

Nautis Naval Task Force Trainee Station Software Functional Specification

VSTEP B.V.

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1. Introduction

Nautis is a new generation of advanced maritime training simulators offering an affordable and effective alternative for training maritime officers and crews.

Nautis features advanced ship dynamics and top of the line visuals. It comes with highly detailed user and target vessels containing realistic manoeuvring properties. A large number of vessels are included in the standard library. Nautis includes realistic and accurate sailing environments, based on the latest hydrographical navigation charts as used for navigation on real vessels.

The Nautis Trainee Station software is a state-of-the-art training tool that can be configured for a wide range of training needs. These include:

- ✓ Navigation and passage planning
- ✓ Ship handling and manoeuvring
- ✓ Bridge team management
- ✓ Mission rehearsal
- ✓ Flag and Morse light communications
- ✓ Search and Rescue operations
- ✓ Man Over Board
- ✓ Tug assistance
- ✓ Replenishment at sea

2. Graphical quality

The 3D engine which is integrated in Nautis is from such advanced level that the environments are brought to life, enhancing the training experience of the students.

The environment and expanded vessel databases offer the unique opportunity to train on selected locations around the world on a large variety of ship types.

- ✓ Advanced 3D engine
- ✓ Realistic environments
- ✓ Realistic vessels

Various different camera positions provide for realistic situational awareness of the student:

- ✓ Helmsman camera
- ✓ Walkthrough: the ability to walk around on the vessel
- ✓ Bridgewing camera

Additional camera positions provide for external overview and the ability to observe and assess the situation from all angles:

- ✓ Orbit camera
- ✓ Birds-eye view camera



3. Vessel database

The vessel database contains of the following vessels:

Military:

- LCS1
- LCS2
- Corvette Baynunah
- Durance class replenishment vessel
- La Fayette Class Frigate
- Mine hunter Sandown class
- M-Frigate
- LCAC Military hovercraft
- LCU Landingcraft
- Frigate Lekiu Class
- Response Boat – medium
- RHIB
- LPD San Antonio
- Destroyer Arleigh Burke
- Aircraft Carrier
- Nuclear Attack Submarine

- Harbour tug
- Harbour tug (Azimuth thrusters)
- Russian Tugboat
- Coastal rescue boat (SAR)
- Pilot boat
- Harbour patrol boat (P6)
- Incident response vessel (Port Authorities)

Sea going vessels:

- Cruise ferry
- [Cruise ship](#)
- Raptor Class Passenger & Car Ferry
- Fast ferry
- Large container vessel
- Large heavy lift vessel
- Multi-purpose freighter
- VLCC

Helicopter:

- Sikorsky SH-60R
- Eurocopter AS332)

Inland vessels:

- Inland pushboat (towboat)
- Inland container vessel

Coast Guard:

- Protector
- Cutter
- Rescue Boat

Special vessels and objects Other:

- Hovercraft
- Fishing vessel (Cutter Class)
- Natural gas platform
- Pirate attack boat

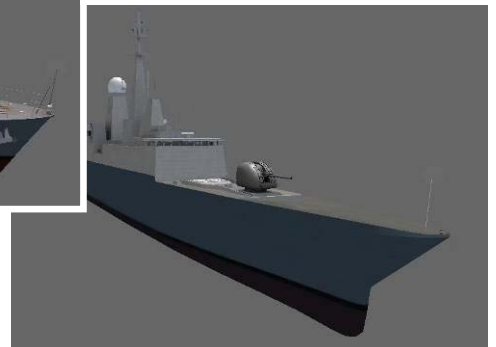
Work boats and OSV:

- Anchor Handling tug (3x)

Detail sheets of the military and Coast Guard vessels are available in a separate document.

Additional vessels can be added on customer request.

In addition, Nautis Trainee Station includes a large number of vessels which can be used as autonomous moving vessel in exercises ("Target vessels"). The "Own Vessel" types listed above can also be used as Target Vessel.

