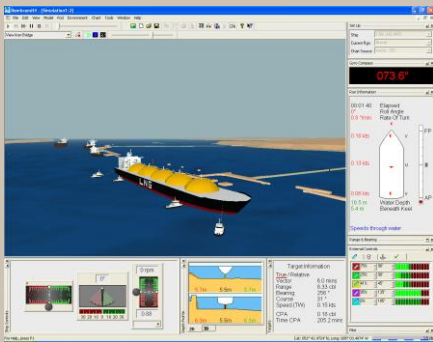


“Where will our knowledge take you?”

## Manoeuvring Simulation

### BMT PC Rembrandt



BMT has many years experience in all aspects of ship manoeuvring from full scale trials, free running and captive model tests to mathematical prediction and simulation.

PC Rembrandt V4.0 is a real and fast time ship-handling and manoeuvring simulator. It is PC based and designed using standard Windows user interfaces and structure to ensure user-friendliness. It is principally designed for the following applications:

- Manoeuvre rehearsal;
- Ship performance and operational assessments;

- Assessment of port arrangements (berths, channels, etc);
- Assessment of tug requirements;
- Ship-handling training;
- Incident investigations.

PC Rembrandt uses industry standard electronic charts as the interactive simulation backdrop enabling the mathematical model to interact with the bathymetry and land objects contained within the vector chart data. Mathematical ship models are based on specific ships and are modelled individually by BMT ARGOSS, based on many years experience in the manoeuvring performance of surface vessels.

PC Rembrandt V4.0 includes the following principal features:

- Full ENC / ARCS chart display and functionality giving use of industry standard electronic charts for simulations with worldwide coverage for minimal additional costs.
- 3D visual databases for all vector charts generated at no cost and providing an ‘out of the bridge’ view from the ship, including night-time views and reduced visibility settings.

- 3D and cross-section (2-D) underwater profiles showing the local bathymetry and channel dimensions.
- An advanced mathematical model including bank effects, dynamic squat, ship – ship interaction and wave forces.

The simulator includes many of the features found on modern Integrated Bridge Systems (IBS) and is available with a number of additional modules including, spatially variable currents, anchors, mooring lines, tugs and 3D traffic vessels.

The electronic charts are typically purchased by the end-user through their normal chart procurement processes. The charts used on-board a vessel (i.e. S-57 ENC or ARCS) can be used in the simulator. Ship models can be created individually for a client based on a specific ship or can be chosen from a library of nearly 100 vessels. All ship models are validated by BMT ARGOSS with assistance from nautical staff.

Dedicated control consoles can be supplied that utilise the same controls as the ship, therefore providing a realistic control interface to the simulator. These can be designed to match the layout on-board the ship.



## Ship Models

All hydrodynamic ship models are created by our team of experienced Hydrodynamicists and Naval Architects. Vessels are individually modelled to reflect the characteristics of a ship or Class of ship. All vessels mathematically modelled for PC Rembrandt are fully validated and can be supplied singularly or as a library of different ships. For example, each license placed on-board a particular ship could be ship specific, yet a shore-based system could be configured to provide the option of simulating any ship in a particular fleet or a range of ship types common in a particular port.

Most ship types can be accommodated on the simulator, including:

- Bulk carriers;
- Container ships;
- Cruise ships;
- Ferries (ro-pax);
- Gas carriers (LNG / LPG);
- General cargo;
- Tankers (coastal → ULCC);
- Warships.

A wide range of environmental conditions, hydrodynamic effects and control systems can be modelled including:

- Wind (gusting), tide, current and waves;

- Bank effects, squat, and ship-ship interaction;
- CPP, podded propulsors and azimuth thrusters;
- Conventional, high-lift and flapped rudders;
- Diesel, diesel-electric and gas turbine propulsion systems;
- Joystick and DP controls.

Standard 'library' vessels of a range of different merchant and naval ship types are also available.

Each ship model goes through a comprehensive validation process, where the mathematical model is prepared by BMT and validated against sea trials or model test information and against our own experience based on our extensive database of ship manoeuvring data. Following this first 'phase', the ship model is evaluated by a person familiar with the handling of the vessel, such as a Master or local Pilot. It is our aim to ensure that every ship model is indistinguishable in performance from the real ship.

## Electronic Charts and 3D Visuals

PC Rembrandt V4.0 is compatible with the following format electronic charts which provide the interactive 'backdrop' to the simulations:

- ENC: Standard ENC's produced to the standard S57 data format (not SENC).
- ARCS: ARCS charts stored in

their natural Hydrographic Office (HO) format.

- BMT: Standard BMT format charts converted initially from C-Map's CM93/2 database.

ENC and ARCS charts may be purchased from normal nautical chart distributors and provide extensive coverage of world-wide ports and navigable areas. For PC Rembrandt systems used on-board, the same charts can be used on PC Rembrandt as on the ship's IBS.

Where vector charts (ENC and BMT formats) are available PC Rembrandt can create a 3D visual scene directly from the electronic chart. The 3D visual scene is created automatically at no additional cost, therefore removing the cost of expensive port databases. All seabed characteristics, land areas, major landmarks and aids to navigation defined by the chart are created and displayed in the 3D view. This includes all defined navigational light sectors, ranges and sequences.

The user may move around the visual scene at will and may use pre-defined viewpoints including bridge view, bridge wings and bridge wing views looking aft. Both visibility (to reflect the reduction due to fog) and daylight settings may be varied.



