

motorboat *simulator*



Motorboat Simulator 1.2

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1 Introduction

1.1 Objective

Motorboat Simulator is specially developed to practice maneuvers and navigation with power boats on a modern Game PC. Version 1.2 is giving you all of these opportunities, using one of the 4 single propeller power boats. Specially the 10m Cruiser is suitable for instruction. Also, a twin screw NoLimit 1500 can be used for practicing maneuvers in a special Motorboat Simulator instruction scenery with harbor. Wind, stream, waves and sailing area can be selected, allowing you to enjoy and practice virtual power boating under different circumstances. Version 1.2 also offers multiplayer-support. This means you can go boating with other users now. For the fanatics, motor-/powerboat racing is supported over the Internet or LAN. A spectacular option is controlling the new KNRM rescue boat Koning Willem I. This boat with 2*1000 PK jet propulsion has been developed in cooperation with the KNRM (Dutch rescue organization, www.knrm.nl) and is sponsored by Hamilton Jet (www.hamjet.co.nz).

New in version 1.2 (CD-ROM and download version):

- KNRM rescue boat with jet propulsion
- Search for updates through Internet added
- Now also in German, French and Italian language
- Keyboard definition added to helpfile

1.2 Simulation

Motorboat Simulator is a real physical simulator, developed with Stentec's DirectX Simulation Technology, as used for Sail Simulator (see www.sailsimulator.com). Developing Motorboat Simulator, we do not pretend to simulate exactly the boat speed and response. We hope detailed physical and technical modeling will give you the illusion and feeling of real power boating. We appreciate your suggestions for improvements very much (e-mail to software@stentec.com).

What is being simulated

- Six degrees of freedom equations of motion for the ships
- Wind resistance on hull, deck and house
- Hydro-static and dynamic pressure on the hull
- Propeller equations for a single screw (right/left rotating) including wheel effect, cavitation, and trim for an outboard motor
- Bow screw
- Equation of motion for rotation using torque-rpm curve in combination with the propeller torque
- Non linear interfering wave field, controlled by wind or adjustable, for testing the seaworthiness of your boat. You can make your own specific waves. The advanced wave field model makes Motorboat Simulator also suitable to compare different ship designs on seaworthiness and predicting wave response
- The wave height and wind speed is reduced at windward shore and breaker might be visible at the lee shore

1.3 Future developments

As a license holder of version 1 you can download all version 1 updates for free. Therefore visit www.stentec.com/motorboatsimulator_i frequently for the latest update, and subscribe to our "Software for Sailors" newsletter at www.stentec.com/postoffice/subscribe.html.

For future updates the following new options can be expected (modifications reserved):

- Anchoring
- Certificate training course

1.4 System requirements

- Pentium III 350 MHz or equivalent (800 MHz recommended).
- 64 MB RAM (128 MB recommended).
- Windows 98, Me, 2000 or XP.
- DirectX 8.1 or higher (available at www.microsoft.com/directx).
- DirectX 8 compatible 32 Mb 3D-video card.
- DirectX 8 compatible 3D sound card.
- 250 MB free on your hard disk, CD-ROM drive.

2 Starting



2.1 Starting screen

After starting up the starting screen appears. In the top-left corner, you see the version number and the name of the license holder.

All options are described here:

- **Start**
After choosing Start, you first have to choose a default or other situation. You can save situations during the simulation. Starting up the simulation can take some time after Initializing, Loading Scenery, Loading boat and Updating Environment. After the fading screen you will enter the situation in the virtual world you have chosen. See further the description of the simulation screen below.
- **Multiplayer (chapter 8)**
- **Demo**
You can start endless demo's of the Cruiser and Runabout. Start up the continuously running demo's. You can make one yourself by copying a situation of a Auto Pilot controlled powerboat to the demo directory. If the last waypoint is overlapping the first one the demo will be endless. The Auto Pilot mode needs to be set on Waypoint
- **Configuration**
At Display you can activate the Windowed mode. If not Full Screen simulation will be used, which is faster on most systems. In the simulation you can use Alt Enter to switch between both screen modes. The frame rate can be adjusted real-time in the simulation menu at Options/Performance.
 - At Control you can return the Y-direction for tiller instead of wheel mode, or for using the Sail Simulator control unit.
 - Select your Language from Dutch, English, German, French and Italian.
- **Help**
This manual
- **Exit**

2.2 Sceneries

The download version of Motorboat Simulator 1.2 includes 2 sceneries: The Sail Simulator Training Area and Isle d'Ouessant. You can download more Sail Simulator 4.2 sceneries from www.sailsimulator.com. We strongly recommend you to download the new Motorboat Simulator Training Area (~13 Mb). On some user sites you will find impressive self-made sailing areas.

Version 1.2 will also be released on CD-ROM, with all sceneries made by Stentec and a couple of sceneries made by users. These can also be downloaded from www.sailsimulator.com. In large sceneries, some problems can occur (e.g. vibrations) . For this reason, the larger sceneries have not been included on the CD version. A solution for this problem will be implemented in a future version.

Sailing areas created by Stentec Software for the 1.2 CD-version

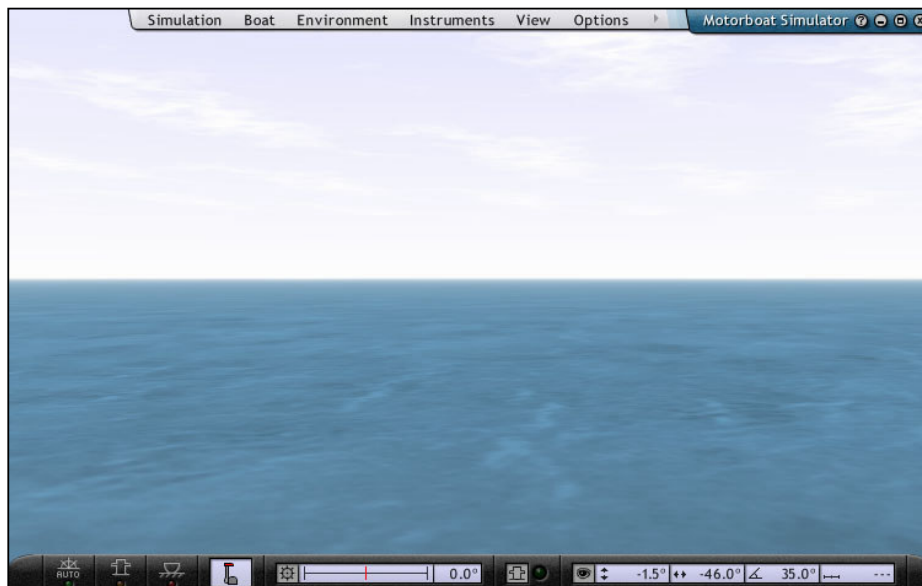
- Motorboat Simulator Instruction area (designed for version 1.0.1)
- St.Martin (Stentec, sponsored by Alex)
- Lake Luzern (Switzerland)
- Lake of Constance (Germany)
- Isle of Ushant (France)
- Sail Simulator training area

Sailing areas created by other users included in the 1.2 CD-version (modifications reserved)

- Lake Tahoe (Russ Lewis)
- Crater Lake (Racing) (Russ Lewis)
- Eagle Island Yacht Club (Russ Lewis)
- Lofoten (Alexander Lindeijer)
- Vaeroy (Alexander Lindeijer)
- Inner Oslo Fjord (Alexander Lindeijer)

Use Scenery Designer Toolkit, available in our online shop, for creating sceneries by digitizing charts or from DEM files (available from the Internet). A limited Demo version is available on the 1.1 CD version and can be downloaded from www.sailsimulator.com. The free Object Editor can be used to position objects and create buoys for your sailing areas.

2.3 Simulation



2.3.1 General functions

- **Full screen**

Use **Alt+Enter** to switch between Full Screen and Window Mode. Maximizing you Window (in Windowed Mode) is also possible, but not as fast as Full Screen mode. Look at the frame rate fps (frames per seconds) in **menu → options → performance**. For a reasonable simulation minimal 15 fps is required. If less change your setting at **menu → options → performance** or use less screen resolution and color depth in the **startmenu → configuration → display**.

- **Menu**

In the upper-right corner you will find a sliding menu. Activate this with your mouse or the **Alt** key.

- **Keys**

A list of key definitions will be shown clicking the **?** in the upper right corner of your screen.