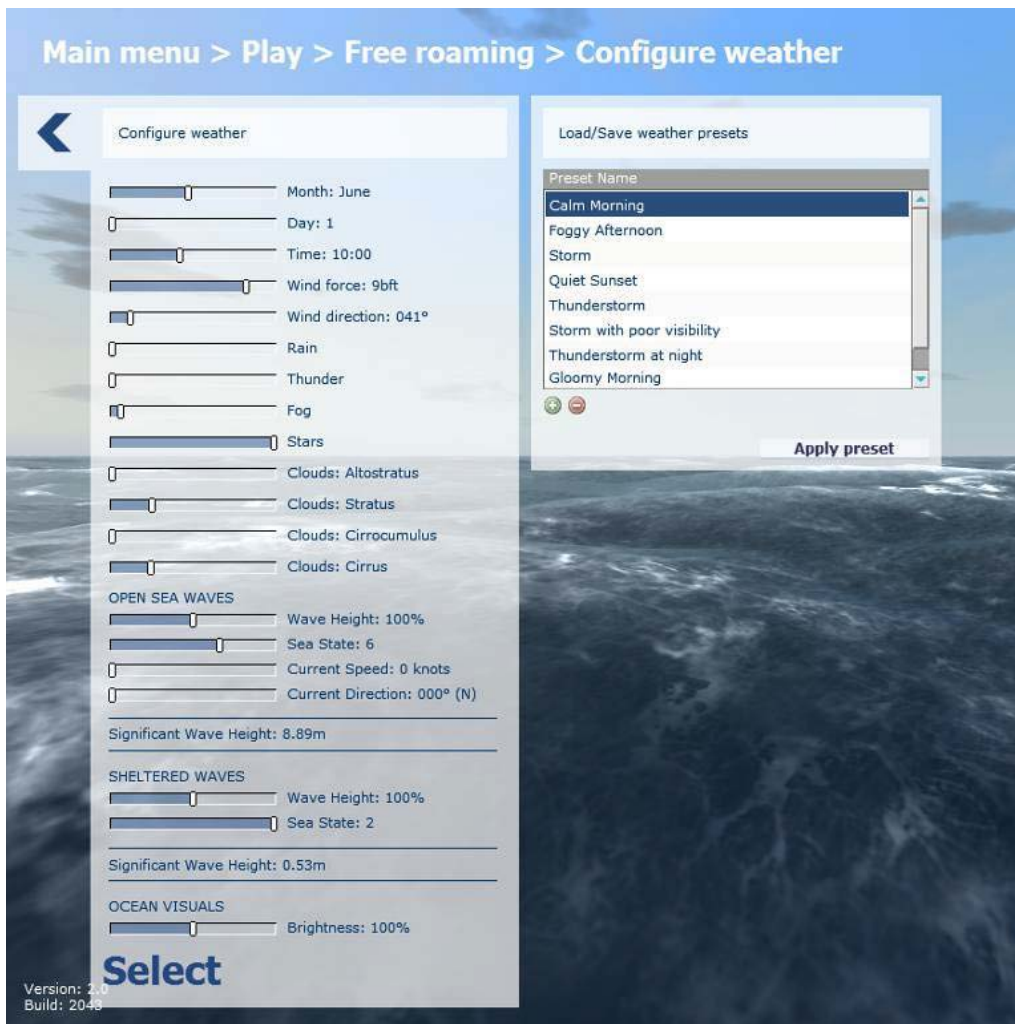


4. Environment database

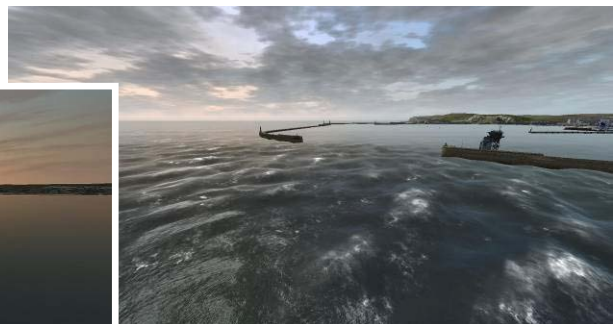
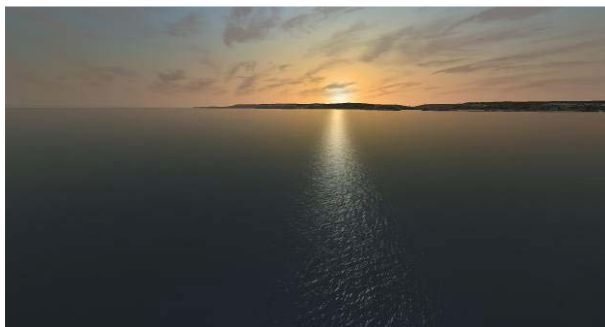
- ✓ Rotterdam, The Netherlands
- ✓ Approach to Rotterdam
- ✓ Marseille, France
- ✓ Hamburg, Germany
- ✓ Southampton, United Kingdom
- ✓ Dover, United Kingdom
- ✓ Calais, France (English Channel)
- ✓ New York, USA
- ✓ San Francisco, USA
- ✓ Padstow, Cornwall, United Kingdom
- ✓ Atlantic Ocean

Additional environments can be added on customer request.

5. Weather settings



- ✓ Extensive weather settings, including four different types of clouds, wind force and direction, rain, fog, thunder, wave height etc
- ✓ Dual wave model: bigger sea state in open sea vs. in ports with a gradual transition
- ✓ In port or sheltered waves separated from open sea waves
- ✓ Dynamic current model to increase the required level of manoeuvring skills during entering of a port between breakwaters
- ✓ Real time weather preview in background



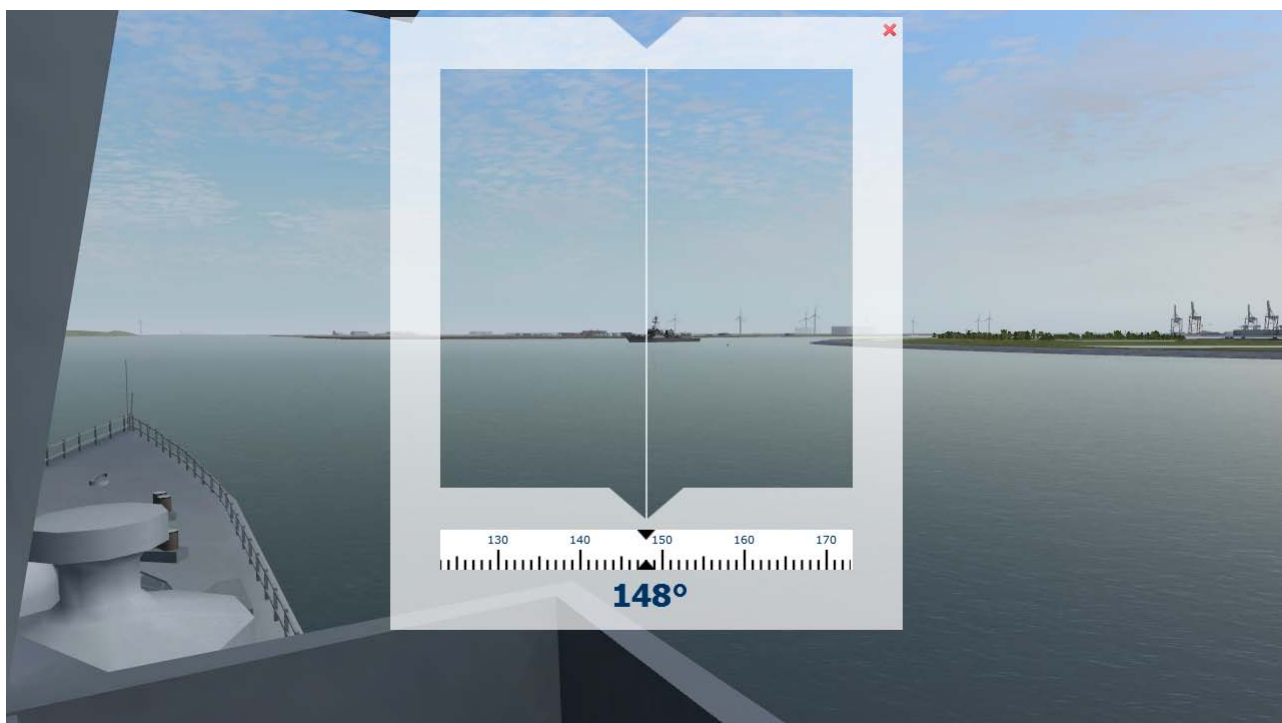
6. Binocular view



The binoculars in Nautis are simulated and can be used in the bridge view or on a separate screen.

- ✓ Dynamic pan speedcontrol
- ✓ Touchscreen ready

7. Bearing instrument



Coastal navigation cannot be carried out without the gyro bearing instrument, especially in combination with Radar range and bearing, ECDIS etc.

