CEACT

Channel ECDIS, AIS &
Course Trajectory System

US Waterways Version

Version 1.6

User's Guide

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SevenCs AG & Co. KG

CEACT Information Systems, Inc.

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Preface

This User' Guide describes installation and operations of *CEACT Electronic Chart system*. This tool was designed based on ECDIS technology. ECDIS *(Electronic Chart Display and Information System)* has been standardized by the International Hydrographic Organization (IHO) and the International Maritime Organization (IMO) to ensure that all display devices for electronic charts will show the same behavior, and will be able to access the same worldwide chart database.

Like any ECDIS *CEACT* has an interface to connect external navigational devices (positioning sensors, e.g. a GPS receiver).

Since ECDIS originally was developed for seagoing vessels it was necessary to modify and add functions to create an ECDIS suitable for inland navigation. *CEACT* was developed in close contact with experienced practitioners, thus its various functions reflect the everyday requirements of inland navigation.

Some of the outstanding features offered by *CEACT System*:

Display in landscape or portrait format

Provided your screen can be rotated the charts will be displayed in either landscape or in portrait format, depending on the position of the screen when *CEACT System* is started. Using Portrait format will display a longer portion of the river.

Channel text orientation to reduce text clutter

Depending on the position of the respective object text information is aligned left or right of the object, thus reducing the possibility of text clutter.

Radar Overlay

CEACT System can import data from external radar devices and display this additional information..

Ship and barge towbuilding

CEACT System provides menus supporting true scale ship and barge towbuilding.

Creation of user definable objects

CEACT System includes menus and templates enabling the user to define additional objects, e.g. buoys, mooring facilities, etc. and enter text and comments.

Export of user defined objects

Any information created by the user can be exported onto data carrier, and can be used on other systems.

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1 Introduction

1.1 Preface and Disclaimer

To facilitate navigation *CEACT System* utilizes electronic navigational charts from different manufacturers. This software cannot replace the use of official nautical charts. At the moment only official nautical charts and notices to mariners offer all necessary information to ensure safe navigation.

As skipper you are responsible at any time for the correct use of navigational aids as complies with good seamanship. The performance of the software depends on the utilization of adequate hardware, the operating system, and the correct installation and application of position sensors or compasses.

Disclaimer

The manufacturer is not liable to pay compensation should any damages occur because of the utilization of the software or the inability to utilize this software. This includes without any limitation damages due to missed profits, operating interrupt, loss of business information or data, or other financial loss. This applies even in case the manufacturer has been previously informed about the possibility that such damage might occur. In any case the liability of the manufacturer is limited to the sum that has actually been paid when purchasing the product.

This limitation of liability does not apply to damages which have been caused by the manufacturer with intent or negligence. Claims based on inalienable legal rules on product liability also remain unaffected.

No further liability accepted.

The manufacturer expressly excludes all further liability related to the software, its manuals and other written material.

1.2 Contact

Software cannot be absolutely perfect and meet every user's expectations. In case you have any problems with *CEACT System* please send an e-mail to

support@ceact.com.

Your suggestions will be taken seriously. *CEACT System* is constantly being optimized.

1.3 About this Document

In the following installation and use of the *CEACT System* are described.

Background Information describes the functions of an *Electronic Chart Display and Information System* (ECDIS) and the *S-57 Electronic Navigational Chart Format* (ENC format).

> **NOTE:**
> You may want to read this chapter later. It does not contain any information essential to installation and operation of *CEACT System*.

Installation and Configuration gives advice on installation and configuration, and describes the registration of *CEACT System* and navigational charts.

CEACT System Start Menu Features describes the components and functions of the *CEACT* user interface.

Navigation Display describes the displays in the *CEACT* user interface.

Global Functions describes functions which can be accessed directly from the *CEACT* user interface.

Menu Index describes the various menu items which can be accessed via the *Menu Select* button in the *CEACT* user interface.

Context Menu describes the functions offered in this menu.

1.4 Conventions Used in this Document

Times New Roman font is used for:

- plain text in this document

Italic font is used for:

- program and component names

Boldface is used for:

- chapter and section headlines
- important notes
- cross references

`Courier New` font is used for:

- any text typed by the user
- file content and names

Note:

Displays important information which should not be ignored.

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2 Background Information

NOTE:

You may read the chapter *Background Information* later. It does not contain information essential to installation and operation of *CEACT System*.

2.1 ECDIS

The characteristics of ECDIS have been defined according to the Performance Standards for Electronic Chart Display and Information Systems of the International Maritime Organization (IMO), Transfer Standard for Digital Hydrographic Data (S-57) and Specifications for Chart Content and Display Aspects of ECDIS (S-52) of the International Hydrographic Organization (IHO). That is why ECDIS meets the requirements for all traditional chart work, e.g.

- Navigational calculation
- Chart updates
- Route construction
- Course monitoring

CEACT System is based on the *SevenCs EC2007 ECDIS Kernel*. This software is the main product of *SevenCs AG & Co. KG*. It is the base for many ECDIS currently on the market.

2.2 directENC

Digital sea charts, also called *Electronic Navigational Charts* (*ENCs*), are published by the Hydrographic Offices in *S-57 format*. This is a worldwide standard.

If a computer is to display an *S-57 navigational chart* the contents of the file must be converted into a proprietary data format to ensure fast data access for display and retrieval. In an ECDIS this proprietary format is the format of the internal chart database, the so-called *System Electronic Navigational Chart (SENC)*.

The conversion process from *S-57* into *SENC format* is performed only once during the data import. However, depending on the amount of information it may take a few minutes per chart. In case of a single chart this may be acceptable, but

not for a large set of charts when the waiting period can easily increase up to several hours.

That is why *SevenCs* has developed a method to supply *CEACT System* with charts in an easy and fast manner. The idea was to use the *SENC format* as exchange format, too. *SevenCs* calls this format *directENC* because it allows direct access to the S-57-chart as soon as it has been copied to the system's hard disk.

There are ECDIS systems which are utilized on large seagoing trading vessels based on the same technology as *CEACT System*.

The *directENC format* is protected against unauthorized access. To view S-57 charts in *CEACT System* you need a *Chart Permit*. You'll obtain the *Chart Permit* from CEACT Information Systems, Inc. when *CEACT System* is registered, and when purchasing additional charts. Thus the investment of the chart producers is protected, and the users of *CEACT System* will get the benefit of a constantly growing supply of charts.

2.3 Facts on Fuel Consumption and Ton Miles

Using CEACT Course Trajectory information to reduce oversteer is a very important reason for companies to choose to use CEACT Channel Navigation Software. It has been noted for years now that some pilots steer a vessel as much as 7% more efficiently than other pilots, month after month. This improved efficiency is primarily due to less steering. Once oversteer has occurred an opposite oversteer is required to put the vessel back in the right track. This occurs on every bend in the river and even on some straight parts of the channel.

When the rudder angle is increased the engine is loaded heavier causing the governor to react to maintain RPM. This action increases fuel consumption. The pilot can use the course trajectory information to reduce oversteer and decrease fuel consumption.

When excessive steering is applied engine thrust is diverted to the side causing the vessel to slow down. Under some conditions this decrease in speed can be greater than 10%. The increase in efficiency will increase the yearly ton miles of the vessel considerably.

CEACT Channel Navigation software could easily pay for itself and the associated sensors within a month of operation due to these reasons alone. The software is also designed to improve navigational safety and therefore companies could assume higher liability to reduce insurance costs.

The following four images show how CEACT was used to reduce oversteer of a vessel travelling up bound on the Ohio River in high water. CEACT Channel Navigation Software had been in use for approximately four hours prior to the beginning of this test. The computer display was turned off for 15 minutes and the pilot steered with radar, the second fifteen minutes the computer monitor was turned on and the pilot used the course trajectory information to reduce oversteer.

The first image shows a graph of the Standard Deviation of Swing using SpeedGraph Software. The data that was used is referred to as tonmiles.dat and is the same file that was collected during the test mentioned in the above paragraph. The Standard Deviation of Swing compares the swing variation to the average amount of swing. 0 on the upper graph would represent no variation from the average value of swing. The higher the value the greater the variation. The first half of the graph (left side) shows the standard deviation of swing when the radar was used. The second half of the graph (right side) shows the standard deviation of swing when the CEACT Course Trajectory information was used. SpeedGraph clearly shows that steering efficiency is significantly improved when using the CEACT Course Trajectory information. It also shows in the lower graph that even though the channel narrows as the vessel moves forward, the rate of decline in speed is greater in the first half of the data.

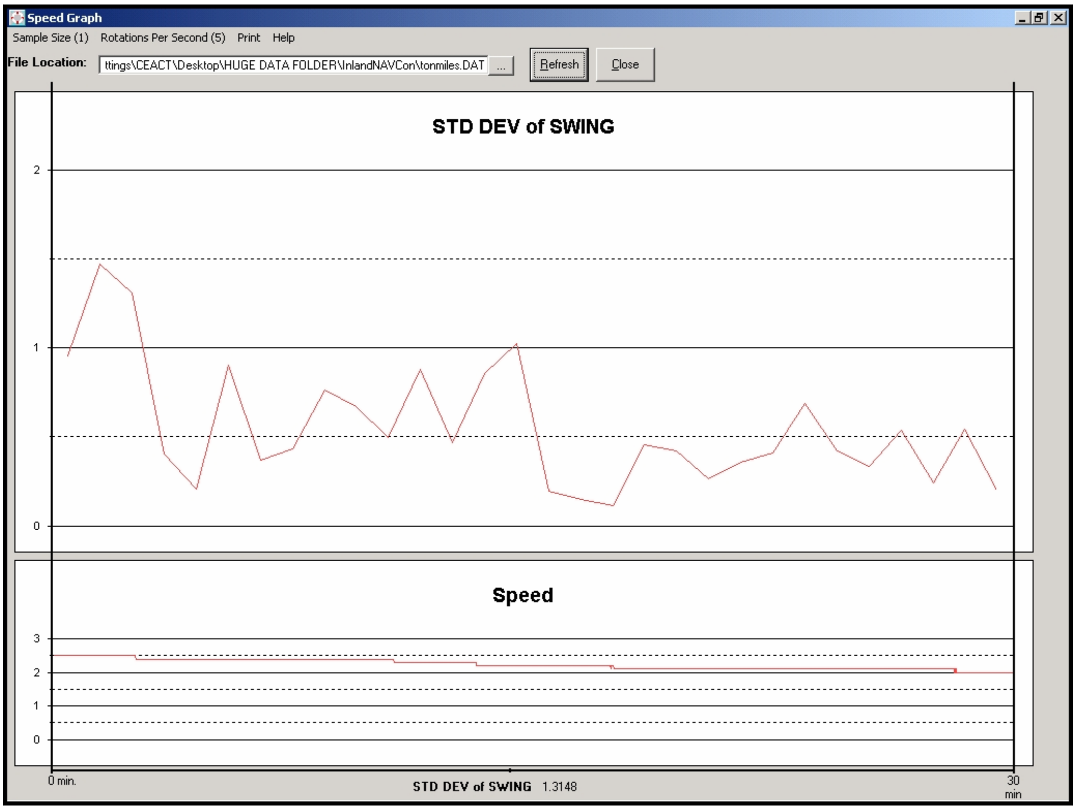


Figure 2.1: Graph Standard Deviation of Swing

SpeedGraph Software can be purchased from CEACT Information Systems.

The remaining three captured images show how the vessel course trajectory looked in both halves of the test and the past track line information as the vessel moved up the narrowing channel.

In the upper right hand corner of the images is the swing meter indicator. The prediction shown in the first screenshot was unavailable to the pilot that ran the test, but has been added to show the trajectory of his oversteer. Note the swing here is only 6 degrees per minute.

The second image shows a much lower swing rate on the swing meter. This single screenshot is representative of how the vessel was steered when the pilot was using the CEACT Course Trajectory information.

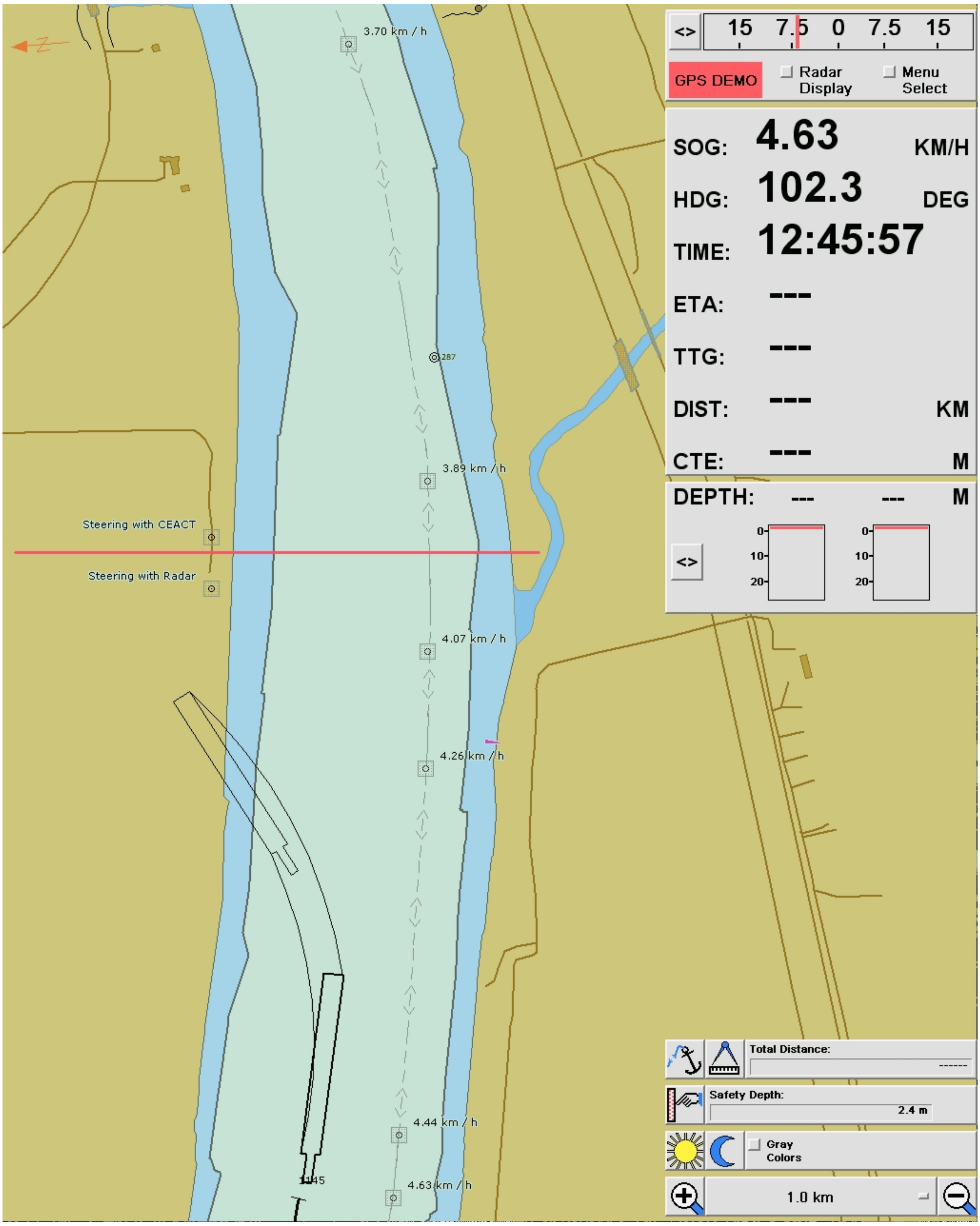


Figure 2.2: Lower Swing Rate

The third image shows the past track information from the entire 30 minute period. It is quite evident that the vessel had significantly more lateral movement in the lower half of the screenshot.