The function keys combined with **Shift** can be used for selecting camera's. With **F1** and **F2** (without **Shift**) controls for motor power and outboard trim angle can be set. If so they are visible on the status bar.

2.3.2 Menu

Switch on/off with **Alt** or with the mouse. The menu offers the following opportunities (left to right):

- **Simulation**

In the simulation menu, you can open and save situations, pause the simulation, adjust simulation speed and end the simulation. In a multiplayer session, you can also start the match and activate the chat mode in this menu.

- **Boat**

The boat menu is being used for selecting a boat and adjust its configuration. You can adjust load (affects seaworthiness and speed), the crew and options concerning the direction of the screw. You can also reset the position of the boat (for example when you capsized). This is also possible by using the key combination **Ctrl+R**.

The Fleet of MBS 1.2:

- Cruiser: Single propeller motor cruiser with bow-thruster (32', 4 tons, 65 hp)
- Runabout: Classical outboard runabout (14', 18 hp)
- Launch: Double-ended launch (25', 10 hp diesel)
- Tugboat: Tugboat (64.6', 150 hp diesel)
- No Limit 1500: Twin propeller Ocean cruiser with bow-thruster (15m, 18 tons, 2*480 hp)
- Koning Willem I rescue boat of the KNRM with twin-jet propulsion (18.8 m, 28 tons, 2*1000 hp)

- **Environment**

In the environment menu, you can select a scenery (look at www.sailsimulator.com for more sceneries) and adjust settings concerning the simulation. The following settings can be adjusted:

- Time (directly affects position of the sun and daylight).
- Wind (variation and period make gusts visible as dark areas on the water surface, also on the wind arrows on the chart and on the wind particles to be set at **Visual Wind**).
- Waves (automatic means 2 interfering waves coupled to the main wind (direction and speed). Visualize the combined waves in the graph. Set the scale an optimal value. Breakers will be shown as red line parts in the graph. Breaking strongly depends on the slope and on the breaking condition. Sliding the breaking condition to the left simulates increasing wind speed with more white breakers in the wave fields. The development of the waves goes from short waves left to long and large waves sliding to the right). Breakers build up sooner when the breaker slider is shifted to the left).
- Water (temperature and stream are adjustable).

- Sky (Visibility = fog distance, air pressure, air temperature and cloud layers). Finally, it is possible to show wind particles with the option **Show Wind (Ctrl+W)**. This option shows a wind particle layer moving at an adjustable altitude above the water. This altitude can be adjusted at **Menu → Environment → Settings → Wind at Visual Wind**.
- **Instruments**
Also with keys **1** till **9** and **0**.
- **View**
The view menu offers settings concerning how the camera is looking at the boat. This can also be set on automatic, meaning the simulation will select the best camera when the boat is within a certain distance of that camera. These automatic cameras can be adjusted and added with the chart plotter instrument (chapter 3). You can also switch the steering wheel and status bar on/off in the view menu.
- **Options**
In the options screen, you can adjust the performance of the simulation in case the simulation is reacting slowly. It is also possible to adjust camera speed and the units used in the simulation.

2.3.3 Statusbar



The statusbar can be found in the bottom of your screen. When it's not activated, you can do this with the space bar. From the left to the right the statusbar offers the following information:

- Auto Pilot indicator.
- Boat fixed on Bollard indicator (one bollard = orange, two or more bollards = red).
- Ship Aground indicator.
- Control status:
Control indicator (**F1** for Gas) of Trim (**F2** for Outboard Power Trim). If activated then control is possible with the vertical arrows. Combined with **Ctrl** will speed it up. Press left and right mouse button together and sliding from and to you also works.
- Steering wheel button:
By pressing with your left mouse button or key **s** the steering wheel with pop up. Click once again to find your favorite position.
- Rudder indicator (plus on the right the angle itself).
- Bollard / mooring mode button:
If switched on by pressing on it, the boat can be fastened with springs to its bollards by pressing with the left button on a bollard. Fastening is only possible if the speed (over the ground) of the bollard is below a certain value (to be set at **menu → boat → settings → options**).
- Default view direction button (green eye).
- Windows with view angles, perspective angle and distance from camera to boat center.

2.3.4 *Looking around*

The easiest way to look around is by moving your mouse with right button pressed. Alternatively you can use the numeric arrow keys, combined with **Ctrl** for more speed.

Use **Alt** and the vertical numeric arrow keys (**8** and **2**) to change the distance **from** boat center to camera (also faster combined with **Ctrl**).

Watch the camera angles and distance to boat in the status bar.

Adjusting the distance is different than adjusting the perspective angle with **Alt +** (zoom-in) of **Alt -** (zoom-out). A good value is 40 degrees. At 10 degrees it acts like a telescope. 60 degrees is a wide angle lens. This angle corresponds with the top and bottom of your view window.

3 Instruments

Motorboat Simulator offers several instruments which can be used in the simulation. The most important instrument, the engine (or dashboard) will be explained in chapter 4. The other instruments will be described in this chapter.

3.1 Autopilot



The Autopilot offers the following options:

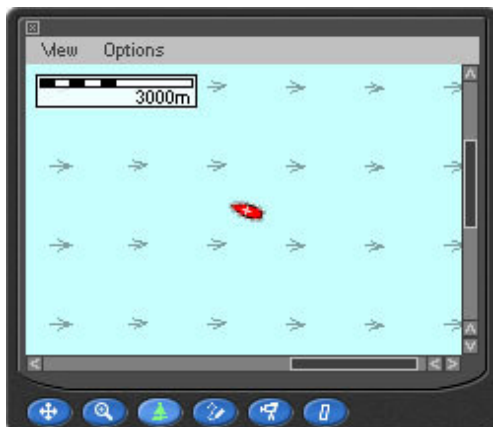
The 'Mode' displays how the autopilot will steer the boat. You can adjust the mode with the page button (third from the right). The autopilot offers the following modes:

- **Compass**
The autopilot will steer a preset compass course. Set the course with "Set" and adjust it by clicking on the left/right arrows. Adjust the angle with the apparent wind with the left/right arrows.
- **GPS**
Works like 'Compass' but the course is now controlled with the GPS receiver.
- **Wind vane**
The autopilot will maintain a preset angle to the apparent wind. When you steer the desired course press "Set" to set this angle. Adjust this angle with the left and right arrows.
- **Waypoint**
The autopilot will steer the boat to successive waypoints. Obviously the waypoints have to be active. If this is not the case switch the autopilot off and steer to the next waypoint by hand or use the wind vane. Switch the autopilot back on as soon as you reach the next waypoint

The trim of the Autopilot can be determined automatically or with the up/down arrow buttons on the instrument. The second button from the right determines the auto trim value (on/off). Use the left/right arrows to determine the Course To Go or the angle with the apparent wind (App. Wind Dir.).

3.2 Chartplotter

This electronic chart can be changed is size like a normal window. For a minimal disturbance of the simulation window is minimized automatically after a few seconds by removing its borders and buttons (if the mouse cursors is outside the chart window).



Above the chart you see a menu with two options:

- **View**
Select **View** to show your favourite objects on the map, like scale, buoys, wind direction arrows, route, etc.
- **Options**
The options menu basically offers an extension of the buttons on the bottom of the chart. With the options in this menu you can remove eg. Self-added cameras, buoys and routes.

The buttons on the bottom of the chart offer the following possibilities (from the left to the right):

- **Panning**
Panning the chart only works if the **Center** option in the view menu is switched off.
- **Zooming**
Click with the left mouse button on the chart to zoom in and with the right mouse button to zoom out. You can always zoom out with the scrolling wheel on the mouse.
- **Change boat position**
You can change the position of the boat by clicking on a certain spot on the chart.
- **Drawing a route**
Click on the chart to make waypoints. These waypoints will also be used by the autopilot. You can remove these waypoints by choosing the menu option **Options → Delete Route**.
- **Cameras**
Click on the chart to add a camera or click on an existing camera to adjust it. The camera radius can be changed by keeping the right mouse button pressed and moving in vertical directions (up and down).

The cameras can be activated by choosing the option **View → Automatic Cameras** in the main menu or by using **Ctrl+C**. You can also use **Shift** and the **function keys** to select a camera directly (eg. **Shift+F2** for camera 2).

- **Buoys**
With the buoy button you can position buoys on the map. First select at **Options → Buoy Type** the desired type. There are only 2 start (green) and 2 finish buoys (red). Blue and yellow buoys are available in almost unlimited number.