- ✓ Aid to visual navigation in landmarks and formation sailing
- ✓ Gyro repeater

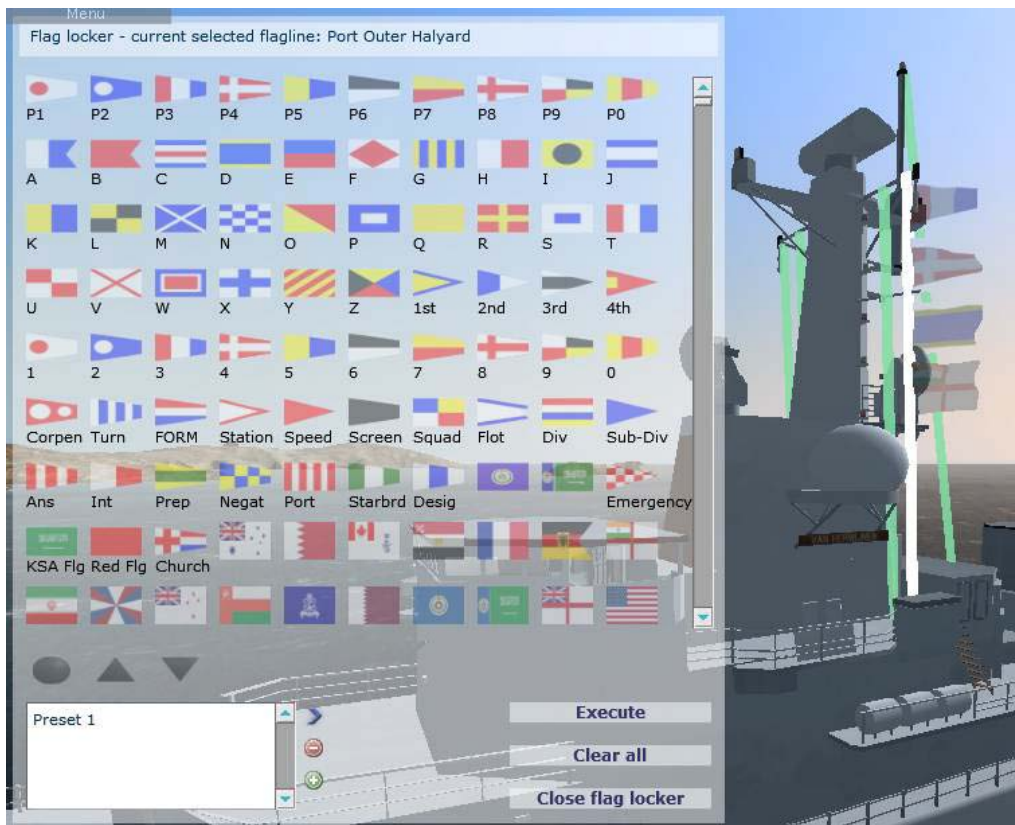
8. FMorse light



Communication between vessels by Morse light is featured by Nautis.

- ✓ Toggle white/red signal light
- ✓ Signal lights can be turned 360 degrees

9. Flag signalling



The flag lines featured on the vessels in Nautis are multifunctional.

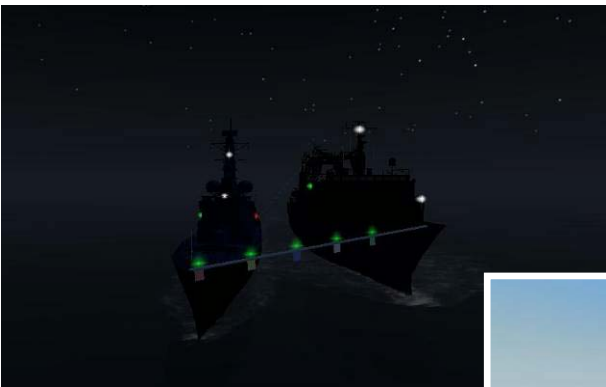
- ✓ Signal flags
- ✓ Country flags
- ✓ Day signals as per International Rules of the Road

10. Replenishment At Sea operation



Since RAS is an essential manoeuvring training in navies around the globe. Therefore special attention has been paid to facilitate this procedure.

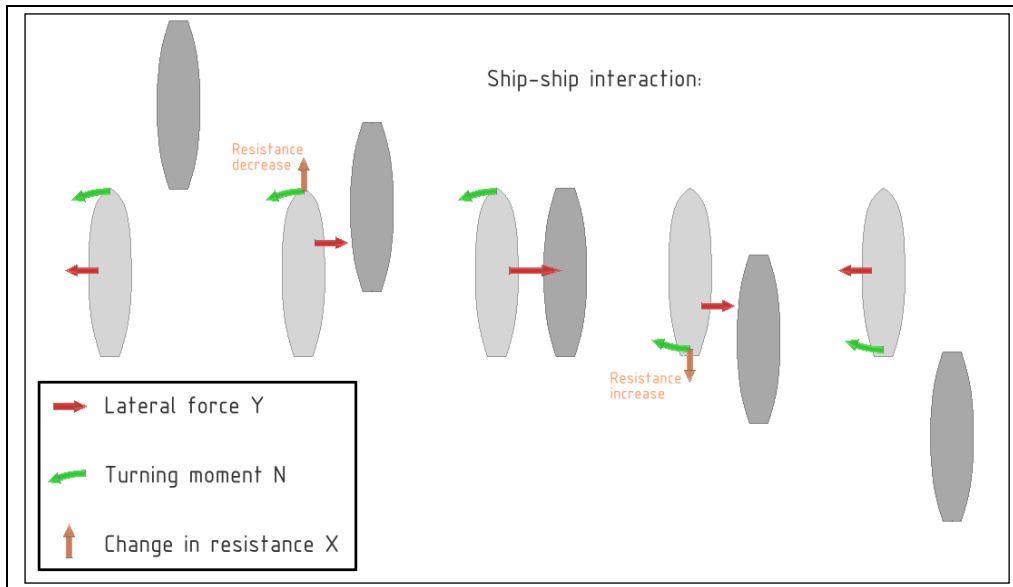
- ✓ Distance line day: flag line
- ✓ Distance line night: light line
- ✓ Animated replenishment hose for increased situational awareness



11. Hydrodynamic effects

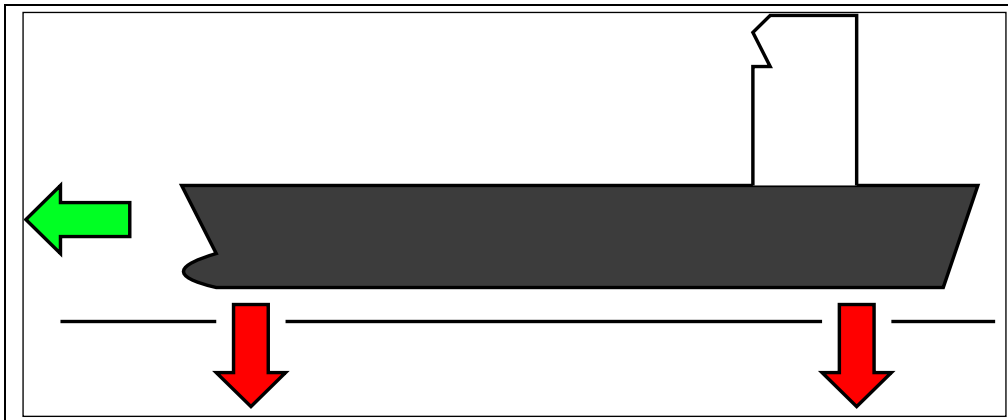
Apart from the six degrees of freedom (DoF), the vessels in Nautis behave conform hydrodynamic effects based on models derived from extensive towing tank tests by hydrodynamic laboratories as well as other studies.