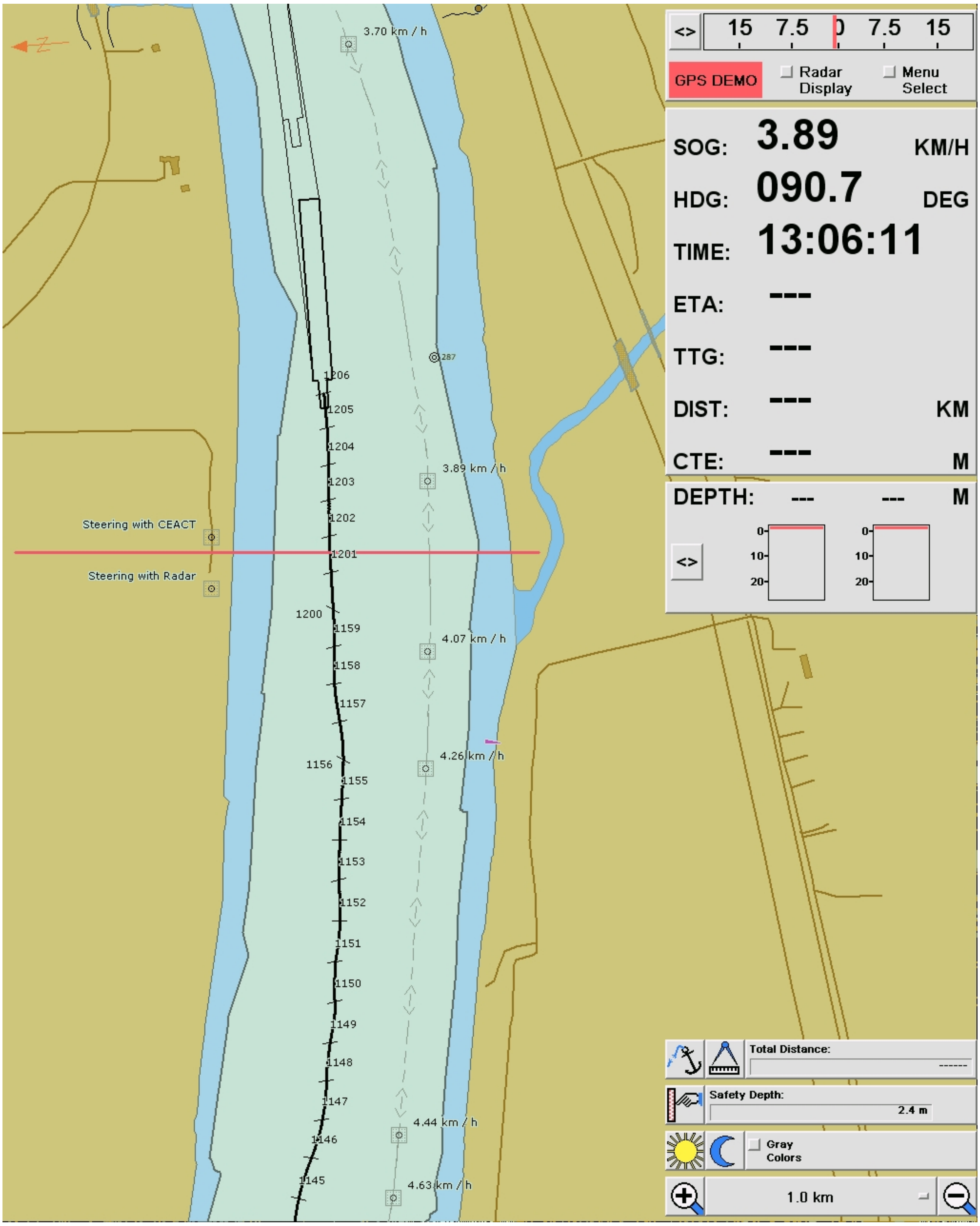


Figure 2.3: Past Track Information

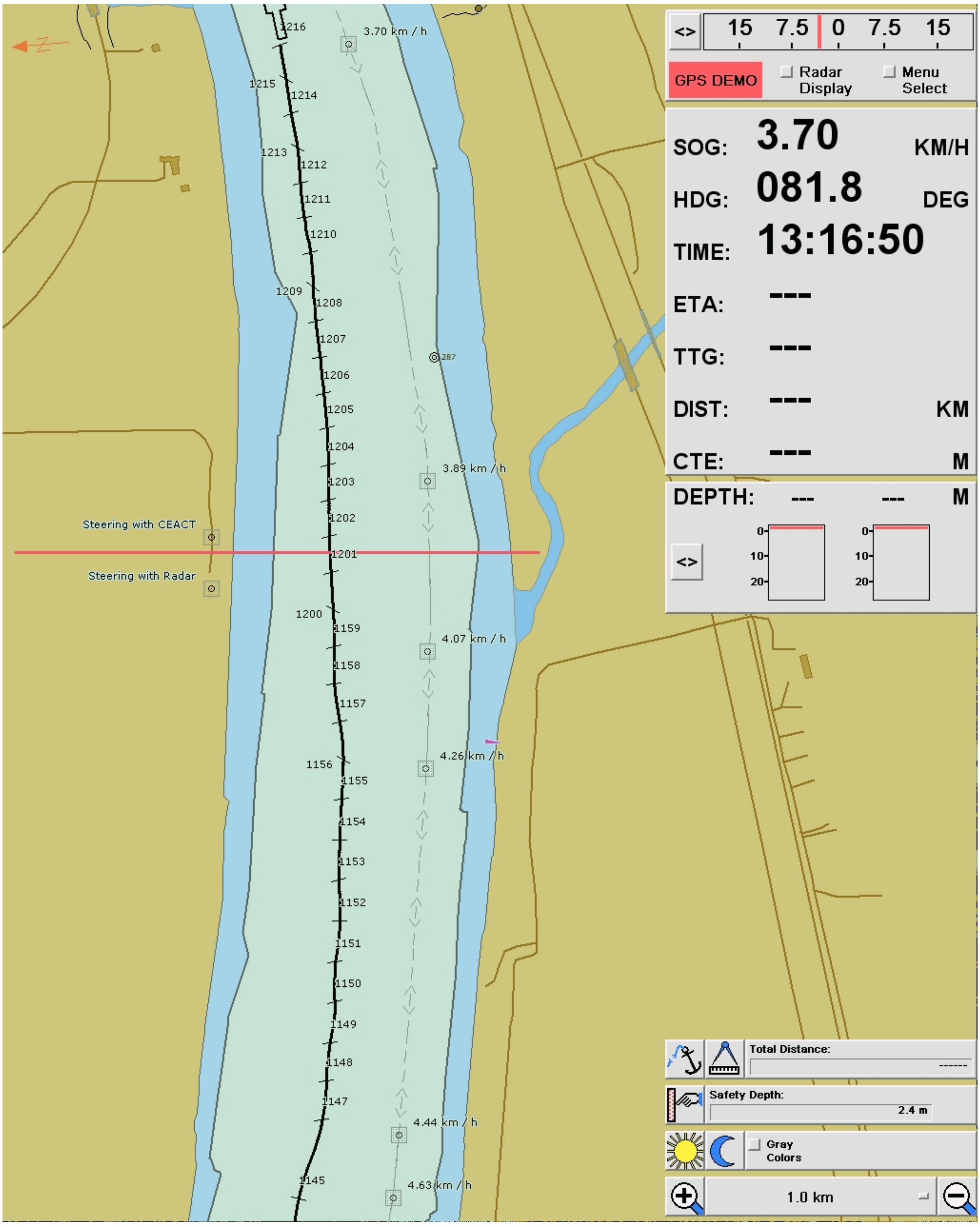


Figure 2.4: Final Stage

3 Installation and Configuration

3.1 Safety Instructions

Do not open the electrical equipment unless totally familiar with electrical circuits and service manual.
Only qualified personnel should work inside electrical / electronic equipment.

Wear a safety belt and hard hat when working on the antenna unit.
Serious injury or death can result if someone falls from the ship's mast or other elevated areas.

Construct a suitable service platform from which to install the antenna unit.
Serious injury or death can result if someone falls from ship's mast or other elevated areas.

Turn off the power at the mains switchboard before beginning the installation.
Fire, electrical shock or serious injury can result if the power is left on or is applied while the equipment is being installed.

Do not install the display unit where it may get wet from rain or water splash.
Water in the display unit can result in fire, electrical shock or equipment damage.

3.2 System Requirements

Computer *

- Processor – 300 MHZ or higher
- Video Resolution - 1280 by 1024, 1024 by 768
- Hard Drive Space - 100 Megabyte
- RAM Memory – 128 Megabyte
- IBM compatible computer
- USB Ports – 2
- CD ROM Drive

Additional Hardware

- GPS Heading Sensor or Gyro compass & DGPS

Additional Requirements for Dual Depth Sounders

- One 2- input Serial to 1-output USB Adapter

Additional Requirements for RADAR Overlay Option

- One RADAR Overlay Integrator

* Note: Minimum computer requirements for *CEACT System* configured without RADAR overlay option.

3.3 System Configuration

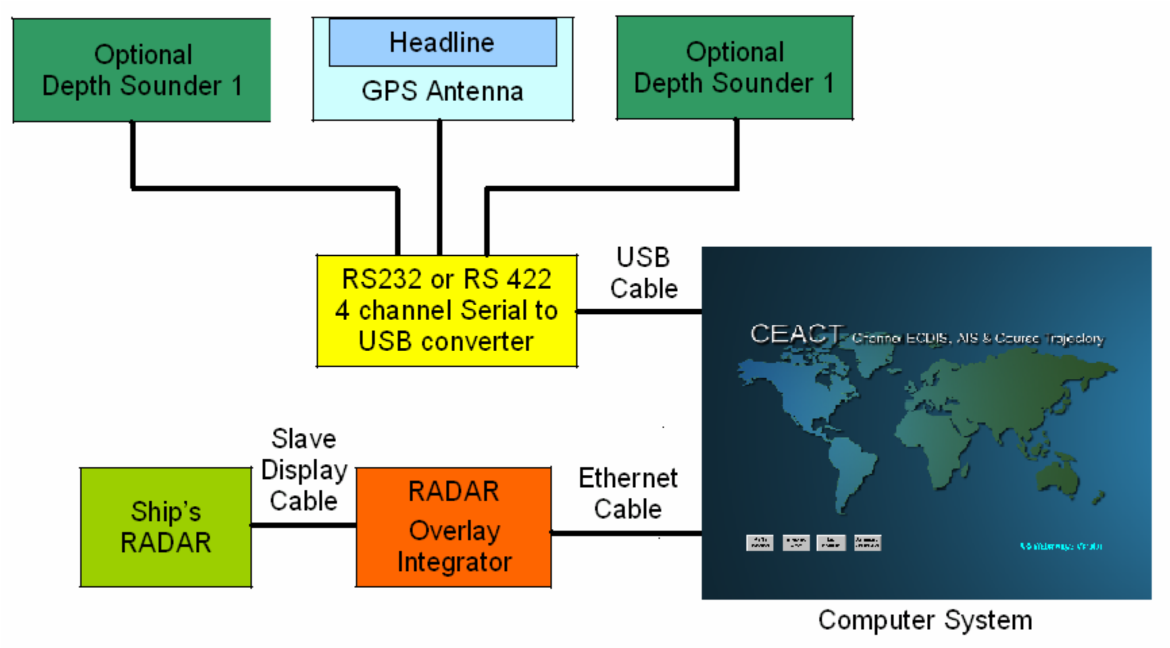


Figure 3.1: CEACT - typical hardware configuration

CEACT chart software has been designed to accept standard NMEA data from such devices as heading GPS Units and depth sounders; heading can be obtained using either a Gyro compass and DGPS or GPS Heading sensor.

Most ship's RADAR systems can be integrated into the Chart viewer using the RADAR Integrator module.

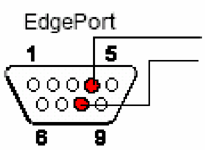
3.4 Hardware Installation

3.4.1 RS422 vs. RS232

The National Marine Electronics Association, NMEA is a Non Profit Committee that defines the open standard that is utilized by marine equipment manufacturers to provide data output from their devices.

The intent of this standard is to allow for interoperability between manufacturers because the data would conform to the standard. Manufacturers, however, do not have to conform exactly to the standard and therefore some of the sentence structures may be different from manufacturer to manufacturer.

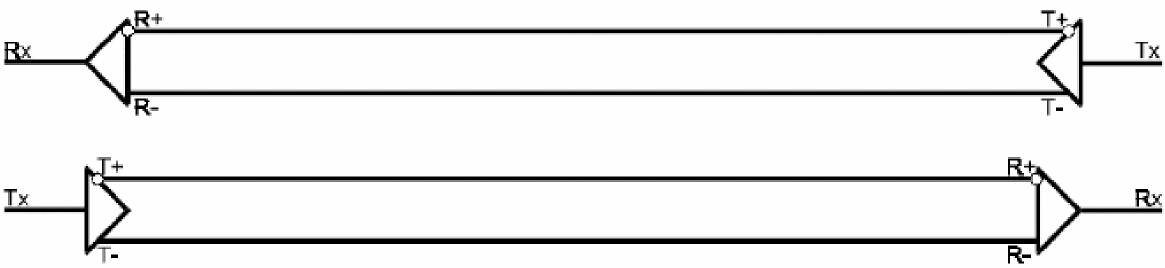
RS422 is the approved electrical interface standard that is recommended by NMEA for transmitting the aforementioned data logs. RS422 is a good electrical standard for ships because it can be routed hundreds of feet unlike RS232 which is only recommended to have a cable length of 25 feet. RS422 is also less susceptible to electrical interference than RS232 because it is based on current rather than voltage. CEACT Information Systems recommends the RS422 electrical interface be utilized wherever possible to eliminate problems associated with RS232.

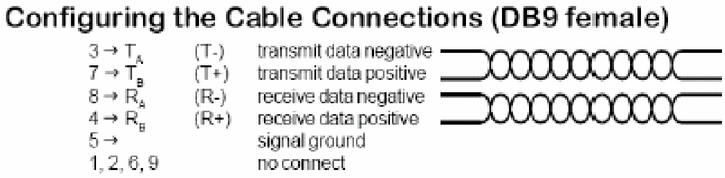


Furuno SC-50		CSI Vector PRO
Pin 2 DATA OUT 1 ~ 5 SC-50	||	Green Wire Transmit RS-422+
Pin 1 DATA OUT 1 ~ 5 SC-50	||	Black twisted with Green Wire Transmit RS-422-

Shown below are wiring details for a popular USB to 422 serial converter device courtesy of Digi International.