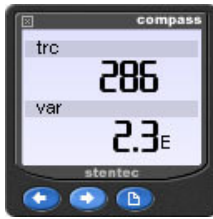
3.3 Clock (with stopwatch mode)



The clock shows the current simulation time. The clock can also be used as a chronometer. The chronometer is controlled by the three buttons on the bottom of the instrument (from the left to the right):

- **Start/Stop**
Starts/stops the chronometer.
- **Reset**
Resets the chronometer.
- **Page**
Switch between the date/time and the stopwatch/time display mode.

3.4 Compass



The compass contains both an analog and a digital display mode. You can switch between these display modes by using the page button (on the right). The variation can be set with the arrow buttons.

3.5 Echosounder



The echosounder serves as a depth controller. It also contains an alarm. This can be activated with the button on the left. The alarm depth can be adjusted by using the arrow buttons. When the actual depth exceeds the alarm depth, the alarm will produce a beep sound and the screen of the instrument will flash.

3.6 Engine (Dashboard)

The engine (dashboard) is one of the most important parts of Motorboat Simulator and differs per boat. Therefore it is being described in chapter 4.

3.7 GPS



The GPS receiver can be used (combined with the autopilot, 3.1) to automatically steer the boat. When you draw a route on the chart (3.2) the waypoints will be loaded into the GPS automatically.

The GPS works with two display modes. Select the desired display mode with the page button (second from the left). The GPS offers these display modes:

- **General**, this mode shows:
 - Speed Over Ground (SOG).
 - Course Over Ground (COG).
 - Distance Made Good (DMG).
 - Position longitude.
 - Position latitude.

Press the button on the left to reset Distance Made Good to 0 (zero).

- **Waypoint**, this mode shows:
 - Bearing to next waypoint.
 - Distance to next waypoint (DTg).
 - "Cross Track Error" (XTE).
 - Speed Over Ground (SOG).
 - Course Over Ground (COG).
 - Next waypoint number.
 - Time to next waypoint.

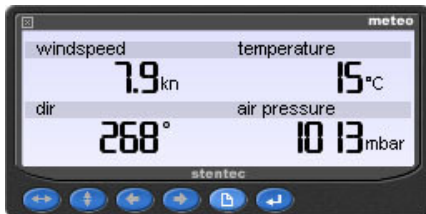
This mode is only working when waypoints have been loaded in the GPS (by clicking a route on the chart (3.2)). Use the arrow buttons to select the next or previous waypoint.

3.8 Log



The log shows current speed and distance made good. The distance can be set on 0 (zero) by pressing the button on the instrument.

3.9 Meteo



The meteo instrument shows wind speed and direction. It also shows temperature and air pressure. By pressing the page button (second from the right) you can get a graphical representation of the weather data. With the arrow buttons you can adjust the graphical representation.

3.10 Vector diagram



The vector diagram draws three arrows to display speed and direction of:

- Boat through water (*black*).
- True wind (*blue*).
- Apparent wind (*red*).

The vector diagram offers an absolute or rotating mode. The mode can be changed with the page button (on the right).

4 Engine (Dashboard)

First the steps to start the engine of the single propeller Cruiser will be described. After that, the control of the twin propeller NoLimit 1500 will be described. The dashboard of the Koning Willem I can be found in chapter 5.

4.1 Starting the engine

First select the cruiser with **boat** → **select**. Activate the Dashboard with key **6** or **menu/instruments**. Notice the power handle with neutral position (free-wheel mode with automatic coupling), a start button, a navigation light indicator and buttons for control of the bow-thruster. Notice the instruments for engine speed, battery voltage, and rudder indicator.



Select first with **F1** symmetrical power control (use **F2** only for double screw propulsion). Press for power control the left mouse button on the power handle on the dashboard, or slide forward with both left and right mouse buttons pressed, or use the vertical cursors keys. Put the power handle right in the middle. The propeller is now uncoupled.

Click with the left mouse button on the start key (or press **Ctrl + F1**), which will turn to the right. The lights start burning and the alarm sounds, because there is no oil pressure or voltage for charging the battery. Now press the right mouse button on the start button, until the engine starts (or press **Ctrl + F2**). The engine can be set neutral to warm up by pressing the right mouse button on the red coupling button, but only when the power handle is in the middle. You can give some extra power without any rotation of the propeller. If the power handle goes back again to the middle the uncoupled mode will be left. Notice the red button is coming out again.

Set the rudder into the desired position. By giving power the propeller is automatically coupled, and the boat starts moving.

Stop the engine by left clicking the start button (key) again with your mouse.

4.2 Steering, wheel-effect en bow-thruster

Use the **s** button to select your favorite steering wheel position. Press and move your left mouse button on the steering wheel surface to rotate the wheel. Pressing close to the rotation axis allows a faster rotation. If the symmetrical power control is activated with **F1** (see also the icon on the status bar), also the horizontal cursor keys can be used (in stead of rudder control). Notice the rudder indicator and angle on the status bar and on the dashboard.

By steering under power the screw jet is deflected by the rudder. The sideward force does have a maximum value at about 45 degrees rudder. At low and reverse speed you can make use of the wheel effect of the screw. Turning left can considerably differ from turning right (same for the turn radius).

Wind and waves will also influence your steering actions to keep the boat on course. With engine turned off you need speed to control the boat by steering.

Beside of the strong sideward force of the propeller under power, you can use the bow-thruster to maneuver the boat at low speed during mooring actions. Use the buttons on your dashboard to control the bow-thruster, or use the **F9, F10** function keys.

4.3 Control of twin propeller propulsion

First activate the dashboard with key **6**.



4.3.1 Twin engine control using the mouse

Start both engines one after the other pressing the start key on the dashboard with the left mouse button. The alarm beeps. Now press a few seconds with the right mouse button on the start key. The engine will start up now, and you are ready to go. Use the left mouse button to slide the power handles for the power control of the both engines.

For more speed both power handles must be moved forward. This is called symmetrical power handle control. At low speeds the twin propeller boat can also be maneuvered by a-symmetrical power handle control. If the right handle is moved forward and the other backward the boat will turn to port (the left). At speed the boat will show almost no response on a-symmetric power control. Instead use the steering wheel, coupled to both rudders behind the propellers.

For optimal control at low speed, we defined a special twin propeller control mode, to control the symmetric and a-symmetric power handle control independently with mouse or cursor keys. Active this so called a-symmetric power handle control mode with function key **F4**. Sliding the mouse forward with left and right button pressed will control the symmetric power for more or less speed. Sideward movements control the a-symmetric mode for changing course or turning the boat.

Before using this mode set the rudder in its zero position, otherwise the propeller trust will be changed in direction. Experienced captains can use the rudder effect to turn faster.

4.3.2 Twin engine control using the keyboard

Press **Ctrl F1** and a few seconds on **Ctrl F2** to start the left engine. Same for the right engine with **Ctrl F5** and **Ctrl F6**. Use the vertical cursor keys for power control. If the single propeller mode is selected with **F1**, use the horizontal cursor keys to control the steering wheel. If instead the a-symmetric power handle mode is activated with **F2**, then you control the power handles of the engines in opposite direction, to turn the boat at low speed. Novice skippers are recommended to set the rudder in its neutral position before pressing **F2**.

5 The Koning Willem I rescue boat

In cooperation with the KNRM (Dutch rescue organization, www.knrm.nl) and sponsored by Hamilton Jet (www.hamjet.co.nz), the rescue boat Koning Willem I has been developed for Motorboat Simulator 1.2. You can learn to maneuver with this boat with 2*1000 pk jet propulsion, with speeds up to 38 knots.

Before you start to steer the Koning Willem I, it is important to know how the jet propulsion works, and how the boat should be controlled. Hamilton Jet supplied a couple of pages from their Hamilton Jet Operating Manual, which can be found in paragraph 5.2. It is recommended to read these pages carefully.

5.1 Dashboard

A special dashboard has been created for the Koning Willem I. One of the first things you notice is the two handles per jet. The inner handles are for controlling the power, and the outer handles are for controlling the buckets.

With rudder, gas and buckets, you have full control over the boat. When the left mouse button is pressed, you can control the handles separately by dragging them.

For simultaneous control of the gas or bucket handles, you can use the keys **F1** and **F2** (gas), and **F5** and **F6** (buckets), in combination with the arrow keys.