11.1. Ship-Ship interaction



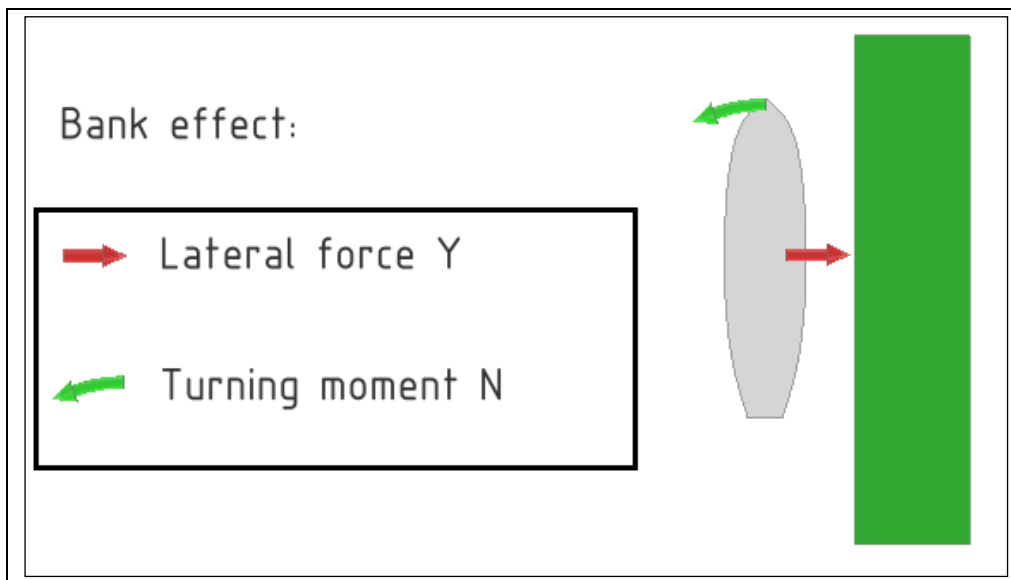
- ✓ Interaction of vessels passing each other at close range.

11.2. Squat



- ✓ The increase of draught in shallow water as a function of speed, underwater hull shape, etc

11.3. Bank effect



- ✓ The effect on vessels when passing a bank or quay side on close range.

12. Navigational Instruments

The Nautis Trainee Station software contains a number of navigational instrument panels. These are usually run on different monitors, connected to the same PC. Up to six monitors can be connected to one PC, using the appropriate PC specification, of which maximum three can be used for the outside view and the rest for navigation instrument panels.

Some of the built-in navigational instruments are not up to the IMO standard, but they are developed for basic training. For more advanced IMO compliant training, additional Nautis modules need to be used, like the In2Sim Nav aids, In2Sim Radar/ARPA, the In2Sim GMDSS and the ECDIS.

Simulator Professional includes several navigation panels on the bridge of the vessels: Conning, Rate of Turn + rudder angle, compass, GPS position + depth, autopilot, gyro heading, radar, ECDIS. These panels can be displayed in a small window on the main 3D screen or full-screen on additional monitors connected to the system. Examples are shown below.

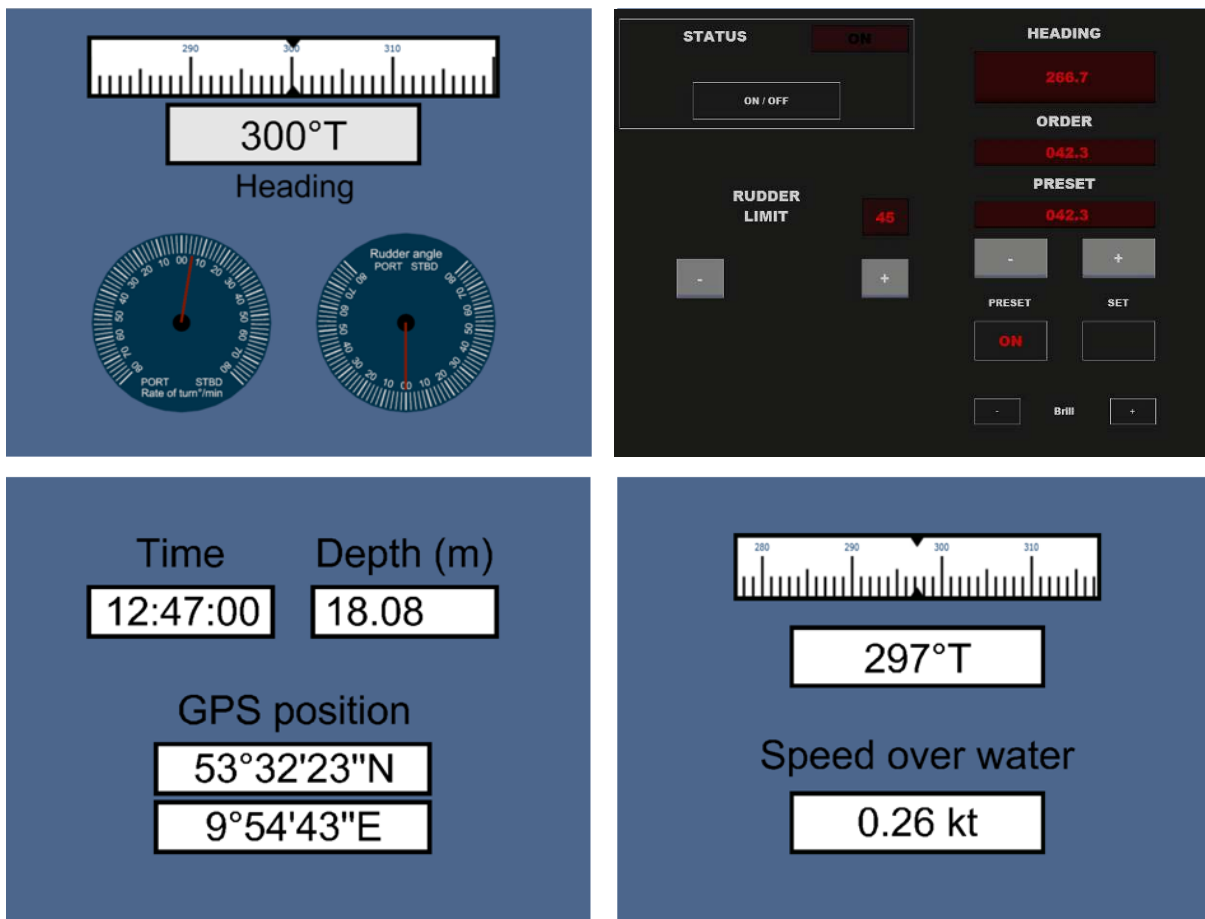


Figure: Examples of navigation panels

12.1. Magnetic compass with option for setting fixed error

Nautis includes a magnetic compass with option for setting fixed error. Using a horizontally placed display monitor and real pelorus hardware mounted on top, the magnetic compass can be used as a realistic pelorus in full mission bridge simulator.