Edgeport/4i with RS-422 Point to Point /Symmetrical





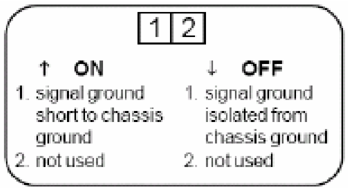


Figure A: Two Position DIP Switch

IMPORTANT: Note that the differential pair T_A and T_B should be together in one twisted pair and R_A and R_B should be together in another twisted pair.

Configuring the Two Position DIP Switch

Edgeport/4i has two position DIP switch. This switch connects the signal ground to chassis ground. **IMPORTANT:** Do not connect signal ground to chassis ground on more than on location in order to prevent ground loops an potentially high currents. See figure A.

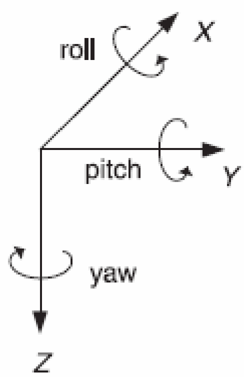
3.4.2 GPS Based Heading Sensors

For several years now major manufacturers of marine electronic equipment have been marketing GPS based heading devices. These devices typically have 2 or 3 antennas, and can compute the ship's heading with a typical average heading accuracy error of less than 1 degree. These devices are not influenced by the earths magnetic field, and therefore compute the heading to true North.

While these devices work very well more than 99% of the time, they are affected by obstructions such as bridges and multi-path nulls.

Bridges obstruct the GPS signals when the Electronic Compass passes under them. This is pretty simple to understand because when a GPS heading sensor travels under a bridge signals from the GPS satellites can be blocked by the bridge. This problem can also occur when a searchlight on top of the ship gets between the GPS satellite signal and the GPS heading sensor antennas.

Multi-path nulls are harder to explain. They occur when the GPS heading compass receives two “path” separated signals from the same GPS satellite. Imagine the GPS heading compass mounted to the handrail on top of the pilot house or bridge of a ship. Typically these handrails are less than 36 inches tall. Any reflective surface, i.e. radar mount and radar, searchlights, masts, bridges, metal storage silos, oil platforms, etc., that are taller than the GPS heading antenna can reflect the GPS satellite signal to the GPS heading sensor antenna. This means the GPS heading sensor could receive two or more signals at the same time, one in a direct path from the satellite, and the other from the reflective surface. The same signal arriving at the antenna at different times can produce undesirable results in the form of heading and position errors or outages.



The solution for Obstructions and Multi-path is often referred to as “Short Term Stability“. Most of the marine equipment manufacturers integrate into their GPS heading sensors a method to “Dead Reckon“ when the GPS heading device is obstructed or when multi-path observations occur. To maintain accurate heading, position and velocity information during errors caused by obstructions and multi-path the manufacturers install one or more solid state gyros and / or accelerometers, which can keep track of ship's heading, pitch and roll for a short period of time, typically 1 to 2 minutes. Some higher priced systems that are marketed for survey work utilize solid state accelerometers for short term compensation of position and velocity information, but most of the Heading sensors marketed as GPS compasses do not.

While these "Short Term Stability" solutions work effectively for passing under bridges, huge errors can result especially in heading when situated next to or under a bridge for long periods of time.

Short Term Stability is especially critical for CEACT installations because GPS malfunctions are magnified by the Course Trajectory resulting in very erratic behavior of the Prediction.

For the best results, hire an experienced marine electronics contractor to choose a GPS heading sensor that best suits your requirements and to install these types of sensors. They can determine the best location for the device, calibrate the heading offset, and provision the device settings for optimum results with CEACT software.

3.4.3 Heading Compass Installation Tips

Antenna Unit

It is best to locate the antenna above the radar beam. This will eliminate multi-path reflections caused by the radar and support mast, and will reduce the effects of interference that could be caused by the radar transmission.

Make sure the antenna unit is level. This can be done by using a carpenter's level or digital protractor. The antenna unit should be within + or – 5 degrees of level. It is also important to make sure the ship is at or near its normal operating attitude.

Choose a location that can minimize multi-path reflections. A six inch diameter mast will produce much stronger multi-path reflections than a ½ in diameter vhf antenna. If the antenna unit must be installed between these two items the preferred location would be closer to the vhf antenna. Several manufacturers list these types of instructions in their installation procedures.

The antenna unit's field of view typically masks GPS signals that are within 10 degrees of the horizon. Make sure the field of view within 80 degrees of the zenith is unobstructed for the best results. Do not mount the antenna below the bridge of the ship because it will obstruct a large portion of the field of view.

Pick a location and fabricate your antenna mount to minimize antenna vibration. Extreme vibration can cause performance issues and could damage the unit.

Standard length cables are typically provided with these units from the manufacturer. Longer cables can be very expensive. A complete site survey should be conducted to determine the cable route between the antenna unit and the processor unit to ensure the standard cable length will accommodate the installation. If longer cables are a must and you choose to fabricate them yourself, check with the manufacturer to determine the type of cable required and to determine if the length of the cable is critical. When in doubt call the manufacturer of the device.

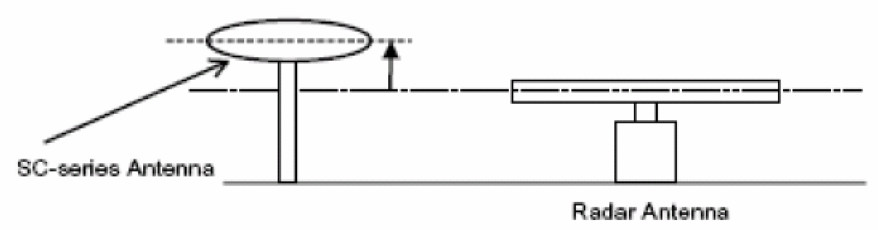
Make sure the antenna is properly aligned. Most antenna units have a “forward mark“ located on them. If the antenna is not mounted with the forward mark pointed towards the bow of the ship a heading offset will need to be adjusted in the processor to compensate the antenna unit heading error. Refer to the manufacturer's instructions on different methods to orient the antenna.

Lay down mounts for these antenna units can be used but a telescoping mast is preferred whenever possible, because the antenna will not work if it is not level. A properly designed telescoping mast should either be marked or mechanically designed to keep the heading alignment from changing when it is raised or lowered.

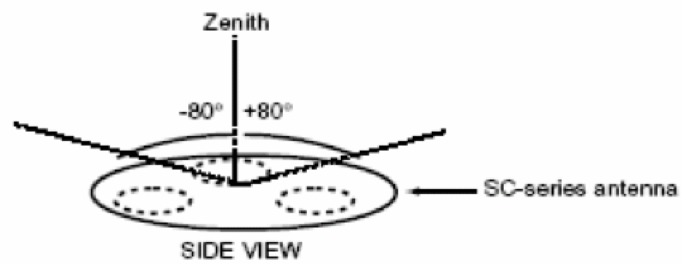
Note:

Always refer to the manufacturers installation procedures when installing the antenna unit. Improper installation procedures can lead to serious performance related issues.

Locate the antenna unit above the radar antenna, out of the radar beam.



The field of view above the antenna should be as shown below ± 80° against zenith. To avoid reflections from masts and the like, locate the antenna well away from the shadows of the radar mast, etc.



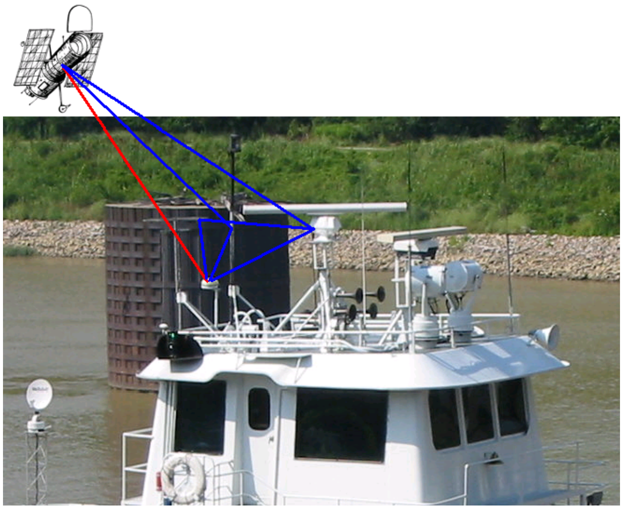
Antenna and field of view

3.4.4 Overcoming Shipboard Muti-Path Related Problems

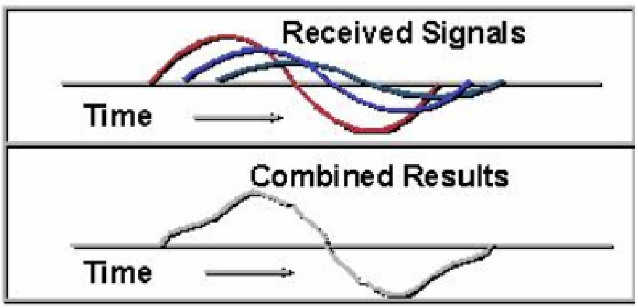
Multi-path propagation occurs when radio frequency (RF) signals take different paths when travelling from a source to a destination. A portion of the signal might go directly to the destination, while another part might bounce off a radar mast, searchlight, or television antenna, then on to the destination. As a result, some of the signal encounters are delayed by travelling longer paths to the destination.

Multi-path distortion is a form of RF interference that occurs when a radio signal has more than one path between the receiver and the transmitter. Most GPS heading compass devices attempt to limit the amount of RF energy that can penetrate the antennas from below the horizon. If these antennas are mounted above all reflective surfaces on the ship multi-path is greatly reduced. If the antenna unit is located below reflective surfaces such as steel masts, radar equipment, searchlights or television antennas multi-path will cause serious problems with the GPS system's ability to accurately determine heading, rate of turn, velocity and position.

The photograph and illustration to the right show how multi-path signals are received by satellite antennas. The small antenna is receiving a direct signal from a satellite via the red line. The blue lines illustrate how the same signal that is generated from the satellite can bounce off of adjacent reflective objects to reach the antenna. The received signals arrive at the antenna at different times and combine in the receiver producing serious phase and amplitude variations degrading the receiver performance.



In a GPS based heading compass system the phase and amplitude relationships between its antennas are / can be used to determine heading, rate of rotation, pitch and roll, velocity and position of the vessel. The information that is derived from these antennas is also utilized by the GPS based heading compass processor to provide bias calibration for its associated inertial measurement unit which is comprised of rate of turn and / or accelerometer sensors. Without accurate information from the antennas it is impossible to provide stable bias to the inertial measurement unit (IMU). The IMU is responsible for providing dead reckoning information when the GPS goes under a bridge or the ship travels next to an obstruction.



Most equipment manufacturers that produce marine GPS based heading sensors do not provide a specification for the dead reckoning accuracy in degrees per minute of their IMU, but some of these devices can provide relatively stable position, rate of turn, heading, and velocity information for one to two minutes while the GPS is obstructed. GPS heading compasses that do provide short term stability for acceleration and rotation will provide a more stable and accurate real time course trajectory.

In short, contact the manufacturer to ensure the equipment can provide several minutes of short term stability before purchasing a sensor. Install the antenna unit as high as possible and away from reflective surfaces, and follow the manufacturer's installation instructions when mounting the IMU as its attitude must be aligned to the ship.

3.4.5 Notes for Installing GPS Heading Compass Processor Units

Most of the GPS based heading sensors manufactured today have a separate processor unit that contains the GPS receivers, inertial measurement unit, and system processor board. Aside from the normal installation routine of finding a location to meet the cable needs and environmental demands there are some special installation requirements that must be taken into consideration due to the IMU that is located within the unit.

These inertial measurement units contain MEMS devices, or Micro Electronic Machines. MEMS devices used to measure rotation and acceleration are sensitive to vibration and temperature change and therefore care must be taken when installing the GPS heading compass processor unit so that it is not subject to rapid changes in temperature or serious vibration.

Miniature MEMS Quartz IMUs typically incorporate solid-state quartz micro machined inertial rate sensors and silicon MEMS accelerometers. They are especially suited for embedded applications where extremely small size, low cost, and low power consumption are required.

They offer substantial performance for a very attractive price and can feature a full six Degrees-of-Freedom sensing capability in an extremely compact size .The unit pictured below uses three GyroChip rate sensors and three low cost silicon MEMS accelerometers.

Note:

Most GPS heading sensors marketed today do not utilize accelerometers as part of their IMU.

Simplified Theory for Short Term Stability Using Hybrid GPS Based Heading Compasses

Long-term stability for heading, velocity and rate of turn information is provided by the two or more GPS antennas and associated GPS receivers. When the unit is turned on the IMU is cold but its internal temperature starts to increase. The system processor uses the raw GPS receiver information to determine heading, rate of turn, and velocity. As the IMU warms up, the rate of turn and acceleration information from the Quartz and Silicon MEMS devices changes. Once the IMU temperature becomes constant the rate of turn and acceleration information becomes relatively stable but the rate and acceleration information are still not calibrated. The system processor then compares the GPS rate and acceleration information to the IMU rate and acceleration information. If the IMU information does not agree with the GPS information the system processor corrects the rate and acceleration information from the IMU by applying a “BIAS” to the IMU data. The calibration of the IMU BIAS is only as good as the GPS solution, and therefore the GPS antenna unit installation is extremely important. Once the IMU BIAS has been calibrated the information from the IMU can be used by the system processor to calculate Position, Heading, Rate of Turn, Course Made Good, and Velocity for a couple of minutes. Boundary conditions can then be used by the processor to determine whether the GPS information is correct or if the IMU information is correct. When the GPS signals become erratic due to an obstruction such as a bridge or due to multi-path the IMU solution is automatically used.

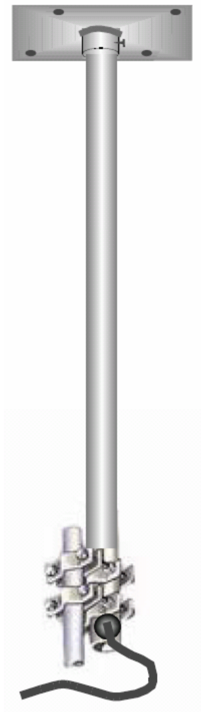
Alignment of the IMU is Critical. It should be level, and should be aligned as close to the heading of the ship as possible. One method of alignment is to mount the processor unit to one of the ship’s bulkheads that are parallel to the ship's beam. These bulkheads are typically designed to run parallel with the beam, they are plumb and transfer less vibration than a horizontal shelf. Use a carpenter’s level or digital protractor to ensure the IMU alignment is level and plumb.