5.1.1 Normal steering with symmetrical handle-control and rudder

At both high and low speeds, steering is done with the rudder. Power and buckets of both jets will be simultaneously controlled with the handles.

After pressing **F1** or **F5**, you can control the rudder with the horizontal arrow keys. The vertical arrow keys can be used after pressing **F1** for power or **F5** for the buckets (symmetrical). With the left mouse button pressed you control the rudder by dragging it. With both left and right mouse button pressed you can control the power handles (after pressing **F1**) or the bucket (after pressing **F5**).

Hint: When the boat isn't moving, put the buckets in the middle and the power on 25%. With the rudder you can now even steer when the boat isn't moving. Forwards and backwards can be achieved with moving the bucket handles up or down. For increasing speed, move the bucket handles forward and open the gas. An emergency stop can be made by immediately moving the buckets backwards.

5.1.2 Special maneuvers with asymmetrical handle-control

Examples of special maneuvers are moving sideways or turn around the nose. After pressing **F2** (power) or **F6** (buckets), you have full control over both jets. Instead of the rudder, you now control the difference in power (after **F2**) or the bucket position (after **F6**), with the horizontal arrow keys. You can also do this by pressing both mouse buttons and dragging to the left or right. The rudder can now only be controlled by dragging this with the left mouse button pressed. When performing special maneuvers, the rudder is generally in neutral position.

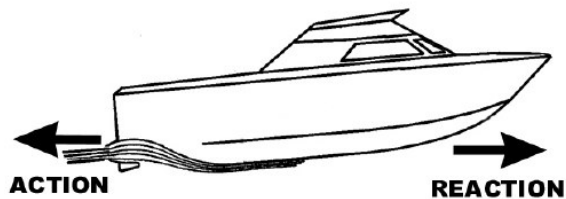
5.2 Controlling a jet-powered boat

5.2.1 Session One: Introduction to the Waterjet

How a waterjet functions...

A waterjet generates propulsive thrust from the reaction created when water is forced in a rearward direction. It works in relation to Newton's Third Law of Motion – "every action has an equal and opposite reaction". A good example of this is the recoil felt on the shoulder when firing a rifle, or the thrust felt when holding a powerful fire hose.

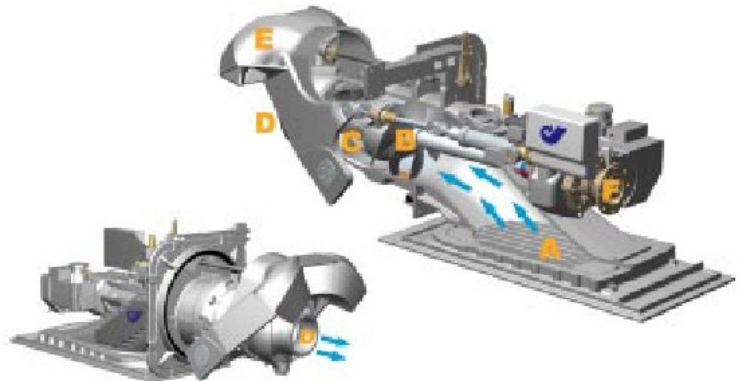
Put simply, the discharge of a high velocity jetstream generates a reaction force in the opposite direction, which is transferred through the body of the jet unit to the craft's hull, propelling it forward (see diagram below).



Ingested water is given additional momentum by the waterjet pump and nozzle, generating a force in the opposite direction to drive the boat forward.

In a boat hull the jet unit is mounted inboard in the aft section. Water enters the jet unit intake on the bottom of the boat, at boat speed, and is accelerated through the jet unit and discharged through the transom at a high velocity.

The picture opposite shows where water enters the jet unit via the Intake (A). The pumping unit, which includes the Impeller (B) and Stator (C), increases the pressure, or "head", of the flow. This high pressure flow is discharged at the nozzle (D) as a high velocity jet stream. The Reverse Duct or Astern Deflector (E) is positioned above the jet stream during normal operation. The driveshaft attaches at the coupling (F) to turn the impeller.



Steering is achieved by changing the direction of the stream of water as it leaves the jet unit. Pointing the jetstream one way forces the stern of the boat in the opposite direction which puts the vessel into a turn. Reverse is achieved by lowering an astern deflector into the jetstream after it leaves the nozzle. This reverses the direction of the force generated by the jet stream, forward and down, to keep the boat stationary or propel it in the astern direction.

Control Functions

Basic control functions of a Hamilton Waterjet include throttle, steering and head/astern. These functions can be used separately or in combination to create precise vessel control and manoeuvrability in all low and high speed situations.

Throttle

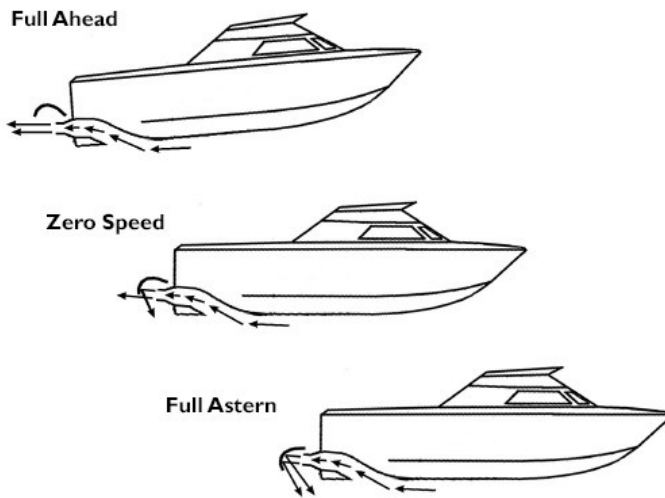
Increasing the revolutions per minute (RPM) of the impeller results in an increase in thrust from the waterjet. Generally waterjets allow a vessel to be precisely controlled without significant throttle adjustments, so long as there is thrust to produce sufficient force through the steering nozzle and ahead/ astern deflector.

Steering

Turning the vessel's wheel to port or starboard causes the steering nozzle to pivot left or right, which changes the direction of the water exiting the jet and thus turns the boat. Unlike a rudder which will turn a moving boat regardless of the thrust generated by a propeller, to maintain steering control at all boat speeds a waterjet requires high jetstream velocity.

Ahead/Astern

Raising and lowering the Ahead/Astern Deflector into the stream of water exiting the jet alters the balance of forward and reverse thrust applied to the boat. As the Deflector is lowered, more of the water from the jet unit is deflected down and forward to increase astern thrust and cause the boat to remain stationary or move backwards.



When thrust forces forward and reverse are equal, the boat will hold its position. As reverse thrust is increased and forward thrust decreased, the boat will move backwards. As with steering, the ahead/ astern function requires sufficient thrust from the waterjet in order to maintain accurate forward and reverse control.

When used in conjunction with the throttle and steering functions, a vessel is able to be fully turned in a stationary position or, in multiwaterjet installations, moved sideways (see Section Two – Manoeuvring).

5.2.2 Session Two: Waterjet Operation

Starting up

Before starting the engines, the following checks should be carried out...

- 1 • The vessel is securely tied up or well clear of other objects or vessels.
- 2 • The Helm is centred and the Reverse Controls are at Zero Speed.
- 3 • Clutches and Gearboxes, if fitted are in the "Neutral" position.

After starting the Engine(s)...

- Adjust the Helm and Reverse Levers to control vessel movement.

Note:

With Jet or Engine driven Hydraulic Pumps it is not possible to move the Reverse Duct until the Pump is running.

Acceleration

Acceleration of the boat will depend on the type of hull, number of waterjet units employed and the size of these units, and the use of hull features such as trim tabs.

With planing speed craft the throttles will have to be fully engaged in order to get the boat on to the plane, but once over the planing hump the throttle can be backed off slightly without loss of boat speed. With semi-planing or displacement speed craft, acceleration to full speed can be more gradual, but throttle settings must be maintained in order to maintain a set boat speed. Hull features such as trim tabs and interceptors will increase hull resistance and affect ride control both approaching and when at planing speed. It is important these features are used properly and at the correct time to ensure acceleration and overall boat speed are not adversely affected.