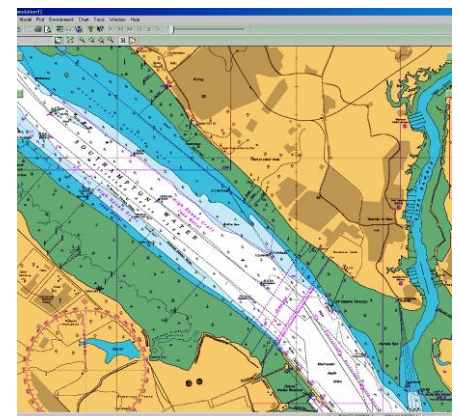
## Software Modes and Features

The facilities of PC Rembrandt V4.0 include:

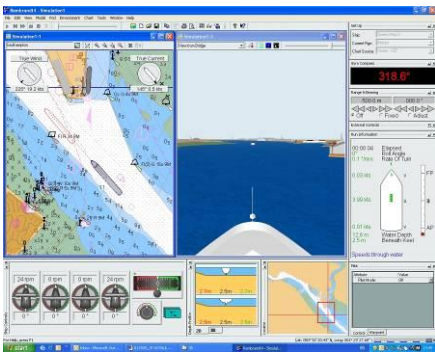
- Real or fast time simulations with the facility to pause or fast forward at any time.
  - Three chart display modes to suit individual preferences: Bow or track up, North up or fixed chart.
  - Historical and future position displays, heading line and analogue or digital gyro-compass.
  - Customisable display with saveable panel layouts.
  - Fully variable environmental conditions (wind, tide, current and waves).
  - Save and re-load facilities with re-play in real or fast time for use in briefing / de-briefing sessions for the bridge team and pro-active training sessions.
  - Detailed simulation reports, including position plots, graphs and tabular formats.
  - The ability to save simulations as scenario files, based on a particular port and environmental conditions.
  - On-screen pivot point indicator, showing its position along the length of the ship.
  - The ability to interrogate chart information for familiarisation
- with the characteristics of a particular port.
  - Accurate waypoint plotting on the electronic charts to represent particular tracks, enabling PC Rembrandt to be used for passage planning and training.
  - User defined 'hard-quays' and dolphins as part of the berth arrangements. The ship interacts with these and displays the impact velocity accordingly.
  - Placement of stationary vessels on the electronic chart to represent moored vessels in a particular port.
  - The use of traffic vessels in simulations to represent other port traffic, therefore increasing the realism of manoeuvres.
  - Channel cross-section view showing the position of the ship at bow and stern in a channel, when coming alongside a berth or in shallow / confined water.
  - User defined spatially variable currents in simulations, therefore taking into account the turning effect when the bow and stern are in different tidal streams.
  - Use of up to six tugs in simulations, allowing the effects of tug assistance to be incorporated into simulations.
  - The ability to use anchors, mooring lines and fenders during simulations, therefore allowing
- the dynamic effects of mooring lines and anchors to be included in the ship's mathematical model.
  - Use of navigational aids such as Range & Bearing markers, range rings and parallel index lines during simulation, to assist with navigational exercise and increase the realism of a particular manoeuvre.
  - Interactive help facilities and a detailed user guide.

PC Rembrandt V4.0 may be supplied with the following optional modules:

- Joystick Control Module
- Tugs Module
- Spatial Currents Module
- Anchors and Mooring Lines Module
- 3D Visuals for traffic and stationary vessels



- Track-pilot Module



## PC Rembrandt is designed to run on the following specification

### PC:

- Intel Core 2 Duo E6400 or better processor; or equivalent.
- Minimum 1GB of RAM.
- 1 or more dual-output graphics card with OpenGL 2 support (specific recommendations available).
- CD-ROM drive.
- 20 GB of hard disk space.
- 3 x USB & 1 x RS232 serial port.
- Windows XP Pro SP2 (English) or Vista Operating System
- 1 or more SXGA (1280 x 1024 pixel) display(s).

Purpose-built control consoles are available from BMT ARGOSS for use with PC Rembrandt. The consoles are designed to replicate a ship's controls layout and include industry standard control levers from Kwant and other manufacturers. Both desktop and Integrated Bridge System style console are available and all consoles are 'plug and play', using a single USB connection to the simulator PC.

The use of a control console allows the user to navigate and manoeuvre the ship using real ships controls, therefore increasing the realism of the simulation by providing 'hands-on' control.

### PC Rembrandt Applications

PC Rembrandt is regularly and effectively used by pilots, ship operators, naval architects and port authorities for:

- The assessment of safe operating limits in a particular port under varying

environmental conditions, including under-keel clearance.

- Use of alternative methods of control, such as tugs and the optimisation of tug usage.
- Assessment of tug requirements for a given vessel in a particular port under defined environmental conditions
- Evaluations and risk assessments for new or proposed berths, terminals, approaches and channel design.
- Port familiarisation, manoeuvre rehearsals and verification of passage plans.
- Familiarisation of officers and pilots with the handling characteristics of a new vessel
- Training of junior and senior officers (and pilots) in ship-handling and the aspects particular to different ship types.

PC Rembrandt may be used at a client's office (shore-side) to provide overall company use as well as on-board ship, where it is ideally suited to the rehearsal of manoeuvres (with or without pilots) prior to commencement, the verification of passage plans and for providing junior officers with ship-handling experience that they would otherwise not receive.

PC Rembrandt v4.0 may be combined with an advanced Ship-handling Computer Based Training package to provide a formal and assessable structure to on-board training. It may also be combined with a navigational predictor (integrated into the ships IBS) giving a more accurate future position display on the ship's ECDIS and the capability to re-play actual manoeuvres VDR style.