Note:

Some GPS heading compass processor units have additional mounting brackets for the internal IMU allowing the processor unit to be installed several different ways and some do not. Always refer to the manufacturers installation procedures when installing these devices.

Antenna Mount Tips for GPS Based Heading Sensors

GPS heading sensor antennas must be installed higher than other metal objects on the ship to reduce the effects of multi-path. These antennas are typically small and lightweight. A simple low cost antenna mount can be constructed to raise the antenna above search lights and radars. The fixed antenna mount can be constructed from a two inch aluminium conduit, a two inch conduit coupling, an 8 inch by 8 inch by ¼ inch aluminium plate, a suitable mast clamp, and a ½ inch long #10 metal screw.



Remove the two inch conduit coupling from the conduit and weld it to the center of the aluminium plate. Drill the mounting holes to match the antenna pattern, and drill a one inch diameter hole in the center of the plate. This will allow the antenna cable to be routed through the mast rather than attached to the outside of it. Thread the plate and coupling back onto the conduit. Drill a small pilot hole through the conduit coupling and conduit and install the screw. This will keep the antenna from turning after installation. Prime and paint.

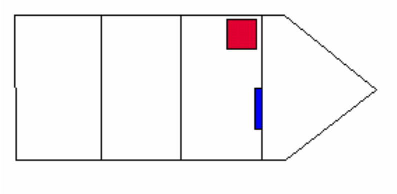
Cut the Conduit to the desired length. **No more than 5 foot of conduit should rise above the upper mast clamp**. Attach the antenna mast to a structurally suitable vertical pipe or vertical rail support to minimize vibration. The new antenna mount when finished should be level and plumb with respect to the ship's normal operating attitude. Always refer to the manufacturer's installation manual when installing GPS heading sensor antennas.

Processor Unit Mounting for GPS Based Heading Sensors

Processor units typically contain Rate of Turn sensors that must be mounted to a particular ship axis and must be level and plumb. The cable run between the antenna and the processor must be less than 50 ft. The processor unit should be fixed securely to reduce vibration. The processor unit should not be subjected to rapid changes in temperature and therefore must not be placed adjacent to a heating or air conditioning vent.

Bulkhead Mounting

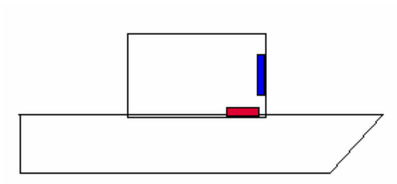
Processor units must be mounted square within ±2.5° of the ship's fore-and-aft line. Most Bulkheads are plumb and run parallel to the ship's beam ensuring accurate installation to within ±2.5°. Bulkhead mount examples to the right are indicated by the blue boxes.



Plywood may be attached to the bulkhead first to create a mounting structure for the processor, cable clamps, and serial to USB converters.

Deck Mounting

Examples to the right are indicated with the red boxes. Processor units must be mounted square within ±2.5° of the ship's fore-and-aft line and must be level with respect to the ship's normal operating attitude.



Provisioning the GPS Heading Sensor

Once the GPS heading sensor has been properly installed the unit can be turned on and provisioned. It is very important to go through the menu information and verify that the necessary options and settings are configured properly. One of the main elements to check is smoothing parameters. Smoothing is used to reduce fluctuations in the velocity, rate of turn, heading, position, and course made good. In oceangoing vessels when operating in high seas smoothing can be set to a higher value to keep autopilots and other such devices from working too hard. On the Inland Waterways and in other areas of restricted maneuverability the information needs to be more dynamic to reflect exactly how the ship is maneuvering. CEACT information systems recommends that smoothing parameters be set to minimize smoothing.

Note:

Smoothing parameters that are set too high will have the effect of smoothing the prediction as well and this is not desirable.

These smoothing parameters can be referred to differently from manufacturer to manufacturer, and CEACT information systems does not have all of the information from these equipment manufacturers. Therefore care should be used at the time of installation to ensure that excessive smoothing is not programmed into the GPS unit. The default value for some of these devices could be as high as

30 seconds. Upon installation always make sure these adjustments in the provisioning menus are set properly.

Once the heading information has stabilized and the GPS heading compass is connected to CEACT the chart display can be used in conjunction with the heading offset menu control provided by the GPS heading sensor manufacturer to adjust the heading. If the vessel is in a lock chamber the heading can be adjusted so that the orientation of the tow matches the lock walls. If a lock is not available, the ship's configuration menu in CEACT can be edited to make the ship thousands of feet long. While the pilot holds the ship steady pointing at a bridge pier or other known fixed object, the heading offset can be adjusted. It is a good practice to record the heading offset for future reference.

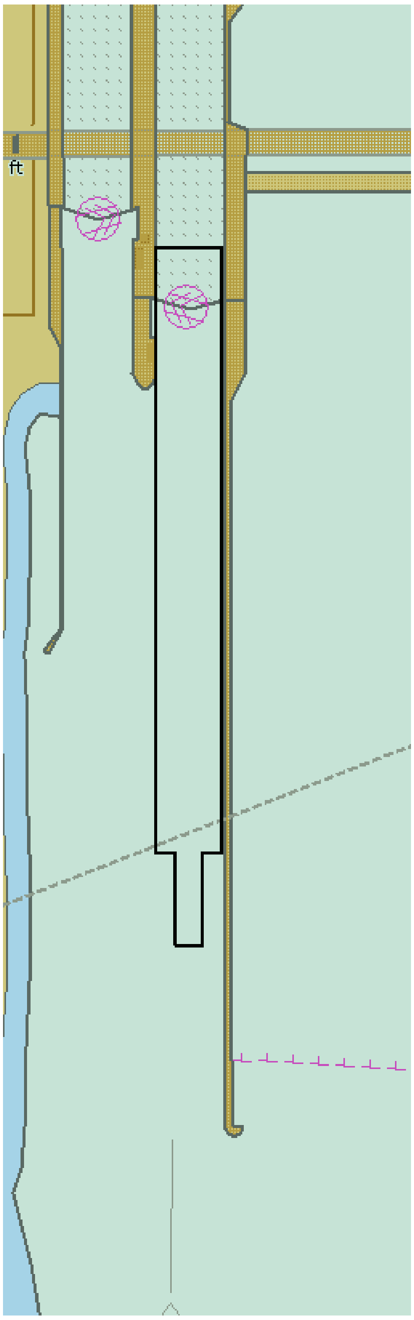


Fig. 3.2: Adjustung heading along side lock wall

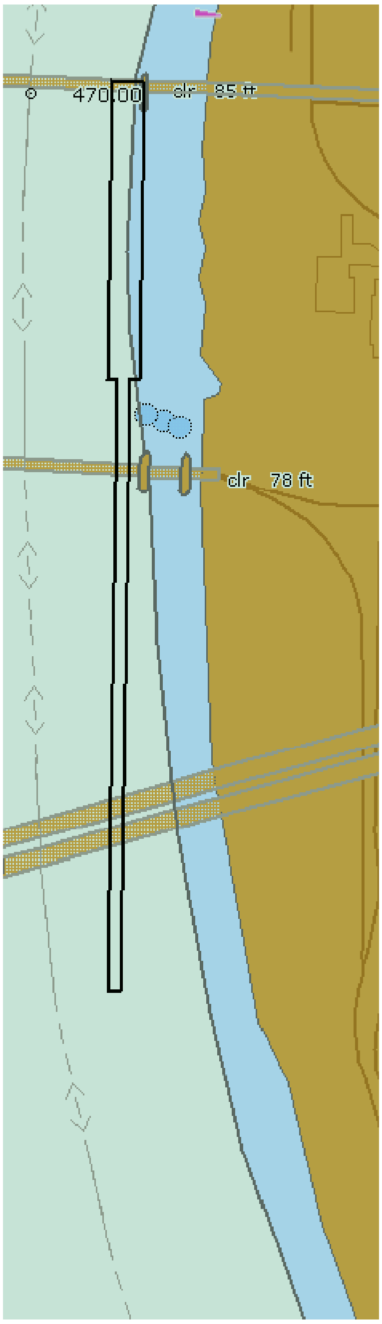
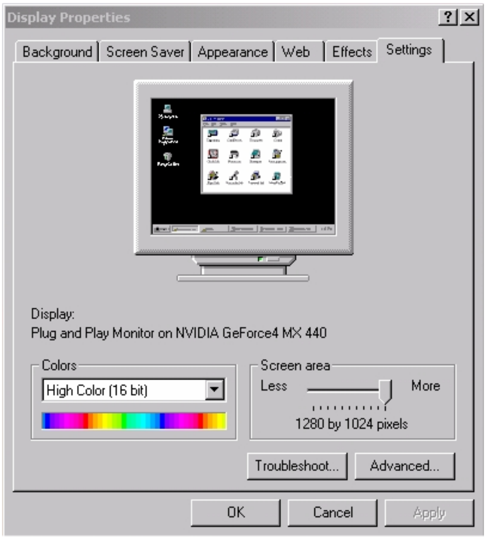


Fig. 3.3: Adjusting heading using ship's configuration menu

3.5 CEACT System and Chart Software Installation

Installing CEACT Software

Place the CEACT Digital Channel ECS disk into the CD drive in your computer. Select *My Computer* on the desktop, select the CD Drive and open the CEACT folder.



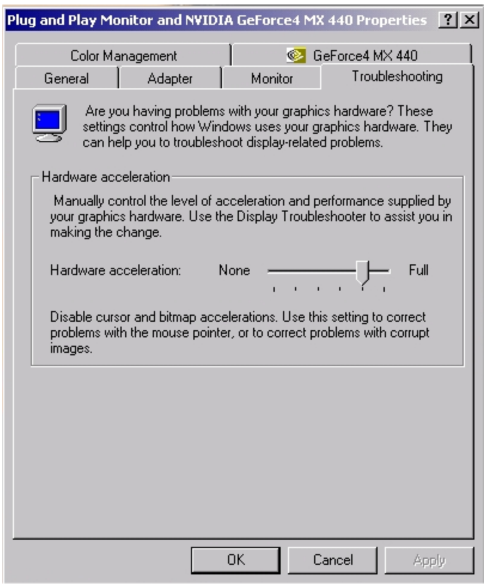


Figure 3.4: Installing CEACT

Run the CEACT executable file to start the installation of CEACT. It is recommended to use the default installation directory location and other default settings by clicking the next button. When the installation is complete insert the USB dongle.

CEACT menu areas are optimized for the following screen resolutions, 1024 X 768, 768 X 1024, 1280 X 1024 and 1024 X 1280. The chart portion of CEACT supports all resolutions. Colors should be set to 16 or 24 bit. Adjust display settings with a right click on your desktop, and select the *Properties* and *Settings* tab to make the necessary adjustments. Select the *Advanced/Troubleshooting* tab and ensure acceleration is not set to “Full”.

If CEACT software did not come with a dongle it must be registered before the software can be used. To complete the registration process go to START\Programs\Sevens\CEACT. The registration screen opens and displays the Hardware ID String. Copy and paste this string to an email and send it to **support@ceact.com**

Within 24 hours you should receive via email a registration key. Copy the registration key, run the CEACT software as before, and paste the registration key into the defined area. Once the registration process is completed CEACT will open to its start page. Select the *Last Position* button.

CEACT software comes complete with demo data and several miles of charts for the lower Mississippi. When the *GO to Last Position* button is used for the first time mile 103 on the lower Mississippi should be in view.

Software Setup

1. Install and turn up the GPS Heading sensor using the manufacturers installation and turn up manual.
   Make sure that the following Data logs are being output:
   - GPGGA - Position
   - GPVTG - Velocity
   - GPHDT - Heading True North
   - GPROT - Rotation
   - GPZDA - Time

   The standard data output baud rate is 4800 bps, GPGGA, GPVTG and GPZDA should be set for 1 second output intervals. GPHDT and GPROT will provide a more accurate prediction if set to 200 millisecond output intervals.
2. Connect the GPS heading sensor to the computer.
3. Open the *CEACT* software by selecting `Start / Program Files / SevenCs / CEACT`
4. Select the `Automatic Chart Feed` option.
   The automatic chart feed will automatically load the charts for your location provided the GPS and COM ports have been configured properly.

The message below will be displayed if the COM ports are not configured properly.

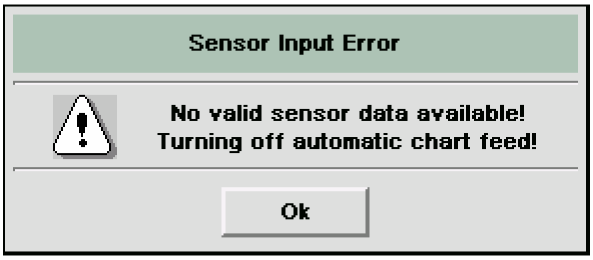


Figure 3.5: Sensor Input Error

In that case please refer to chapter **7.7 Communication Settings**.

3.6 Mouse Functions in CEACT System

Left button (*Info*)	Pops up the *Pick Report*.
Left button (*Do*)	Executes a function after it has been selected in the *Task* menu or in the *Function Bar*.
ALT + left button	Manual entry of geographic coordinates if a function has been activated.
Middle button (*Pan*)	Sets the new chart centre thus shifting the chart area displayed on the screen. Alternatively, position the cursor and strike the space bar
Middle button (*Zoom*)	Keep the button pressed to open a frame. The content of this frame then will be enlarged.
ALT + Middle button	Manual input of geographic position to set new centre of the chart.
Right button (*Cancel*)	Cancels an activated function.
Right button (*Popup*)	Opens *context* menu in case no function is active.

4 CEACT System Start Menu Features

4.1 Starting CEACT System

To begin using *CEACT System* software select
`Start/Program Files/SevenCs/ CEACT`,
and the startup screen below will be displayed.