Care must be taken to prevent cavitation damage to the Jet Units, as described below:

- 1. Running at speed with a partially blocked Inlet Grill** or debris on the Impeller will result in cavitation damage to the Jet Unit. Do not accelerate to full speed without first clearing the intake (refer to Handling Blockages and Debris section, page 20)
- 2. Acceleration should be carried out gradually.** Full power cannot be used at low vessel speeds such as when operating on one engine only.
- 3. Blockage of the Jet Unit will result in higher than normal engine RPM,** slow acceleration and best speed will be reduced. If such symptoms are noticed, immediately slow the vessel and clear the blockage.
- 4. In conditions of severe weather or overload,** the engine speed should be reduced accordingly.

STOPPING

Stopping a vessel can be achieved in two ways...

- 1. Normal Operation** – close the throttle, select "Zero Speed" or "Astern", then gently open up the throttle to bring the vessel to a standstill.
- 2. Emergency "Crash" Stop** – Selecting full astern or Zero Speed while the vessel is moving ahead at high speed can produce a very rapid deceleration (should only be used in emergencies). The Hamilton Jet Astern Deflector is designed so it can be fully lowered into the jetstream at any forward boat speed or engine rpm level.

Select Zero Speed and reduce throttle as soon as the vessel has slowed, and you should not use full Helm control until the vessel has slowed.

Rapidly reducing throttle to below current boat speed will result in loss of all steering control. Always reduce engine rpms gradually and be prepared to apply extra throttle for steering control as boat speed decreases.

NEVER STOP THE ENGINE(S), OR DISENGAGE THE DRIVE TO THE JET UNIT, AT ANY TIME WHEN CONTROL OF THE VESSEL MAY BE REQUIRED.

Manoeuvring

Waterjets provide excellent manoeuvring control in all situations. This control is achieved by the integrated use of throttle, steering and astern functions. Multiple jet installations can provide extra manoeuvrability, depending on size and type of vessel.

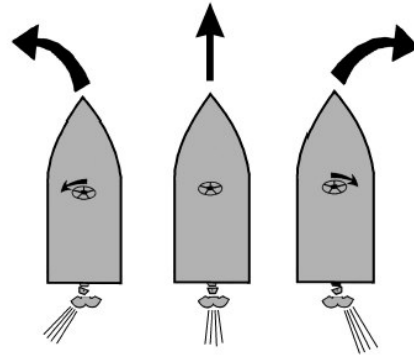
(**Note:** all manoeuvres outlined below assume the waterjet unit is directly driven or, where a gearbox is used, it is engaged in the forward direction.)

Forward

With the Astern Deflector raised and engine idling, the vessel will move forward slowly.

As engine rpms are increased, more water is pumped and the vessel increases speed.

When moving forward, the vessel will have full steering capabilities regardless of boat type or speed, so long as the jet unit is pumping a sufficient volume of water.



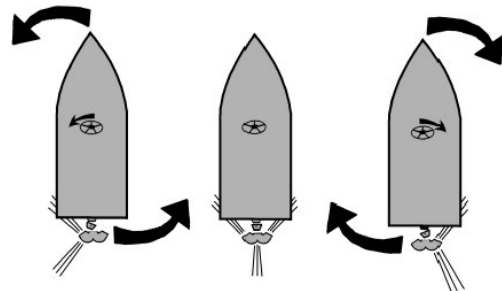
Zero-Speed

By lowering the split duct Astern Deflector partially into the unit's jetstream, some of the forward thrust is redirected down to the sides and under the boat's transom.

At a midway point both forward and reverse thrust are equal, so the boat holds in a stationary position.

In this position the engines can be sped up or slowed down with no affect on ahead or astern boat movement.

In the zero-speed position and with sufficient engine rpms, the boat has full steering control to both port and starboard – the higher the throttle setting, the faster the turn. This means manoeuvres such as 360 degree "on the-spot" rotation are possible.



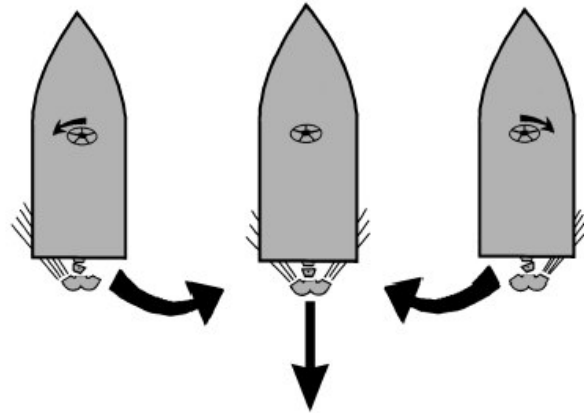
Slight adjustments either side of zero-speed are possible to affect forward and reverse "creeping" of the vessel, again with full steering control.

Reverse

With the Astern Deflector fully lowered, all forward thrust is redirected back to the sides and under the boat's transom. Full steering control is available when reversing.

However, it is important to remember that the directional effect of the Astern Deflector is opposite to what you would experience in boats with rudders or other forms of propulsion.

When reversing a waterjet powered vessel, turning to port will cause the bow to turn to port as the stern of the boat is pulled to starboard. In conventional vessels, a turn to port when reversing turns the stern in that direction and the bow turns to starboard.



Important rule:

A Hamilton Jet powered vessel operates with "same sense" directional control. This means the bow will always turn in the same direction as the Helm Wheel, regardless of whether the vessel is in ahead, zero speed or astern mode.

Low speed manoeuvring and docking

The vessel is best manoeuvred as follows...

1. Move the Reverse Control Lever to the "Zero Speed" position.
2. Set the throttle to a high idle – approximately 1/3 open (in strong tide or wind conditions increase the throttle opening to obtain greater response as required to suit the conditions).
3. A slight movement either way from the "Zero Speed" position will be sufficient to move the vessel ahead or astern until the manoeuvre is complete.
4. Steering will be very responsive at this throttle opening. Full steering control is available at all ahead/astern control lever positions and there is no change of steering "sense" at any time.

NOTE:

- **Do not work the throttles** – leave as set. With Twin Jets manoeuvring is best carried out using the Helm with one hand and both Reverse Levers with the other. One Ahead and One Astern is not as effective.
- **Use only low engine RPM** – high RPM will give faster response but makes control more difficult.
- **If the bow is rotating to starboard**, port lock must be used to stop the rotation (or vice versa) then the Helm centred to hold the desired heading.
- **If the vessel is moved ahead** then the Reverse Lever(s) must be moved astern to bring the vessel to rest (or vice versa) and then Zero Speed selected to hold position.

Moving sideways (Multiple jet installations only)

With Twin Jets... Use the following procedure to move the vessel sideways away from the jetty. Initially both controls are at "ZERO SPEED" and the vessel is stationary.

Moving to Port**A**

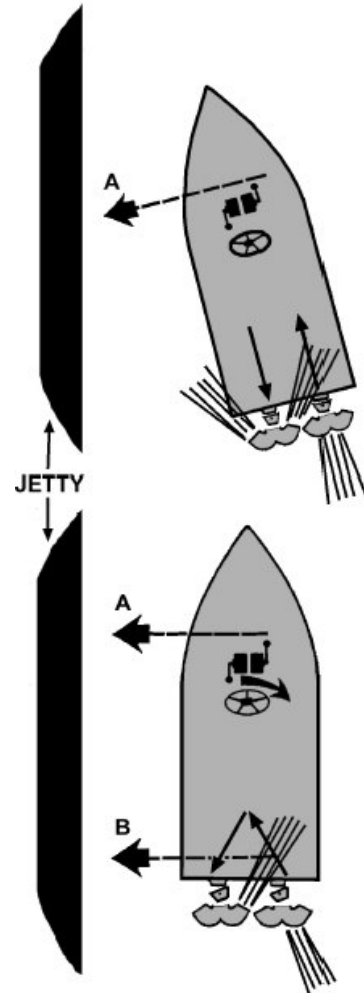
1. Set both engines RPMs to just above idle with slightly higher RPM on the port side.
2. Set steering to straight ahead.
3. Move the port reverse lever to full astern and the starboard lever to full ahead.

B

4. As the bow begins to swing to Port, turn the helm to starboard to keep the vessel parallel with the jetty. The vessel will now move sideways to Port.
5. Adjust the port engine RPM to prevent fore and aft movement (higher RPM will move vessel aft). This may also be done by bringing the starboard reverse control back towards the zero-speed position.

Moving to Starboard

Instructions 1 to 4 are the same but for Port read Starboard and vice versa. When the vehicle is safely clear move both controls back to zero speed and centre helm. Then move off in the required direction.