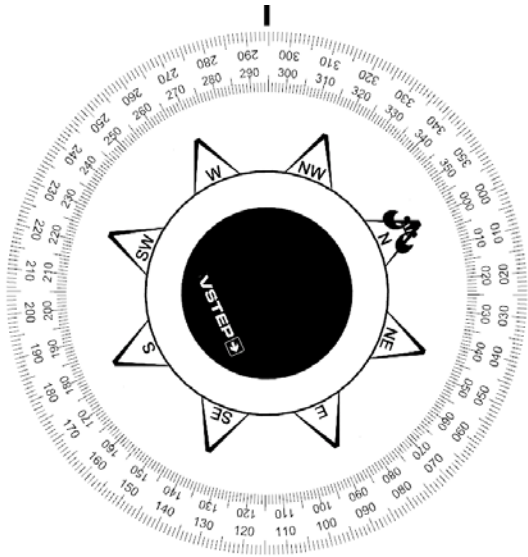
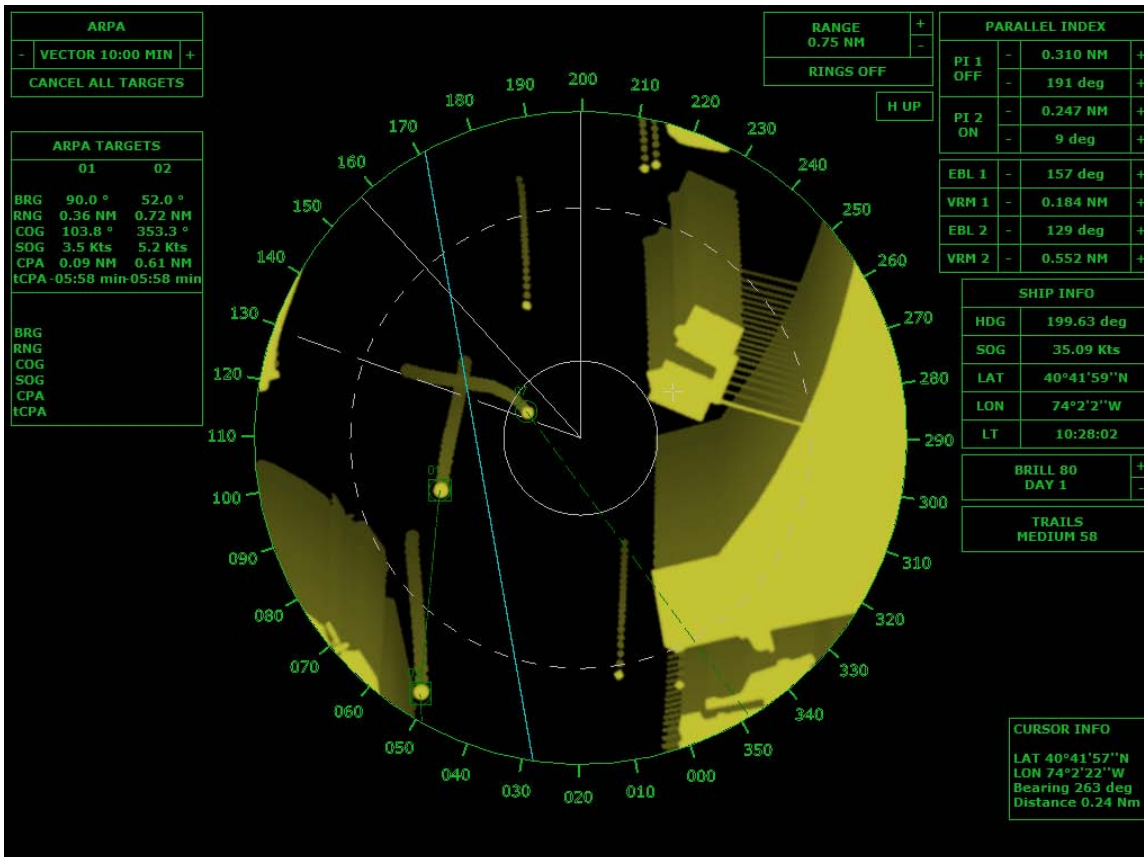


Figure: Magnetic compass with option for setting fixed error

12.2. Basic Radar

Nautis includes a basic radar with options for setting ranges, VRMs, EBLs, parallel indexing, coloured trails, and more than 10 ARPA targets.