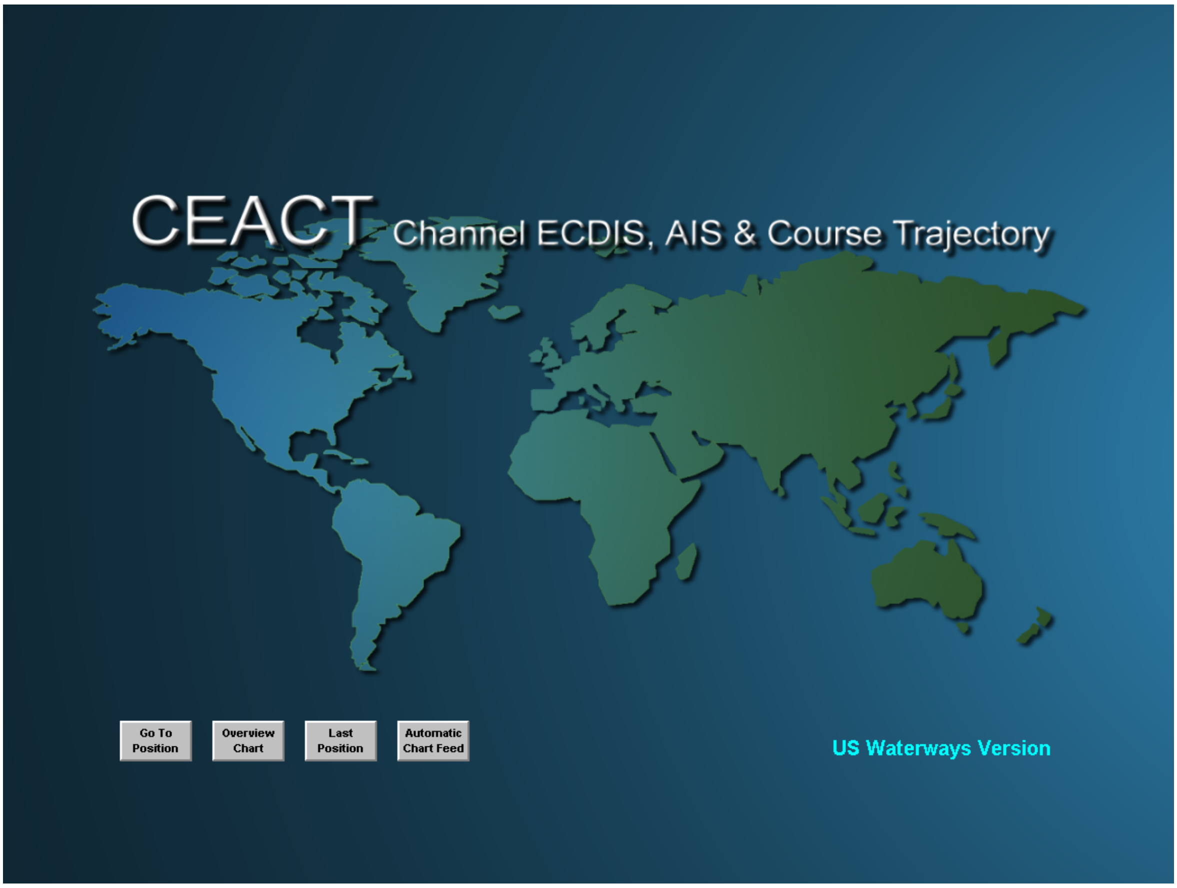


Figure 4.1: CEACT startup screen in landscape format

CEACT System then offers four alternatives to start the software. Just click on one of the four buttons:

- Go to Position
- Overview Chart
- Last Position
- Automatic Chart Feed

> **Note:**
>
> Provide the screen used is rotatable CEACT offers to display the charts either in landscape or in portrait format.

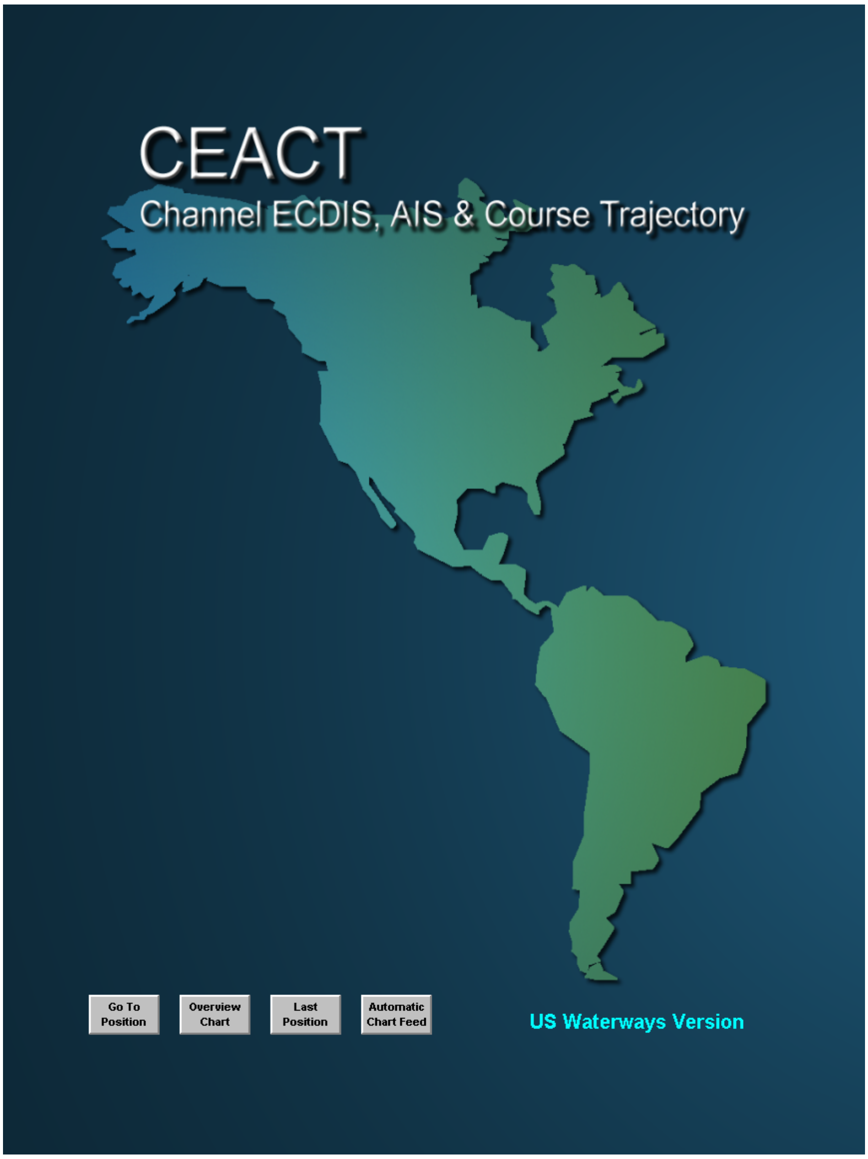


Figure 4.2: CEACT startup screen in landscape format

4.2 Go to Position

The *Go to Position* feature allows the user to quickly find a chart for a specific area of a river. This is accomplished by simply selecting the waterway name and entering search criteria such as the *Mile Marker* or the *Place Name*. Finally, select the *Range* you desire to view the chart.

Click *Ok* to proceed, or *Cancel*.

Go to Position can also be opened via the *Context Menu* (see chapter **8 Context Menu**).

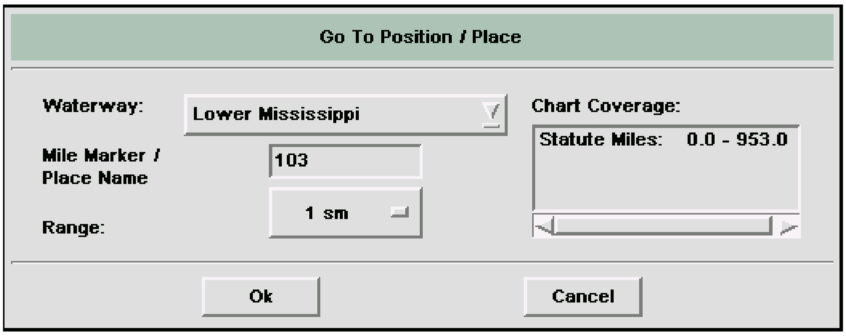


Figure 4.3: Go to Position

4.3 Overview Chart

The *Overview Chart* feature provides the user with a global chart overview. This feature enables the user to view the continental United States. The user can pan the chart by holding down the *shift* key and pressing the left mouse key to center the chart to the desired area.

Overview Chart can also be opened via the *Context Menu* (see chapter **8 Context Menu**).

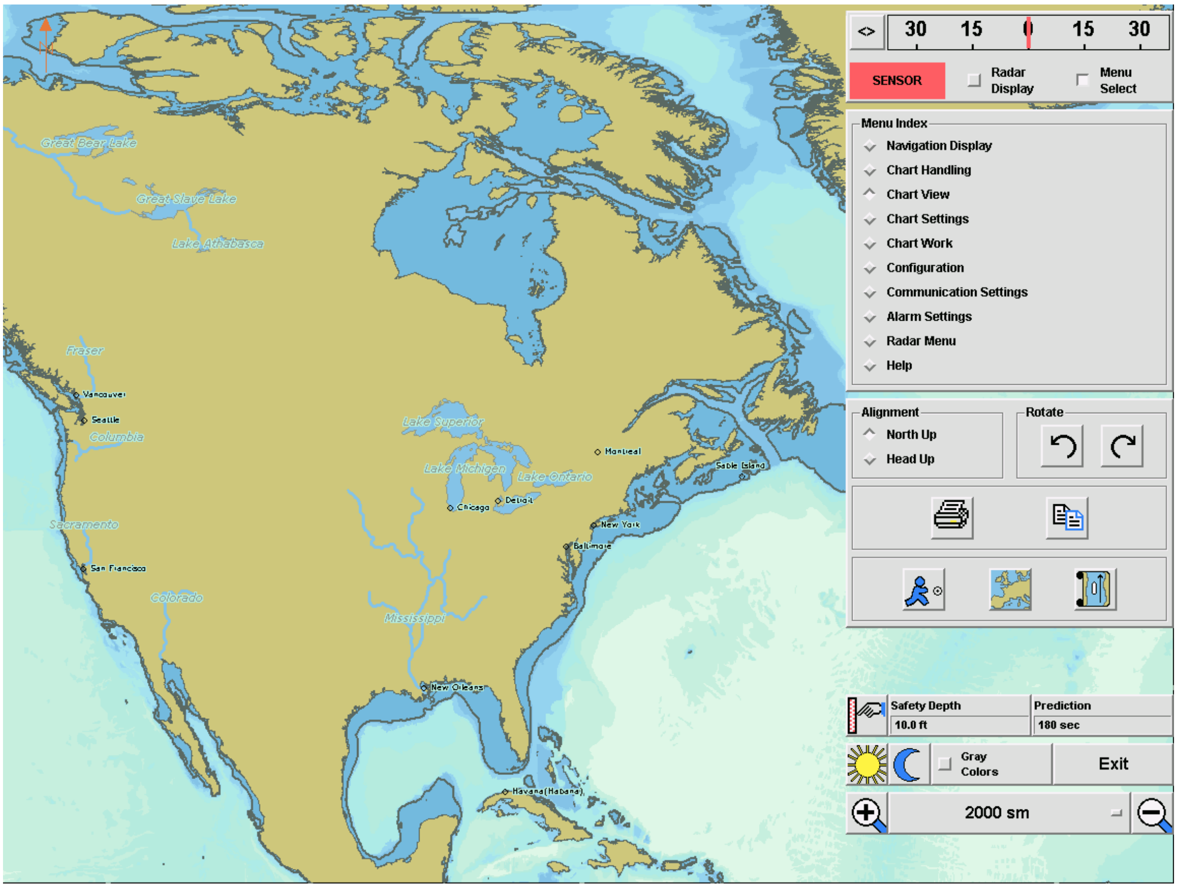


Figure 4.4: Overview Chart

4.4 Last Position

The *Last Position* feature allows the user to go back to the position of the user's last session.

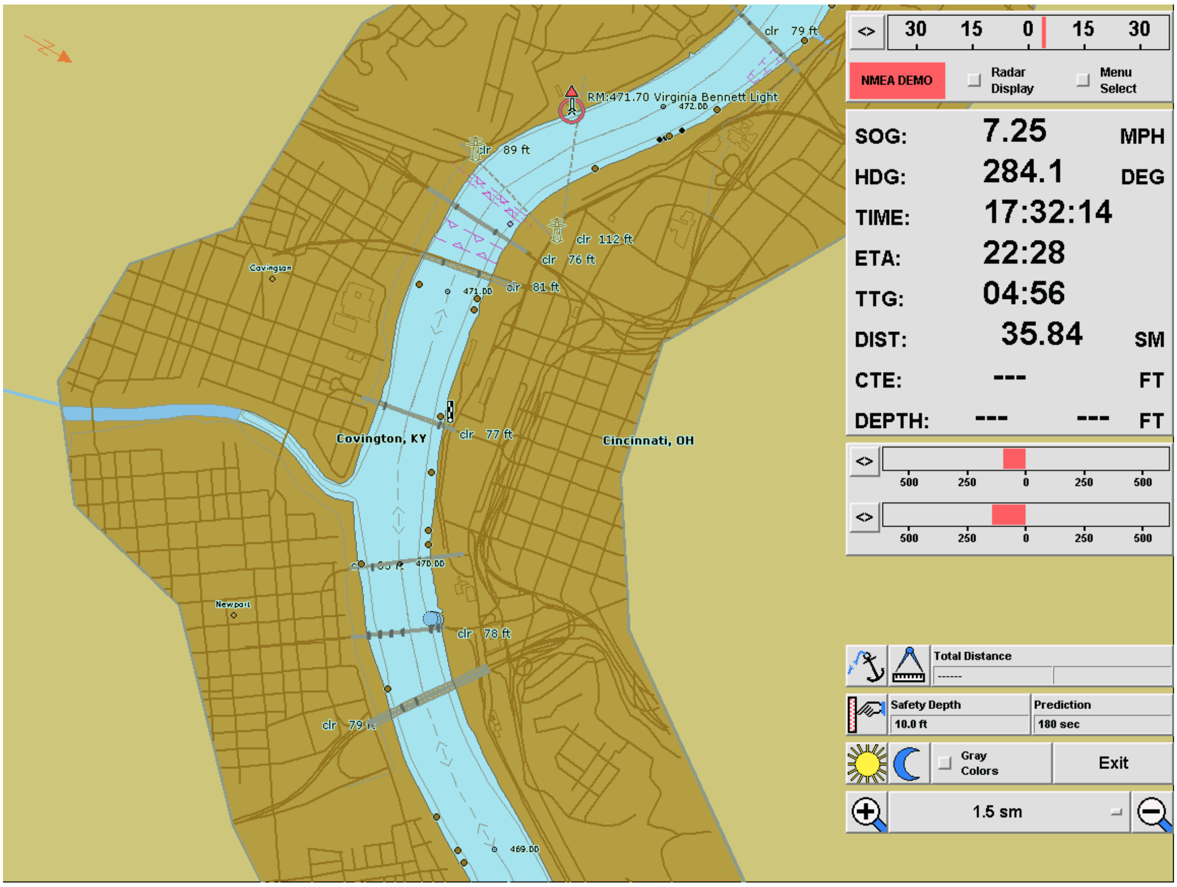


Figure 4.5: Last Position

4.5 Automatic Chart Feed

The automatic chart feed allows hands-free operation of the *CEACT System* while piloting a vessel.

This feature can be enabled or disabled by clicking the menu button shown below.

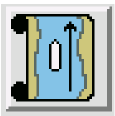


Figure 4.6: Automatic Chart Feed Button

For more information see chapter **7.3.3 Chart View – Other Functions**.

4.6 Exit

CEACT System can be closed by clicking on the *Exit* button in the bottom left corner of the startup screen.

After clicking on *Exit* a confirmation window opens.

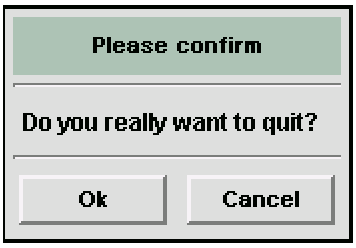


Figure 4.7: Exit Confirmation Window

Click on *Ok*, and *CEACT System* is closed.

