Accum (nm)	To Go (nm)
1	WGS84	11:52:13 6/24/00	000:00:00	SPURN HEAD APPROACHES	53°34.80'N 000°17.70'E	231	2.51	0.00	18.0
2	WGS84	12:22:20 6/24/00	000:00:30	SPURN LIGHTSHIP	53°33.22'N 000°14.43'E	274	1.05	2.51	15.4
3	WGS84	12:34:57 6/24/00	000:00:43	SE CHEQUER	53°33.29'N 000°12.67'E	254	1.26	3.56	14.4
4	WGS84	12:50:02 6/24/00	000:00:58	NO 3 CHEQUER	53°32.95'N 000°10.64'E	295	2.64	4.82	13.1
5	WGS84	1:21:40 6/24/00	000:01:29	SUNK CHANNEL	53°34.06'N 000°06.63'E	319	0.83	7.46	10.5
6	WGS84	1:31:36 6/24/00	000:01:39	HAWKE	53°34.68'N 000°05.71'E	309	2.25	8.29	9.67
7	WGS84	1:58:38 6/24/00	000:02:06	HAWKE S4	53°36.11'N 000°02.79'E	296	0.74	10.5	7.42
8	WGS84	2:07:27 6/24/00	000:02:15	HAWKE S5	53°36.43'N 000°01.68'E	287	0.78	11.3	6.68
9	WGS84	2:16:48 6/24/00	000:02:25	SUNK S6	53°36.66'N 000°00.43'E	285	0.75	12.1	5.90
10	WGS84	2:25:50 6/24/00	000:02:34	SUNK S7	53°36.86'N 000°00.79'W	281	0.82	12.8	5.15
11	WGS84	2:35:38 6/24/00	000:02:43	SUNK S8	53°37.01'N 000°02.14'W	272	1.47	13.6	4.33
12	WGS84	2:53:17 6/24/00	000:03:01	SUNK SPIT	53°37.05'N 000°04.61'W	286	2.86	15.1	2.86
13	WGS84	3:27:35 6/24/00	000:03:35	IMMINGHAM OIL TERMINAL	53°37.85'N 000°09.22'W	000	0.00	18.0	0.00

Pre-departure check list
Navmaster Raster Chart Display System

1: Navmaster system on ☐
2: Correct chart displayed ☐
3: Folio mode and Autoscroll on ☐
4: This route displayed on chart ☐
5: Position logging on ☐
6: Logging on ☐

On completion of pre-departure checks this form is to be signed by the responsible officer and handed to the master.

Port.....

Signed.....
Date.....

Figure 7.20 Passage plan for a route into Immingham on the River Humber. (Reproduced courtesy of PC Maritime.)

limit. When the vessel exceeds the limit a log entry is made, with time and position. A further log entry is made when the vessel returns inside the limit. See Figure 7.19.

Creating a passage plan

A passage plan can be created as follows.

1 Prepare the route.
2 Select the plan tab on the Route panel (a typical Route side panel is shown in Figure 7.16).
3 Enter departure/arrival time and estimated speed.
4 Set any options required.
5 Click on Calc.
6 Click on Report to see the plan.

A typical passage plan report for the route of Figure 7.17 is shown in Figure 7.20.

Because Navmaster calculates routes almost instantly it is a simple matter to change parameters such as vessel speed, date and options.

The above has been extracted, with permission, from the Navmaster User Guide and only gives a very limited overview of the facilities available with the system. More detail can be obtained from the manufacturers PC Maritime, Brunswick House, Brunswick Road, Plymouth PL4 0NP, UK. E-mail: marketing@pcmaritime.co.uk and website: www.pcmaritime.co.uk.