**Docking**

Use the above procedure when approaching or moving away from a jetty or another vessel. Note, if the vessel is moving sideways too fast the controls should be set back to zero speed and the Helm returned to centre. Alternatively, set the controls for sideways movement in the opposite direction until the vessel stops moving sideways. Note that the required control setting will vary according to wind and tide conditions.

5.2.3 Cavitation ("Minimum boat speeds")

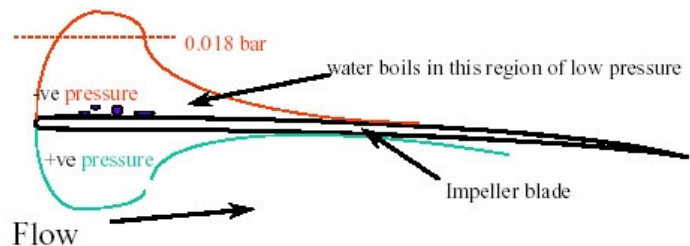
Cavitation is caused by water boiling in the low pressure zone at the back of the impeller blade (see diagram). This causes a loss of performance and results in serious damage to the waterjet components.

Boat operators will experience cavitation in several ways...

- The jet loses its 'grip' on the water
- The engine 'races', with engine rpm increasing
- Acceleration of the boat drops or stops
- Noise in the jet (sometimes)

A number of conditions can work independently or together to cause cavitation...

- Hump Conditions
- Overload
- Weight too far aft
- Bad weather or sea conditions
- Blocked intake screen
- Blunt or damaged impellers
- Excessive impeller tip clearance
- Poor installation

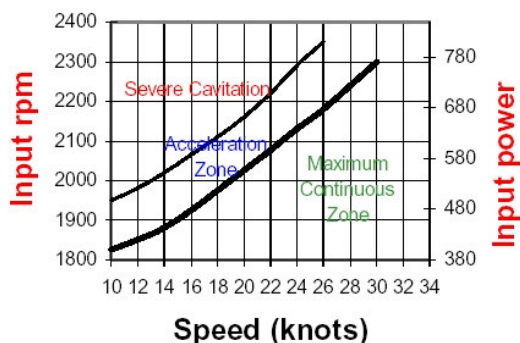


Cavitation can be prevented by...

1. Increasing the jet intake pressure
 - ie: Increase boat speed but do not increase power
2. Reduce rpm
 - less throttle
 - coarser impeller, i.e.. less rpm (steeper pitched blades)
3. Reduce flow plus fit a smaller nozzle

As the graph shows, slow boat speeds combined with high power inputs increases cavitation. This situation must be avoided.

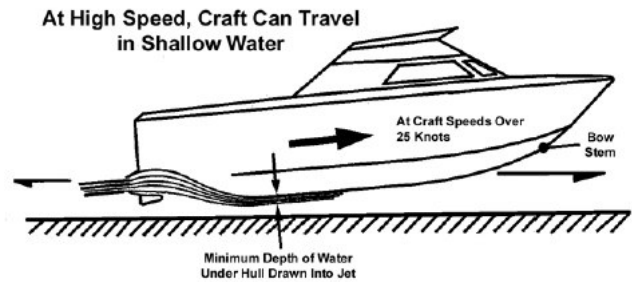
422 Jet Type 65 Impeller



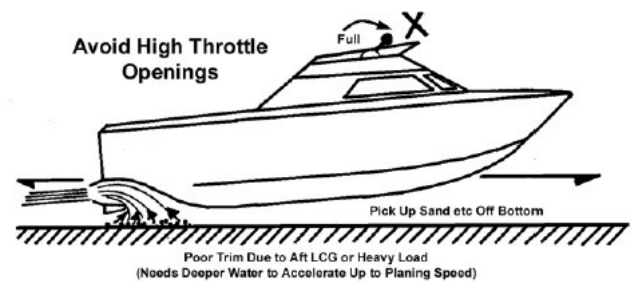
5.2.4 Shallow water operation

It is important to avoid pumping stones, sand and debris through the Jet Unit as this will blunt and wear the Impeller. The following diagrams illustrate good and bad practice...

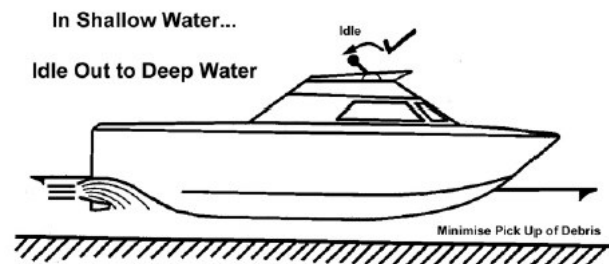
a) At high planing speeds, shallow water operation is not a problem until the vessel is nearly grounded.



b) At slow displacement speeds, avoid using high RPM in shallow water.



c) If it is not possible to pick a deep water area to start off and stop in, then "idle" over the shallow area into deep water before accelerating up to planing speed. If any debris has been picked up in the intake screen, momentarily stopping the engine should allow the debris to drop away from the screen.



Do not run the Jet if the vessel has run aground. Damage may occur to impellers.

6 Controls

6.1 Engine control

| Action | Keyboard | Mouse | Joystick |
|-------------------|---------------|------------|----------|
| Motor 1: | | | |
| - On/Off | Ctrl + F1 | Instrument | Button 5 |
| - Start | Ctrl + F2 | Instrument | Button 4 |
| - Clutch | Ctrl + F3 | Instrument | |
| - Hoist | Ctrl + F4 | | Button 6 |
| Motor 2: | | | |
| - On/Off | Ctrl + F5 | Instrument | Button 5 |
| - Start | Ctrl + F6 | Instrument | Button 4 |
| - Clutch | Ctrl + F7 | Instrument | |
| - Hoist | Ctrl + F8 | | Button 6 |
| General: | | | |
| - Select trimming | F3 | | |
| - Trimming | Arrow up/down | | |

6.2 Boat control

| Action | Keyboard | Mouse | Joystick |
|-----------------------------|------------------|-------------------------|--------------------|
| Handle symmetrical: | | | |
| - Select gas + rudder | F1 | | |
| - Adjust gas | Arrow up/down | Button L+R + up/down | Button 1 + up/down |
| - Select bucket + rudder | F5 | | |
| - Adjust bucket | Arrow up/down | Button L+R + up/down | Button 1 + up/down |
| Handle asymmetrical: | | | |
| - Select gas + rudder | F2 | | |
| - Adjust gas | Arrow up/down | Button L+R + up/down | |
| | Arrow left/right | Button L+R + left/right | |
| - Select bucket + rudder | F6 | | |
| - Adjust bucket | Arrow up/down | Button L+R + up/down | |
| | Arrow left/right | Button L+R + left/right | |
| General: | | | |
| - Bow-thruster starbord | F9 | | |
| - Bow-thruster port | F10 | | |
| - Bollard mode on/off | B | | |
| - Horn | H | | Button 2 |
| - Lights on/off | L | | Button 3 |
| - Hide/show steering wheel | S | | |

6.3 Camera

| Action | Keyboard | Mouse | Joystick |
|----------------------|----------------------------|------------------|--------------|
| Rotate: | | | |
| - Up | Numpad 8 | Button R + up | POV forward |
| - Down | Numpad 2 | Button R + down | POV backward |
| - Left | Numpad 4 | Button R + left | POV left |
| - Right | Numpad 6 | Button R + right | POV right |
| Move*: | | | |
| - Up | Alt + Numpad 8 | | |
| - Down | Alt + Numpad 2 | | |
| - Left | Alt + Numpad 4 | | |
| - Right | Alt + Numpad 6 | | |
| General: | | | |
| - Zoom in | Alt + Numpad + | | |
| - Zoom out | Alt + Numpad - | | |
| - Select camera** | Shift + F1 ... Shift + F12 | | |
| - Automatic camera** | Ctrl + C | | |

* moving is only possible with free camera, ** only with multiple camera's

6.4 Multiplayer

| Action | Keyboard | Mouse | Joystick |
|-------------------|----------|-------|----------|
| Match start/ stop | Ctrl + M | | |
| Start chat | T | | |
| Look at next boat | C | | |

6.5 Simulation

| Action | Keyboard | Mouse | Joystick |
|---------------------|-------------|-------|----------|
| Pause | P | | |
| Control help | Ctrl + H | | |
| Reset | Ctrl + R | | |
| Sound | Ctrl + S | | |
| Hide/show wind | Ctrl + W | | |
| Hide/show statusbar | Space | | |
| Full screen | Alt + Enter | | |

7 Mooring



To simulate mooring and anchoring you can use the bollards on deck to fasten the boat on one or more point. By non visible springs ropes and bumpers are simulated in this way. You also can pull on the bollards with a force. This force acts in an horizontal plane and will be shown as a red vector arrow in the 3D-simulation screen. This force allows easy boat handling at mooring.