Note:

To save all current settings *Save Settings* in the *Configuration* menu must be enabled (see chapter **7.6 Configuration**).

5 Navigation Display

The *Navigation Display* is a collection of various displays in the upper right corner of the screen. It is always displayed first when *CEACT System* is opened. However, you can click on *Menu Select* and have the *Menu Index* (see chapter **7 Menu Index**) displayed instead.

5.1 Rate of Turn Display

The *CEACT System* provides an electronic rate of turn display for the user. Three ranges of degrees per minute are available and can be selected by the arrows to the left of the rotation display.

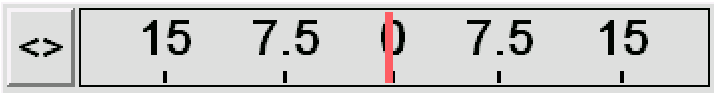


Figure 5.1: 0 to 15 Degrees per Minute

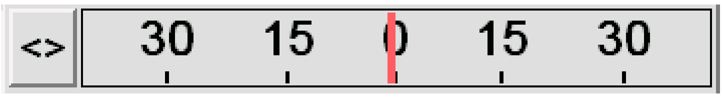


Figure 5:2: 0 to 30 Degrees per Minute

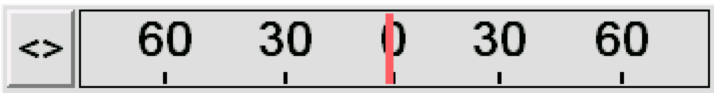


Figure 5.3: 0 to 60 Degrees per Minute

5.2 Sensor, Radar Display, Menu Select

Below the *Rate of Turn Display* there are three entries:

- Sensor
- Radar Display
- Menu Select

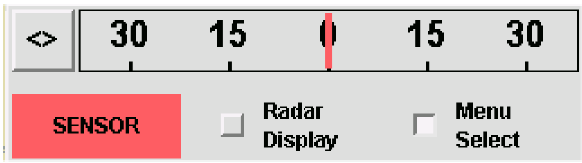


Figure 5.4: Rate of Turn Display with Sensor, Radar Display and Menu Select

5.2.1 Sensor

Indicates whether positioning sensor data are being received. There are three different background colors indicating the quality of the received data:

Red	no valid data received. This color is also presented when *Demo GPS Mode* is active (see chapter **7.7 Communication Settings**).
Yellow	only position data and heading received.
Green	position data, heading, speed and course received

5.2.2 Radar Display

Clicking on the button starts the radar display.

5.2.3 Menu Select

Clicking on the button opens or closes the *Menu Index* (see chapter **7 Menu Index**).

5.3 Display SOG, HDG, Time, TTG, DIST, CTE

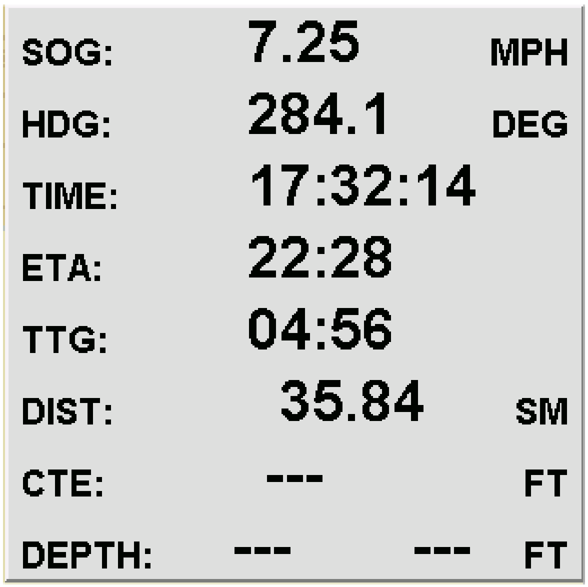


Figure 5.5: Display SOG, HDG, TIME, TTG, DIST, CTE

By default this information is displayed each time *CEACT System* is started. It is replaced by the *Menu Index* (see chapter **7**) when you click on *Menu Select* (see chapter **5.2.3**).

The meaning of the various items is:

SOG	Speed Over Ground: provides the current speed of the vessel.
HDG	Heading: provides heading relative to true north.
TIME	Time: displayed in military format, and is derived from the computer's clock.
ETA	Estimated Time of Arrival.
TTG	Time To Go: displays the amount of time to the destination waypoint.
DIST	Distance: indicates the distance from the current position to the destination waypoint.
CTE	Course Track Error: displays the vessel's distance from the trackline. (Currently disabled)
DEPTH	Depth values (in feet).

5.4 Navigation Display: Options

Below the box presenting the values for SOG etc. *CTE Display*, *Depth Display* or *Slide Display* can be positioned, depending on whether the *Course Track Error* (CTE), the depth soundings or lateral slide information shall be used for navigation.

For information on how to switch from one display to another see chapter **7.1 Navigation Display**.

5.4.1 CTE

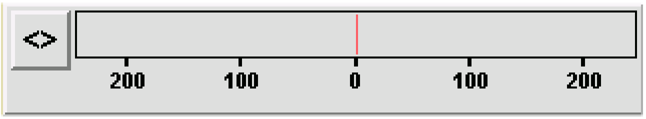


Figure 5.6: CTE Display

When CTE (= Course Track Error) display is selected the vessel's deviation from the trackline is shown.

5.4.2 Depth

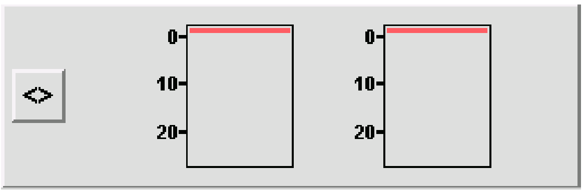


Figure 5.7: Depth Display

When Depth display is selected up to two depth readings can be displayed simultaneously. At installation of *CEACT System* the **Communication Settings** (see chapter **7.7**) can be configured to assign communication ports and baud rates for each sounder in use.

5.4.3 Slide

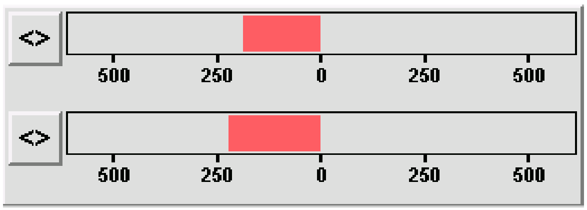


Figure 5.8: Slide Display

When Slide display is selected two bar graphs show the lateral speed at head and stern of the towboat. The displayed values are estimated based on the ship's dimensions and the current movement relative to ground.

6 Global Functions

6.1 Marker and Distance Measurement

Figure 6.1: Set Ownship Position and Distance Measurement

Distance can be easily measured between any two points by selecting the distance measurement button, positioning the mouse cursor at the starting point and left clicking, and then moving the mouse cursor to the area of interest. Measurements will be displayed in the selected scale units SM, NM, KM. For unit selection see chapter **7.6 Configuration**. When measuring small distances the current value is displayed in both the selected distance unit (km/nm/sm) and the depth unit (m/ft)..

In the example below the distance was measured from the head of the tow to the upcoming bridge.

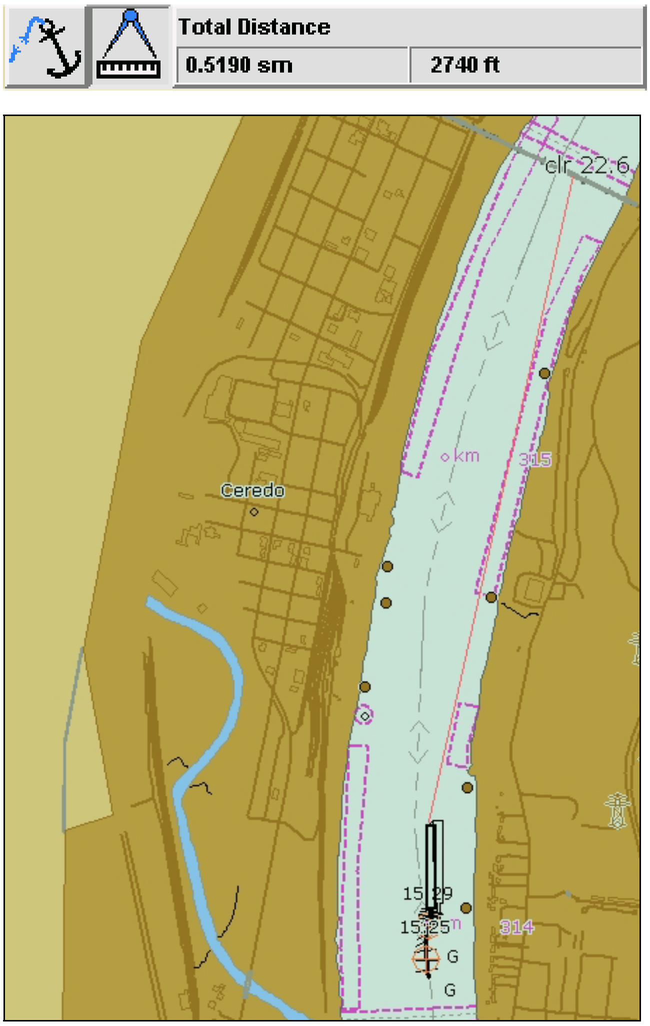


Figure 6.2: Distance Measurement

6.2 Ship Configuration, Safety Depth and Prediction

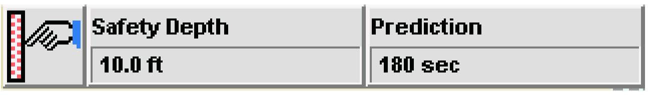


Figure 6.3: Ship Configuration button with Safety Depth and Prediction Time display

Click on the *Ship Configuration* button to configure your barge and tow dimensions. In the *Ship Configuration* window you can then select *Towboat* or *Ship*.

6.2.1 Ship Configuration - Towboat

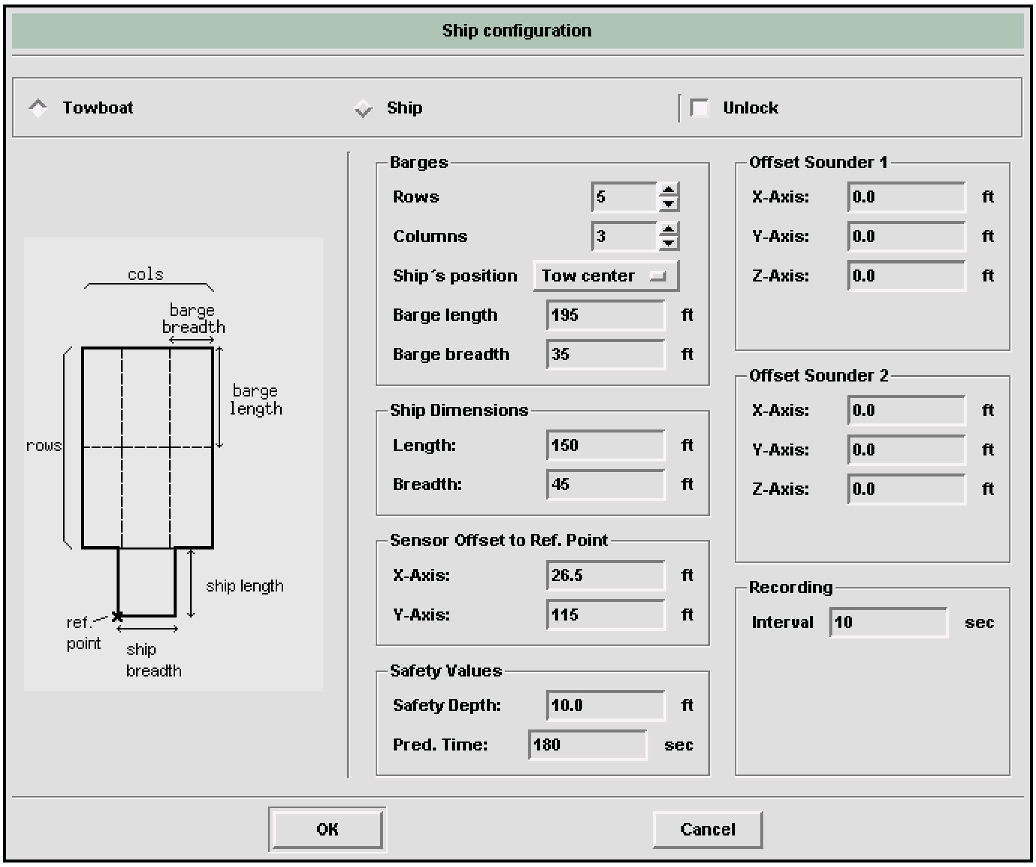


Figure 6.4: Ship Configuration window – Towboat

Some of the values in the *Ship Configuration* window are protected against accidental change. If any of these protected values need to be changed nevertheless the fields first must be unlocked by ticking the *Unlock* check box top right in the window.

However, to enable this check box the master password for your system is required. See chapter **6.5 Changing System Settings** for details.

Tow building is accomplished by editing the appropriate number of barge *Rows*, *Columns*, *Ship's position*, *Barge length* and *Barge breadth*. All barges must have the same size.

The *Ship's position* is *Tow center* (default) or click, open the list and select the desired column.

Normally the *Ship Dimensions* and the GPS antenna position (*Sensor Offset*) are set once at the installation of *CEACT System*.

The *Safety Depth* set in this window will be displayed in the *Safety Depth* window (see chapter **6.2 Ship Configuration, Safety Depth**).

The vertical *Offset* value for the depth sounders is applied when displaying or recording depth values. Display values are reduced by positive offset values for the sounder.

Note:

All dimensions can be entered either in feet or in meters. See chapter **7.6 Configuration** for information on how to change the units.