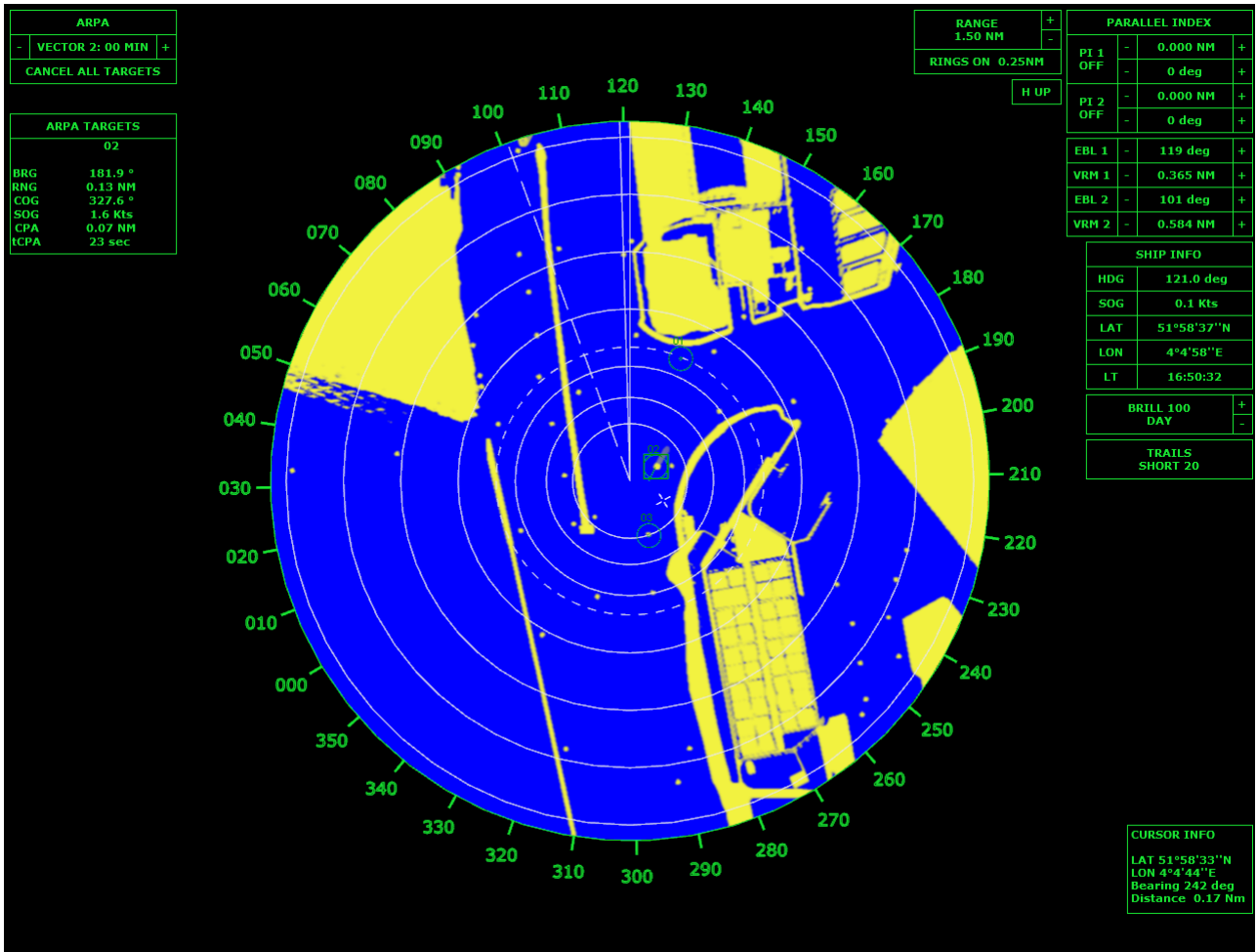


Figure 1: Basic radar with different settings



Figure 2: Small overlay display of basic radar. This can be shown on top of the 3D outside view screen.

12.3. Conning display

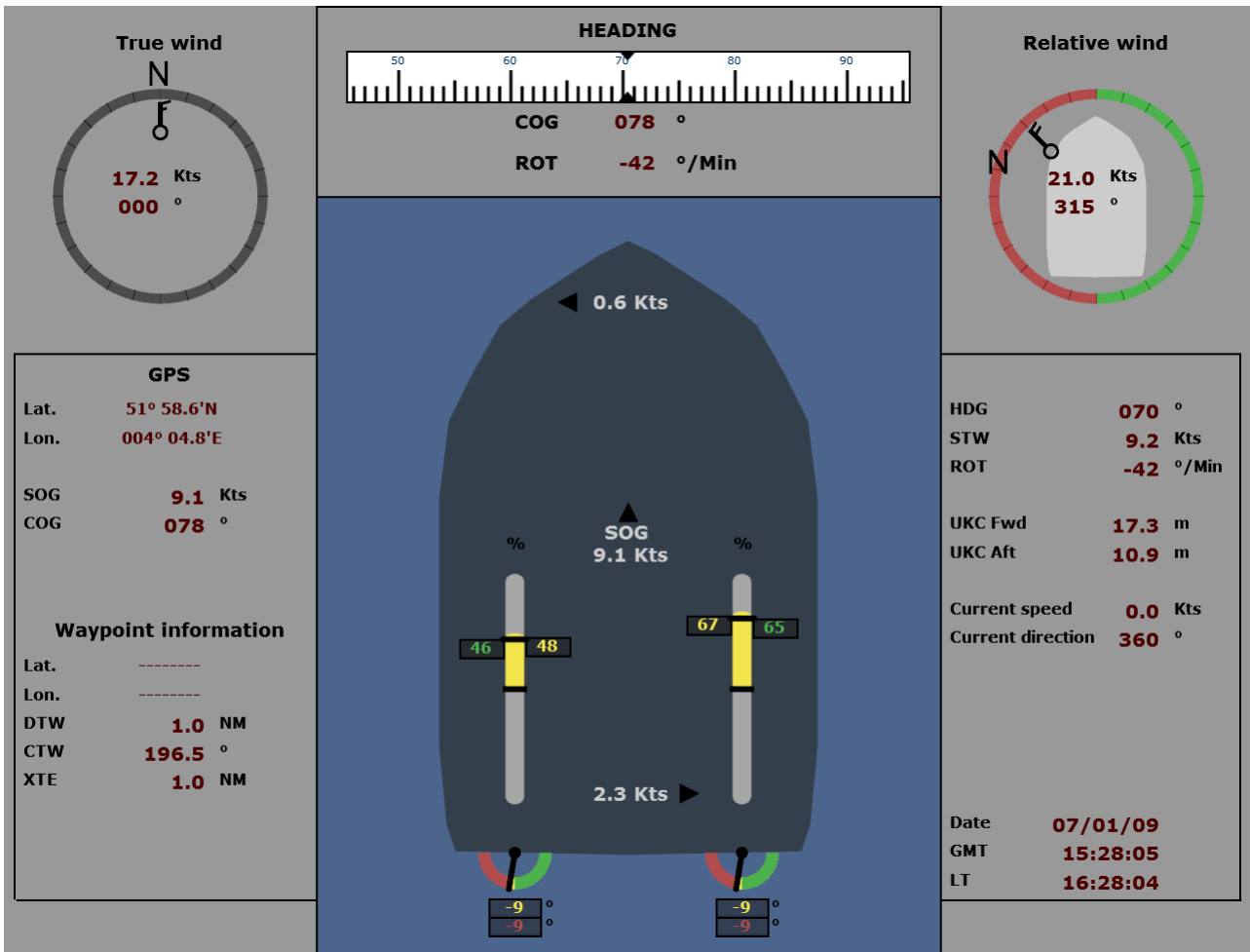


Figure 3: Conning display

The conning display provides the operator with all relevant information required to monitor the ships movement and the elements affecting the vessel (set and drift).

The button in the upper left corner turns the visual of the vessel upside down. This to provide the operator with the correct perspective when handling an OSV or harbor tug.

12.4. Chart screen

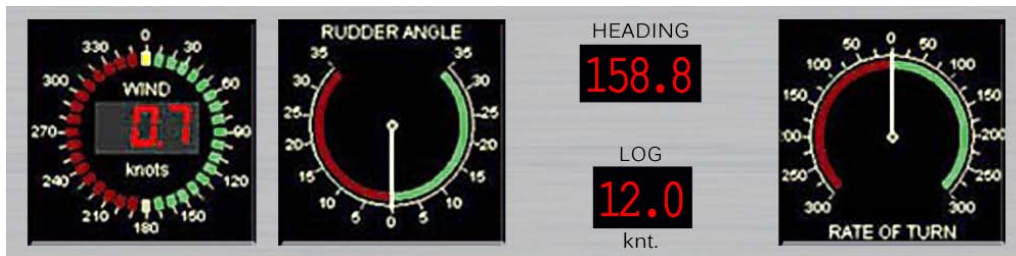
Nautis includes a detailed chart Screen with lights, buoys and depth references. This is not a IMO compliant ECDIS, but merely a basic electronic chart display, intended as a situational display, and for introduction training on electronic chart systems. For IMO STCW ECDIS training, a real ECDIS system should be used, which can be interfaced to Nautis using the NMEA interface.