To use the springs and force vector you first have to activate the bollard mode, by clicking with your right mouse button on the bollard button on the status bar. A green light will appear indication the bollard mode is activated.

Now move the mouse cursor over one of the bollards and press the left mouse button. If the speed is low enough, the bollard will be fastened and will change color. Notice the orange light below the bollard indicator in the status bar. This means the boat has now been fixed on one point, and can only turn on the that point/bollard. A red light will appear when with two or more bollards the boat is completely fastened.

A horizontal force can be set on the bollard by click and slide action of your left mouse button. By moving your mouse (pressed left) you can stretch and rotate the vector with a horizontal circle, to influence the ship speed and position. Stretching is only possible when the bollard is untightened.

By clicking the left mouse button you can untighten the bollard.

Tips

1. Rotate around the boat by pressing and moving your right mouse button, to have a good look at the bollard to fasten. You can come closer with **Alt+ 8** (num arrow key).
2. The default maximum bollard speed for mooring is set on **0.5 m/s or 1 knot**. With high waves this is probably to low to fasten. In that case you better set the maximum moor speed **a little higher** at **menu → boat → settings → options**.

Examples to experiment with:

- Fasten the front-bollard (also simulating anchoring). The ship will turn into the wind.
- Pull with a force on the bollard astern, and try to turn the boat half wind. You also can use the steering the screw jet doing the same, but with more force.
- By fastening the bollard astern the boat will be fixed on its position.
- Untighten the front bollard and use the bow-thruster to turn the ship. Also untighten the bollard astern, give rudder, power and sail away.
- Search for a jetty and practice mooring. But first learn to handle and maneuver the boat you have been selected. Like for real boat this can take some time.

8 Multiplayer

Version 1.1 is the first version with multiplayer support. Players can now race against each other on the Internet or Local Network (LAN). Choose the option Multiplayer in the starting screen of Motorboat Simulator.



In the Multiplayer screen, you can choose if you want to start a session (as server), or if you want to join an existing session (as a client).

ATTENTION: if you have started a session as server, you have to join that session yourself as well.

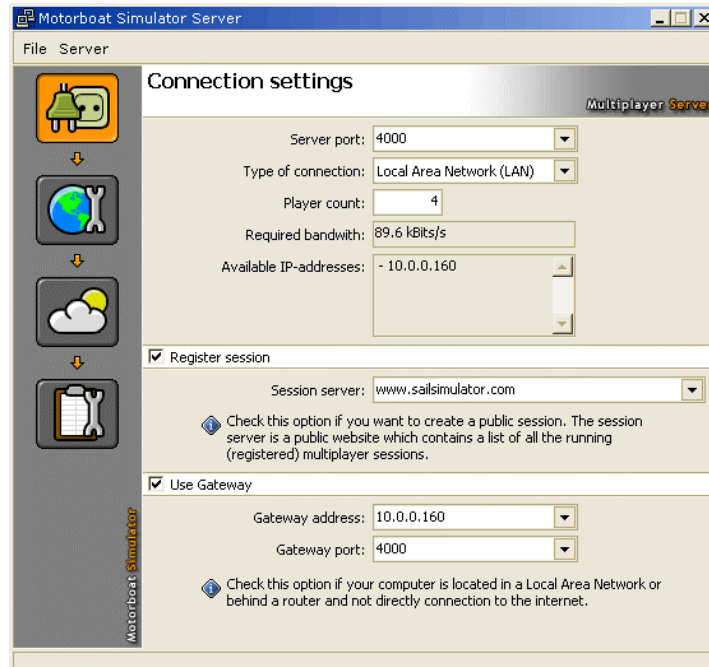
8.1 Starting a session

Step 1

Choose 'Start a multiplayer session' in the Multiplayer screen.

Step 2: Connection settings

In the connection settings menu, you choose options concerning your connection to the internet. These settings are important for the server to function properly.

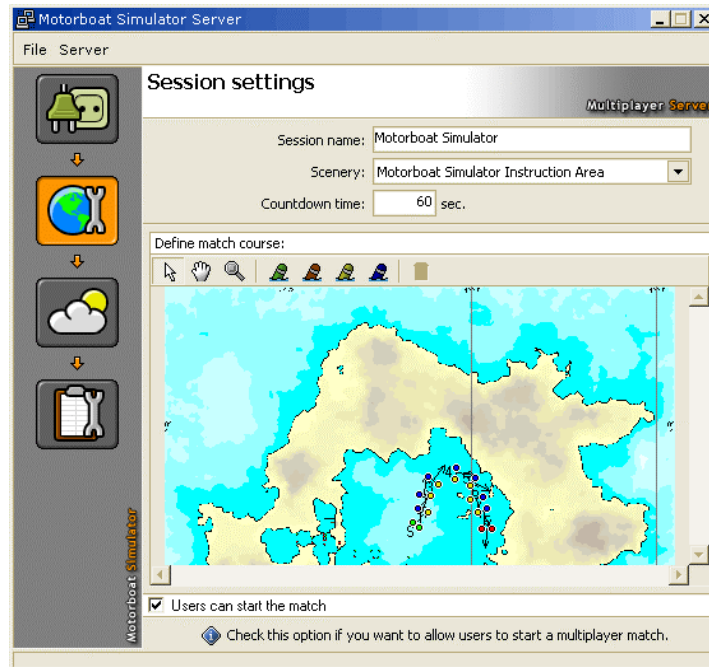


- In the menu 'Connection settings', you first have to choose number of the port through which the server communicates. Standard this is port 4000. Normally you don't have to change this, unless another program is active on this port.
- Then you choose the type of connection the server is going to use. When you connect with a modem or ISDN, you choose slow internet. When you have a connection like ADSL or cable, you choose fast internet. Local network is chosen when you use the session within a Local Area Network (LAN).
- Then you choose the maximum number of players you want to join your session.
- Now you can choose if you want to register your session with a session server. The session server is a public website on which all registered sessions are shown, so users can see if and where sessions are running.
- If the computer on which you're starting a session is located in a Local Area Network (LAN) or behind a router and not directly connected to the internet, you have to choose to use a gateway. The gateway-address is (in this matter) the IP-address of the computer or router (the gateway) with which it is connected directly to the internet (this address can usually be found by opening a MS-DOS-prompt through the start menu of Windows, then typing ipconfig and pressing enter. This gives an overview of your network cards and mentions your standard gateway. The address at standard gateway usually is the gateway-address).

On the gateway, the selected server-port (standard 4000) will have to be "forwarded" to the computer on which you start the session. This means you will have to tell the gateway how it has to handle the information that enters through the server-port. This information has to be forwarded to the computer on which the session is running, because no other computer can treat the information. In the manual of your router or server software you can find more information on this "forwarding" (entering the IP-address of your router in your browser usually brings you to the settings menu of the router).

When you have completed these steps, go to the second settings menu; session settings.

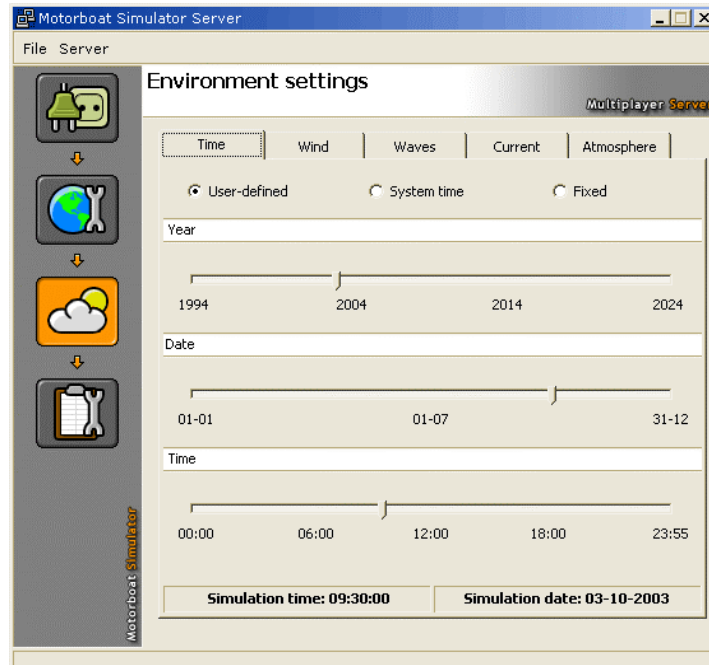
Step 3: Session settings



Name your session, choose a scenery and enter the countdown time. You can determine the track with buoys. The green ones are the starting buoys and the red are the finishing buoys. With the port (blue) and starboard (yellow) buoys you can determine the track in between start and finish. You can also select the option 'users can start the match'. This means every player can start the session. If you don't select this option, the match can only be started by the server.