6.2.2 Ship Configuration – Ship

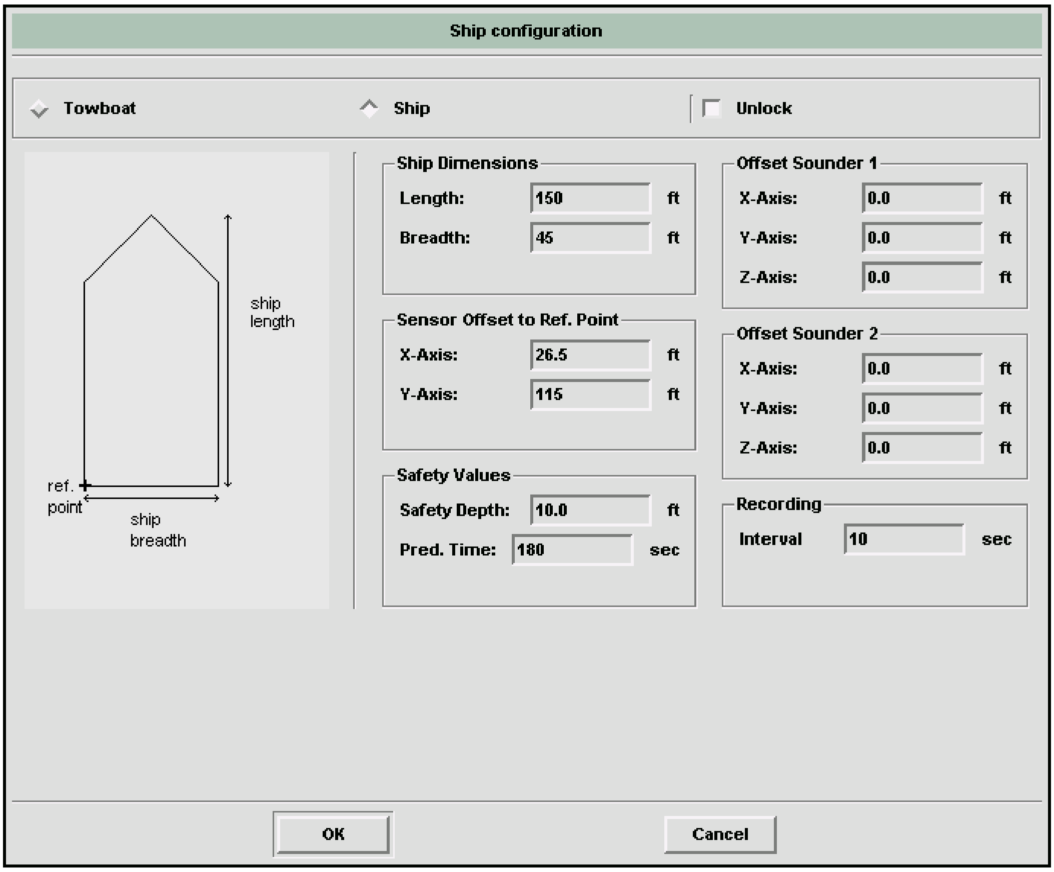


Figure 6.5: Ship Configuration window – Ship

CEACT System software also supports ship configuration.

Some of the values in the *Ship Configuration* window are protected against accidental change. If any of these protected values need to be changed nevertheless the fields first must be unlocked by ticking the *Unlock* check box top right in the window.

However, to enable this check box the master password for your system is required. See chapter **6.5 Changing System Settings** for details.

Normally the *Ship Dimensions* and the GPS antenna position (*Sensor Offset*) are set once at the installation of *CEACT System*.

The vertical offset value for the depth sounders is applied when displaying or recording depth values. Display values are reduced by positive offset values for the sounder.

The *Safety Depth* set in this window will be displayed in the *Safety Depth* window (see chapter **6.2.3**).

The vertical *Offset* value for the depth sounders is applied when displaying or recording depth values. Display values are reduced by positive offset values for the sounder.

Note:

All dimensions can be entered either in feet or in meters. See chapter **7.6 Configuration** for information on how to change the units.

6.2.3 Safety Depth

The *Safety Depth* is set during *Ship Configuration* (see above). Adjusting the safety depth parameter can result in changes to the water depth contour colors and shallow water boundaries.

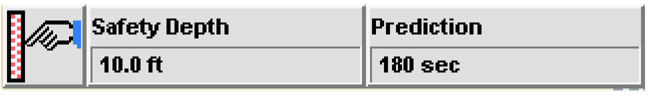


Figure 6.6: Ship Configuration button with Safety Depth and Prediction Time display

6.3 Brilliance Controls

CEACT System provides a quick and simple adjustment of the display brilliance. Up to five color and intensity levels are available. This feature is very useful as it makes viewing the display easier while e.g. piloting a vessel at night.

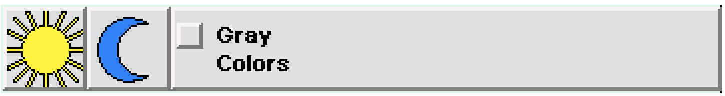


Figure 6.7: Brilliance Controls

The IHO standard S-52 defines the color levels as follows:

Day Bright	displays the chart with a white background and bright colors. Intended for use during bright daylight.
Day Whiteback	also displays the chart with a white background but with normal colors. Intended for use during normal daylight conditions.
Day Blackback	displays the chart with dark background and dimmed inverted colors. It can be used during normal or cloudy daylight conditions. The inverted colors can be used e.g. when a RADAR image is placed over the *Chart Display*. The light-colored object of the RADAR image can be better seen on a dark background.

Dusk	displays the chart with a dark background and dark inverted colors. Intended for use during dusk and dawn.
Night	displays the chart with a black background and dark colors. The colors have been designed not to impair night vision. Intended for use at the night.

In addition to the selected color table a gray mode can be switched on or off.

Gray Colors	This function can be used in combination with any of the color tables described above. It allows switching to a gray mode display. In gray mode the depth areas on the chart are displayed in shades of gray while important chart objects like aids to navigation or land features are still displayed in color.

Note:

The gray mode, if selected, will remain active even when another color table is selected. To terminate the gray mode *Gray Colors* must be deselected.

How to set the Chart Colors:

1. Click on the sun or moon button (for lighter or darker colors respectively). Repeat clicking as often as necessary.

Note:

It is also possible to use shortcuts for adjusting the chart colors:

lighter colors:	Alt + L
darker colors:	Alt + D

2. If desired, select or deselect *Gray Colors* to turn the gray mode on or off.

Note:

The chart colors that have been set are stored and will remain active even when *CEACT System* is closed and restarted. To change the chart colors they must be set anew.

6.4 Range Selection

The *chart range selector* menu in the lower right hand corner of the display allows to zoom in or out, or to choose the appropriate range by selecting range bar, and picking the range. The range values are scaled to SM, NM or KM.

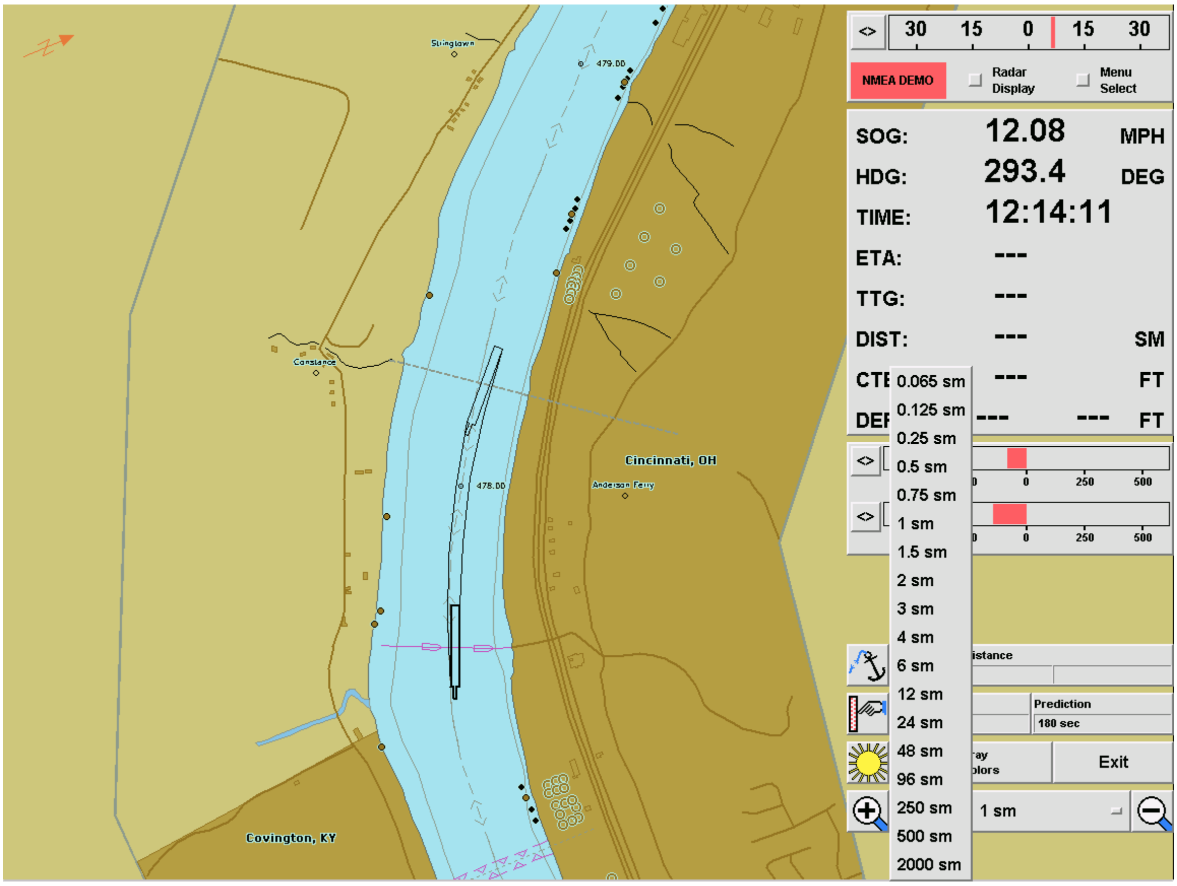


Figure 6.8: Chart Display with Range Selection menu

> **Note:**
> The units (km, nm, sm) are set in the *Configuration* menu (see chapter **7.6**).

6.5 Changing System Settings

Several configuration settings of *CEACT* are set up during installation. Some of these settings usually should not be changed by the pilot. Therefore to avoid accidental change the configuration controls are locked.

To unlock such protected controls a *Master Password* is required. This Master Password is provided by your system distributor or by the installation personnel. Please make sure that only authorized personnel has notice of the Master Password.

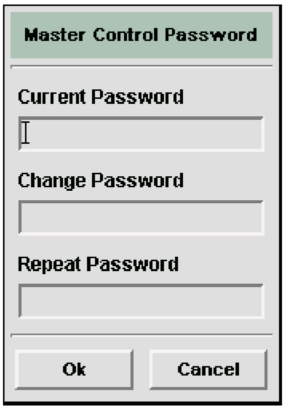


Figure 6.9: Master Control Password

When trying to access a locked control the window *Master Control Password* (see above) opens. To unlock a locked control, enter the Master Password in the field *Current Password*.

The other two fields are only needed if the Master Password shall be changed. In that case enter the new password in the fields *Change Password* and *Repeat Password*, and click on OK.

> **Note:**
>
> The default password is **CEACTmaster**.
> Usually this password should be changed after a successful installation to prevent unintended changes of critical system settings.

7 Menu Index

Clicking on *Menu Select* in the *Navigation Display* opens the *Menu Index*. From the *Menu Index* the user can access various submenus.

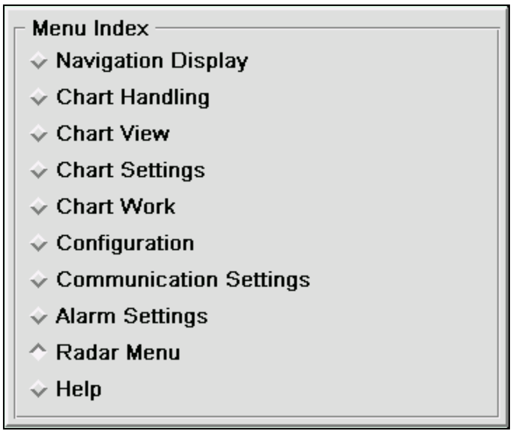


Figure 7.1: Menu Index

> **Note:**
>
> When *Menu Select* is clicked for the first time only the *Menu Index* will be displayed. However, when it is repeatedly closed and opened within one session the submenu that was last open will be opened, too.

7.1 Navigation Display

Figure 7.2: Navigation Display submenu

From the *Navigation Display* submenu three variants can be selected:

- CTE Display
- Depth Display
- Slide Display

7.1.1 CTE Display

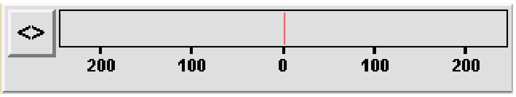


Figure 7.3: CTE Display

Choosing this feature will in addition to the CTE value displayed at the bottom of the *Navigation Display* show a Course Track Error bar graph.

7.1.2 Depth Display

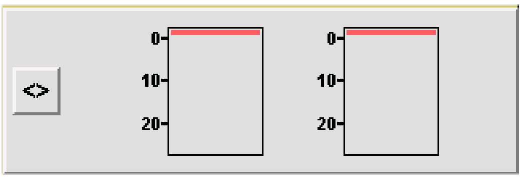


Figure 7.4: Depth Display

Choosing this feature allows the *Navigation Display* to show two depth sounder bar graphs simultaneously.

7.1.3 Slide Display

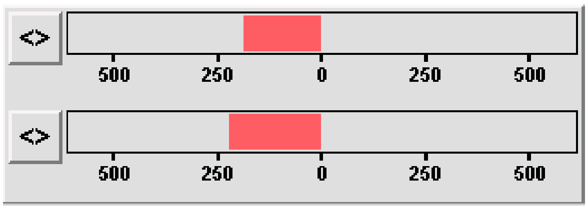


Figure 7.5: Slide Display

Choosing this feature allows the Navigation Display to show two bar graphs for the lateral speed at head and stern of the towboat. Use the *Range Selection* button to change the maximum value for both bar displays. The shown values are estimated based on the ship's dimensions and the current movement. Usually, the real drift speed through water will differ from these values.

7.2 Chart Handling

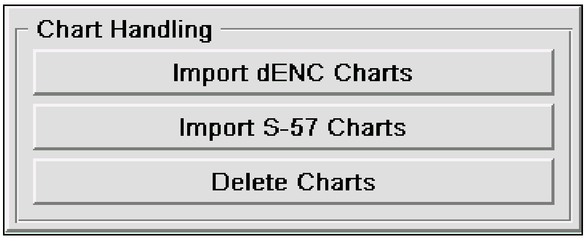


Figure 7.6: Chart Handling submenu

In the *Chart Handling* submenu you can

- Import dENC Charts
- Import S-57 Charts
- Delete Charts

7.2.1 Import Charts

The *Chart Handling* feature allows the user to add or update charts. After clicking on *Import dENC Charts* or *Import S-57 Charts* a window opens. Select the chart packages to be installed.

As usual with directENC chart permits provided by chart distributors must be installed prior to installing the chart packages proper.

7.2.2 Delete Charts

Click on *Delete Charts*. A window opens. In it all installed chart packages are listed. Select those you want to delete.

7.3 Chart View

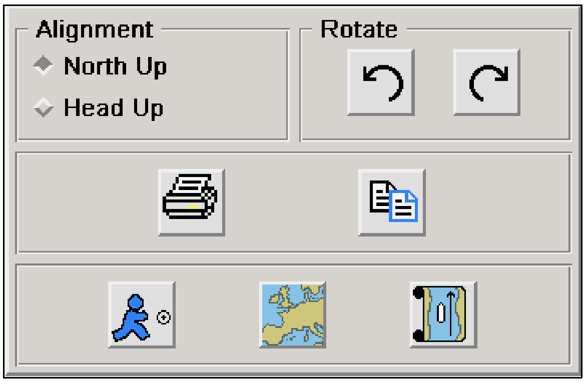


Figure 7.7: Chart View submenu

Among others the *Chart View* submenu offers to change the chart's alignment, to rotate and even to print the currently displayed chart.