13. NavAids

Nautis NavAids is a separate, optional software package, which can interface to the Nautis Trainee Station software. It is described in a separate document, the “Nautis In2Sim Navigational Aids Functional Specification”. The following instrument panels are part of the Nautis In2Sim NavAids package:

- GPS
- Conning Screen
- Steering control
- Echo Sounder
- Doppler log
- Course recorder
- AIS
- Alarms
- Fog horn
- Light panel
- Magnetic compass
- Gyro compass
- Loran C
- Mooring and Anchoring

14. Overhead panels

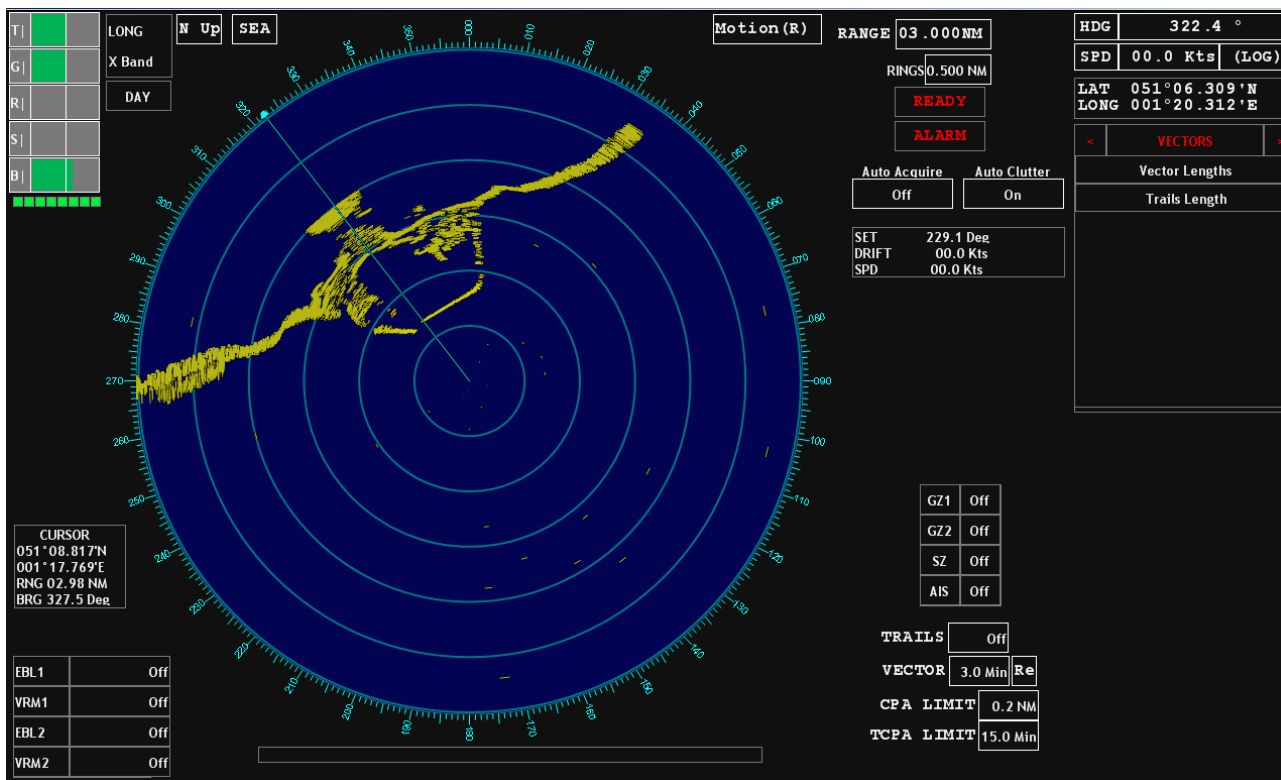


The overhead panels provide for an easy overview of all essential manoeuvring information.

Featuring:

- ✓ Slave wind indicator
- ✓ Rudder angle indicator
- ✓ Gyro heading
- ✓ Log speed
- ✓ Rate of Turn (ROT)

15. Radar/ARPA



Radar/ARPA is considered an essential aid to safe navigation nowadays. Special requirements apply for this equipment. All features included in the Nautis Radar are listed below.

The Nautis radar simulator is an optional separate product, which can interface to Nautis Trainee Station using the built-in proprietary radar interface.

Featuring:

- Both 10 cm and 3 cm radar included
- Stabilised relative motion mode
- Sea and ground stabilised true motion modes
- Weather effects
- Tidal streams
- Current
- Shadow sectors
- Spurious and false echoes and other propagation effects
- Coastlines
- Navigational buoys
- Search and rescue transponders

ARPA Functions

- Manual target acquisition
- Automatic target acquisition
- Past track information
- Use of exclusion areas
- Vector/graphic time-scale and data display