After defining your session settings go to the third menu; environment settings.

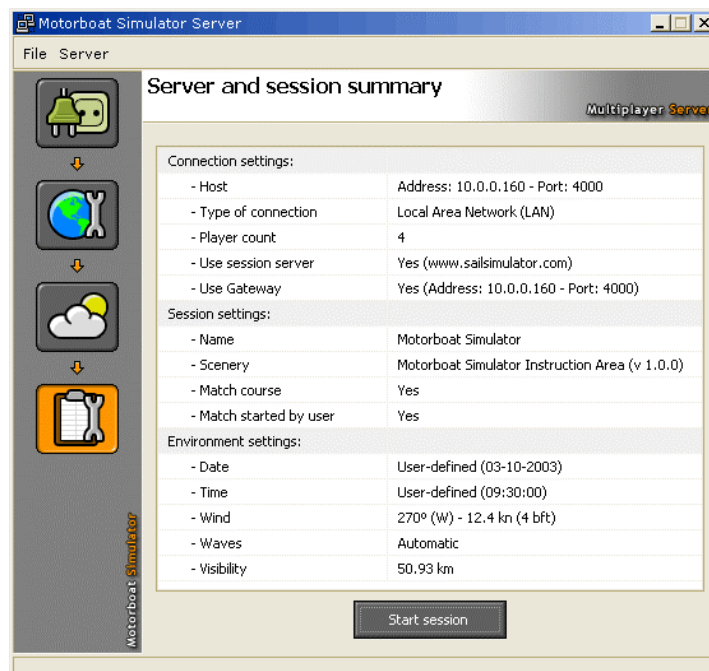
Step 4: Environment settings



Determine the circumstances during your session (time, wind, waves, current, atmosphere). This works the same as the environment menu in the simulation.

Afterwards go to the fourth and final menu; Server and session settings.

Step 5: Server and session summary



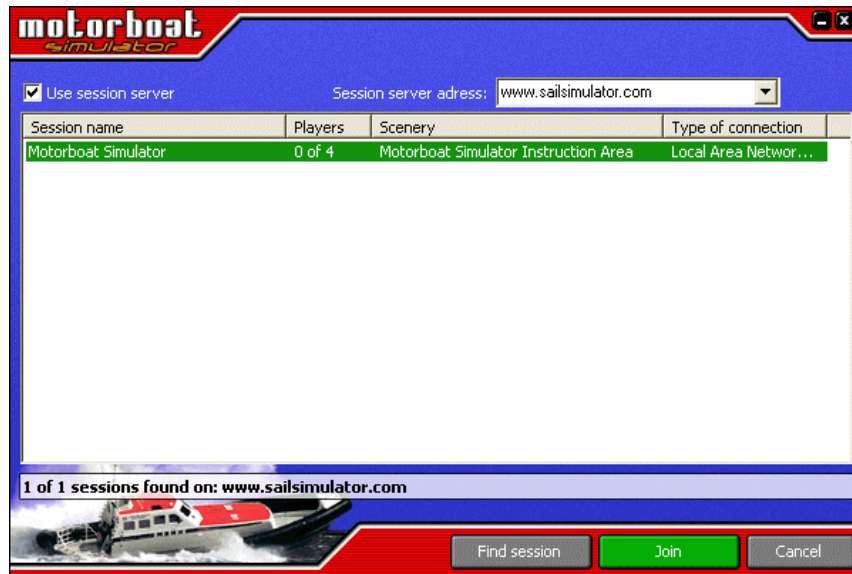
This menu gives you an overview of all settings for your session. Check if everything is right and start the session.

8.2 Joining a session

Step 1

Choose 'Join multiplayer session' in the multiplayer screen. Motorboat Simulator will search for existing sessions. Choose and select a session you want to join.

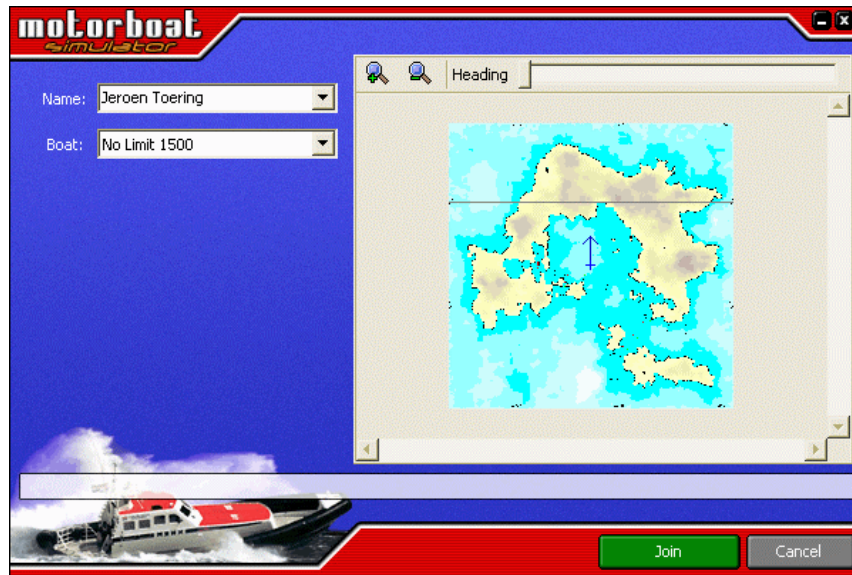
Step 2: Searching a session



The first screen for joining a multiplayer session is the session screen. In this screen you can search for the session you want to join. There are two ways to search a session:

1. The first way is by entering the ip-address (or computer name) in the 'Host IP adress' field and the server port in the 'Host port' field. By clicking on search session afterwards, the session will be searched for with the ip-adress.
2. The second way is with a session server. Select 'use a session server' (in the top left corner) to make use of a session server. The right session server will be selected automatically in the session server field. Then click search session to search for sessions. It is also possible to look for sessions on the session server at <http://www.sailsimulator.com/sessions.php>.

If there are sessions available these sessions will be displayed. Select a session and click join to join the session. You will then enter the next screen in the joining process.

Step 3: Select boat

Enter your name and choose a boat. Your name will be shown next to you boat on the chart so other players can see where you are. It will also be shown with chat messages you send. Determine the position and direction of your boat as well. The boat position can be determined by simply clicking on the chart. The direction (course) can be determined with the bar above the chart.

After determining your boat and position, click join to actually join the session. Motorboat Simulator will be started and you can start.

9 Expected

In one of the coming updates a course with instruction area will be included. This will allow users to learn to maneuver and moor in steps. Users will also learn about the meaning of the different buoys. The course will probably be made suitable for practicing for the navigation license.

Information: The DirectX technique used for this issue is called Ray Picking. Basically you pick a 3D object (the bollard) with your 2D mouse cursor. In future updates this technique will be used to visualize placing mooring ropes on jetties and mooring-posts. With this technique, anchoring can be simulated realistically as well.

10 Service and support

10.1 Customer service

For all your non-technical questions (like prices, upgrades etc.) you can contact us:

- On our website: www.stentec.com.
- By e-mail: software@stentec.com.
- By fax: +31 515 442 824.
- By phone: +31 515 443 515 (*office hours*).

10.2 Technical support

When you have technical problems you can't solve with the online help or this manual:

- Go to the Stentec website www.stentec.com. Probably your problem with the solution will be included in the Frequently Asked Questions (FAQ).
- Check the forum on forum.stentec.com. Perhaps other users have dealt with the same problem and they can help you.
- Send an e-mail to: helpdesk@stentec.com. Be as complete as possible and mention all details, incl. the specifications of your PC and your Windows version.
- Fax your problem to: +31 515 442 824.
- Call the helpdesk on: +31 515 443 515 (*office hours*).



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