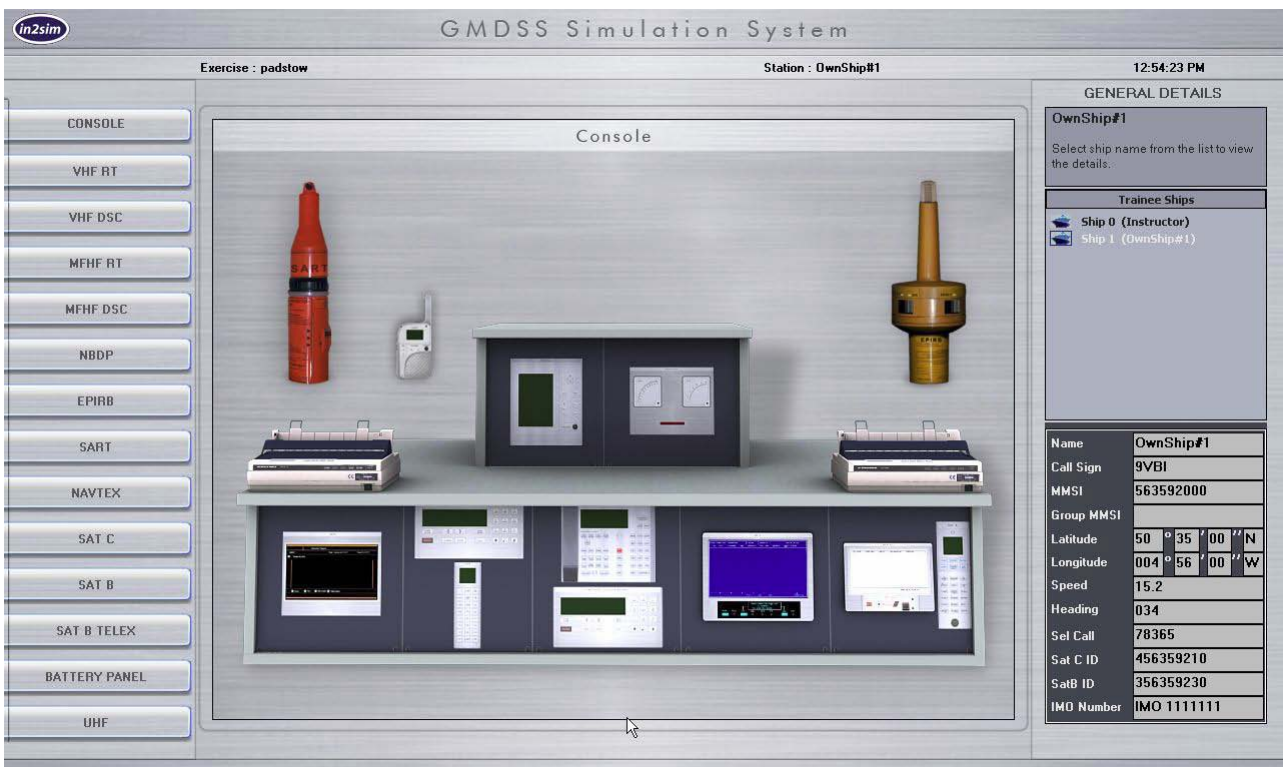
- Trial manoeuvres

Voice Communications

Voice communications functionality is available in a separate product, the Nautis Communications Trainer. It features a VHF, MF/HF, UHF and an Intercom. It can be configured in different arrangement. The buttons can be operated with a mouse or with a touch screen. For the sound input and output, a headset or speaker set can be used, or a Push To Talk handset. Below is an image of the standard configuration.



Another Nautis product which can be used in cases where the set of devices of the Communications Trainer is not sufficient for the training needs is the Nautis In2Sim GMDSS simulator. It contains all the equipment needed for IMO GMDSS. Below is an image of the main screen. A separate document describes this product in more detail.



16. NMEA Interface

Nautis includes an NMEA interface, to send data to external navigation equipment like an ECDIS. It also supports a data input through NMEA, often used to interface Nautis to external controls and external ship hydrodynamics simulators, or DP training systems. In this mode, Nautis' own mathematical model for ship dynamics is disabled, and the external model is used. Nautis provides the outside view and all navigational instruments for the external simulator or DP system.

Nautis supports 23 output sentences and 9 input sentences according to the NMEA 0183 protocol, configurable across 8 serial ports or ethernet. This enables interfacing Nautis to third party navigation equipment like ECDIS and various repeaters.

The following NMEA output sentences are supported:

- ✓ **GGA** - Global positioning system (GPS) fix data. Time, position and fix-related data for a GPS receiver.
- ✓ **RMC** - Recommended minimum specific GNSS data. Time, date, position, course and speed data provided by a GNSS navigation receiver. This sentence is transmitted at intervals not exceeding 2 s and is always accompanied by RMB when a destination waypoint is active. RMC and RMB are the recommended minimum data to be provided by a GNSS receiver. All data fields should be provided, null fields used only when data is temporarily unavailable.
- ✓ **ZDA** - Time and date. UTC, day, month, year and local time zone.
- ✓ **HDT** – Heading true (will be become obsolete in next version)
- ✓ **GLL** – Geographic position – latitude/longitude. Latitude and longitude of vessel position, time of position fix and status.
- ✓ **THS** – True heading and status. This sentence replaces the deprecated sentence HDT. Actual vessel heading in degrees true produced by any device or system producing true heading. This sentence includes a “mode indicator” field providing critical safety related information about the heading data, and replaces the deprecated HDT sentence.
- ✓ **VTG** – Course over ground and ground speed
- ✓ **VLW** – Dual ground/water distance. The distance travelled, relative to the water and over the ground, since the last reset.
- ✓ **DBT** – Depth below transducer, in feet, meters and fathom.
- ✓ **DPT** - Depth relative to the transducer and offset of the measuring transducer. Positive offset numbers provide the distance from the transducer to the waterline. Negative offset numbers provide the distance from the transducer to the part of the keel of interest.
- ✓ **VWT** - True Wind Speed/angle
- ✓ **ETL** - Engine telegraph data. This sentence indicates engine telegraph position including operating location and subtelegraph indicator.
- ✓ **PRC** – Propulsion remote control status. This sentence indicates the engine control status (engine order) on a remote control system. This provides the detailed data not available from the engine telegraph sentence ETL. The sentence shall be transmitted at regular intervals.
- ✓ **MWV** - Wind speed and angle. wind angle in relation to the vessel's bow/centreline and the wind speed, both relative to the (moving) vessel. Also called apparent wind, this is the wind speed as felt when standing on the (moving) ship.
- ✓ **MWD** – Wind direction and speed relative to the Earth.
- ✓ **VBW** - Dual ground/water speed. Water-referenced and ground-referenced speed data. Both shipdirectional and transverse, in knots.
- ✓ **RSA** - Rudder sensor angle. Relative rudder angle, from rudder angle sensor.
- ✓ **ROT** – Rate of Turn

- ✓ **VDM** (AIS) - AIS VHF data-link message. This sentence is used to transfer the entire contents of a received AIS message packet, as defined in ITU-R M.1371 and as received on the VHF Data Link (VDL), using the “six-bit” field type. The structure provides for the transfer of long binary messages by using multiple sentences.
- ✓ **RPM** – Revolutions. Shaft or engine revolution rate and propeller pitch
- ✓ **TRD** – Thruster response data. This sentence provides the response data for thruster devices.
- ✓ **DTM** – Datum Reference. Local geodetic datum and datum offsets from a reference datum.

The following custom defined NMEA output sentences are supported:

- ✓ **SHR** – Ship motion in 6 degrees of freedom (movement plus rotation). Can be used to control a motion platform.
- ✓ **HPR** - heading, pitch / roll. Can be used to control a motion platform.

The following NMEA input sentences are supported:

- ✓ **GLL** – Geographic position – latitude/longitude. Latitude and longitude of vessel position, time of position fix and status.
- ✓ **THS** – True heading and status. This sentence replaces the deprecated sentence HDT. Actual vessel heading in degrees true produced by any device or system producing true heading. This sentence includes a “mode indicator” field providing critical safety related information about the heading data, and replaces the deprecated HDT sentence.
- ✓ **ETL** - Engine telegraph data. This sentence indicates engine telegraph position including operating location and subtelegraph indicator.
- ✓ **PRC**– Propulsion remote control status. This sentence indicates the engine control status (engine order) on a remote control system. This provides the detailed data not available from the engine telegraph sentence ETL. The sentence shall be transmitted at regular intervals.
- ✓ **ROR** – Rudder order status. Angle ordered for the rudder.
- ✓ **TRC** – Thruster control data. This sentence provides the status of control data for thruster devices. This sentence may also be used as a Command Sentence (see Note 9). When providing status data the sentence shall be transmitted at regular intervals.
- ✓ **RSA** – Rudder Sensor Angle. Relative rudder angle, from rudder angle sensor
- ✓ **ZDA** – Time & Date. UTC, day, month, year and local time zone.

17. Simulator configurations

Nautis software can be integrated into various simulator set-ups. In the below images, some options are illustrated. One high-spec PC can drive up to six display screens, of which 3 for the outside view and 3 for the navigational instruments. This implies that low-cost configurations are possible, with limited hardware maintenance cost.