7.3.1 Alignment

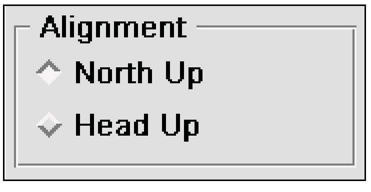


Figure 7.8: Chart Alignment

There are two variants of the alignment of the chart view:

North Up	typically used for navigating large bodies of water.
Head Up	typically used for navigating narrow channels, provides best text orientation.

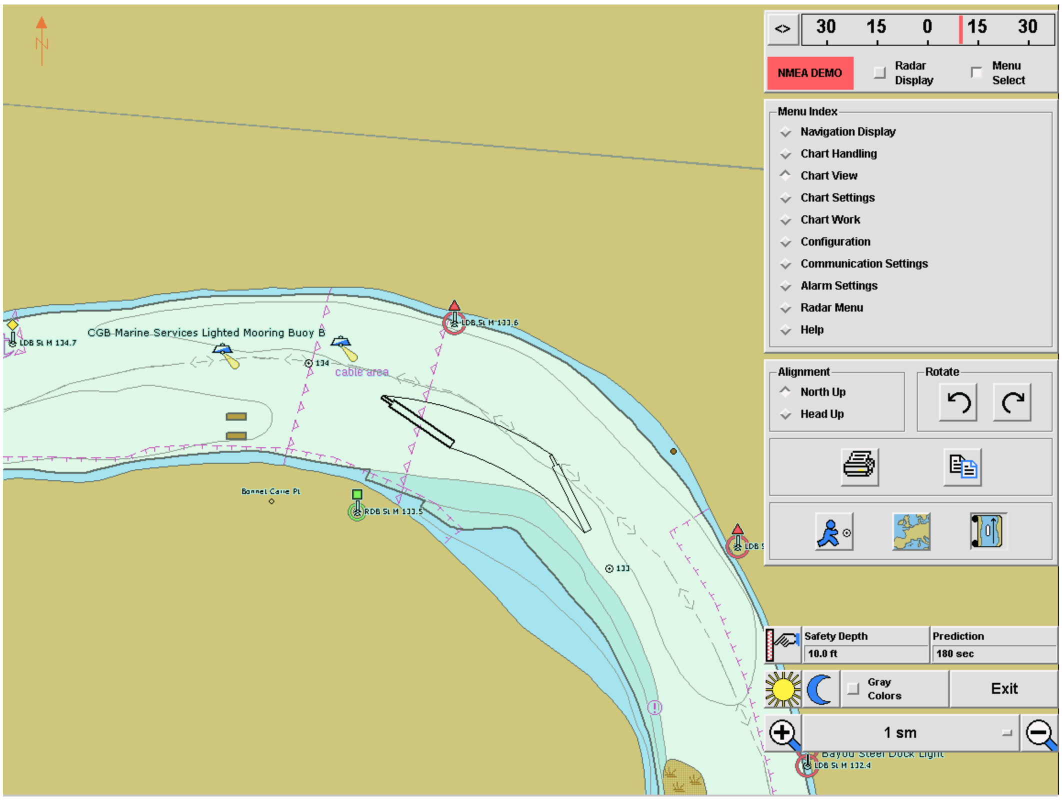


Figure 7.9: Chart Alignment North Up

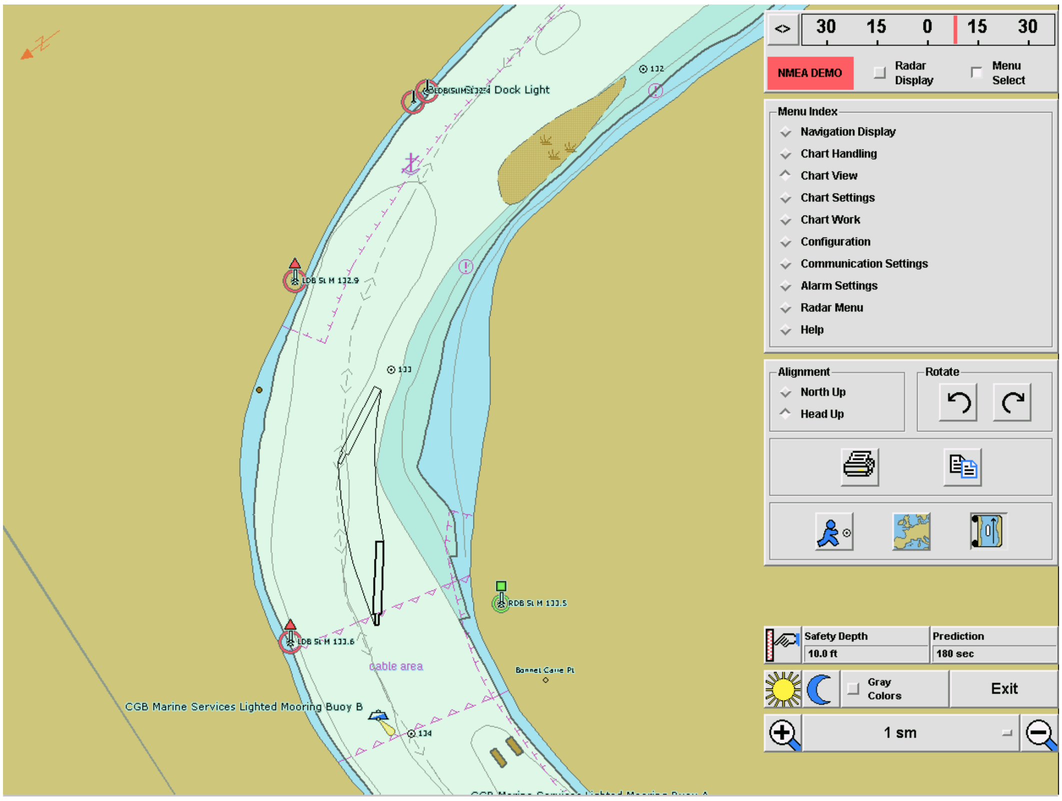


Figure 7.10: Chart Alignment Head Up

7.3.2 Rotate

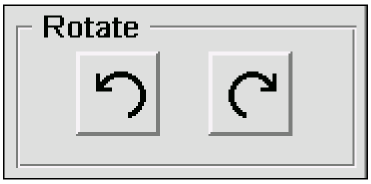


Figure 7.11: Rotate

This feature allows to rotate the displayed chart.

- left button: rotate chart counterclockwise
- right button: rotate chart clockwise

7.3.3 Chart View – Other Functions

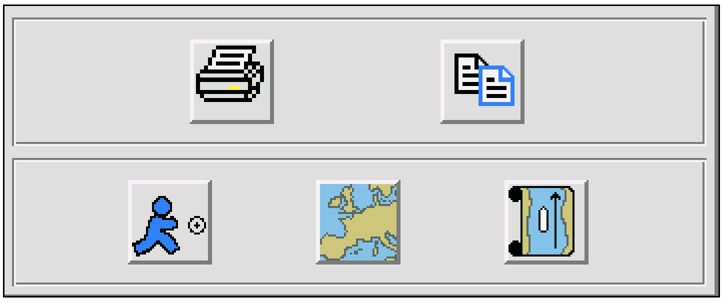
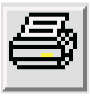
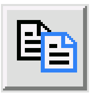
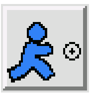


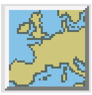
Figure 7.12: Chart View – Other Functions

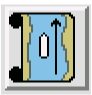
The functions offered are:


Prints the current chart view.


Copies the current chart view onto the clipboard.


Goes to position or place. See also chapter **8 Context Menu**.


Gives a chart overview. See also chapter **8 Context Menu**.


Starts / stops the automatic chart feed. See also **8 Context Menu**.

7.4 Chart Settings

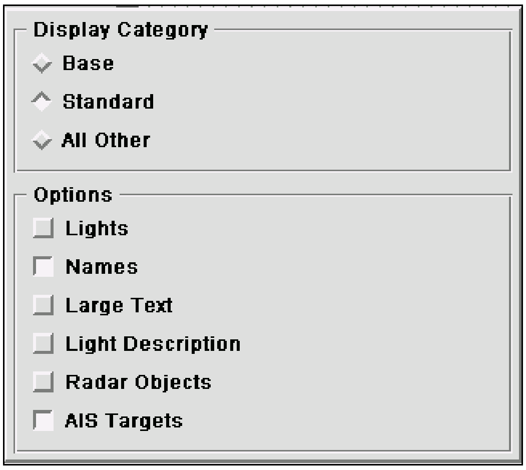


Figure 7.13: Chart Settings submenu

7.4.1 Display Category

The IMO (*International Maritime Organization*) has defined the following *Display Categories*:

- **Base**: The base SENC information compulsory for charts. This covers all objects necessary for navigation, e.g. land and water areas, buoys, beacons, offshore platforms, lighthouses, etc.
- **Standard**: SENC information which is displayed by standard. In addition to the objects enclosed in **Base** this covers all visible landmarks (chimneys, windmills, cairns, etc.), anchorage areas, danger zones, etc.
- **All Other**: All further SENC information not already enclosed in the **Standard** display. In addition port positions are displayed, too, showing the names of the respective ports.

The content of the respective *Display Category* is defined in the IHO S-52 standard.

The Categories *Base*, *Standard* and *All Other* allow the user to quickly increase or decrease the number of attributes displayed.

Select one of the three radio buttons:

- Base
- Standard
- All Other

Examples Display Category:

Base **Standard** **All Other**

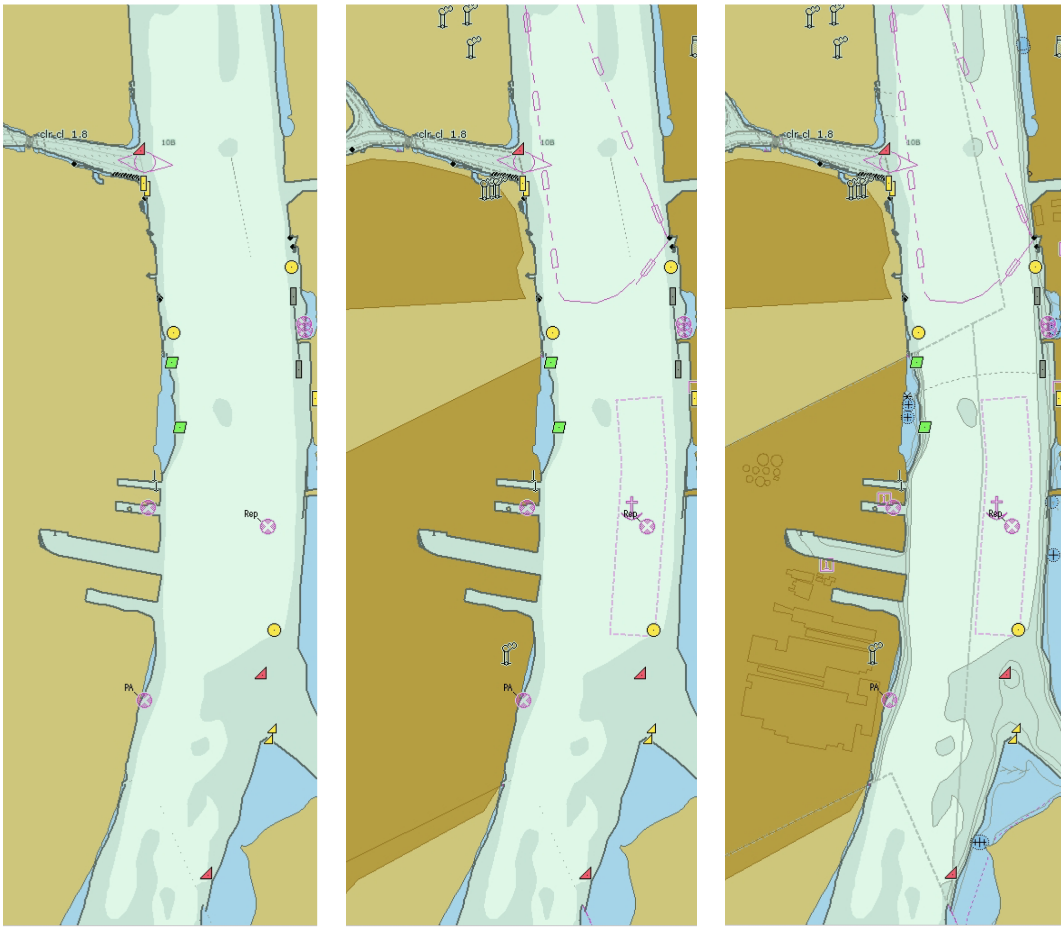


Figure 7.14: Examples Display Category

7.4.2 Options

With this feature the appearance of the Chart Display can be changed.

The following options are available:

- Lights
- Names
- Large Text
- Light Description
- Radar Objects
- AIS Targets

Lights
Displays the lights symbols (e.g. lighthouses, lights on buoys, etc.).

Names
Displays object names.

> **Note:**
>
> Depending on the respective object's position text is displayed either left or right of the river; thus the navigable water is not obscured by text display.

Large Text
Enlarges displayed text without changing the size of the chart display.

Light Description
Displays text describing light symbols.

Radar Objects
Highlights those objects which are classified as "radar objects".

AIS Targets
Activates tracking and display of AIS targets.

You may select none, all, or any combination.

7.4.2.1 Display of AIS Information

With the advent of GPS, DGPS and modern data communication it has become feasible to provide an automatic reporting device (transponder) to control and monitor the maritime environment of a ship.

An automatic reporting system has been developed for the maritime industry using the maritime VHF band for the transmission and reception of its data signals, and has been defined as "Universal Advanced Identification System (Universal AIS).

In combination with *CEACT* the AIS system will display on the screen the latest position information of all vessels within range of the AIS.

Data Flow

The application reads data from the serial RS-232 interface to which the AIS transponder is connected. These raw bytes are then sent to the AIS module which calls the hardware driver (DPI) to evaluate the received data. After the driver has returned the result of the evaluation to the API the AIS module processes this information. Finally the information is passed on to the application which is then able to display AIS targets and messages on screen, both addressed and broadcast.

Guard Range

The *Guard Range* is a radius (in nautical miles) defining a circle around the ship. All AIS targets within this range will be marked as dangerous. The default value for the Guard Range is 1.0 nm.

Timeout

If its AIS signal is not updated within the set amount of seconds an AIS target will be erased from the Chart Display. The Timeout value applies to all AIS targets on the Chart Display. The default value is 360 secs.

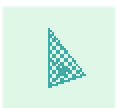
Update Rate

Defines the period of time after which the Chart Display is redrawn. The default value is 1 sec.

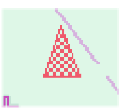
> **Note:**
>
> When many AIS targets are displayed overall performance may decrease.

7.4.2.1.1 AIS Target Symbols

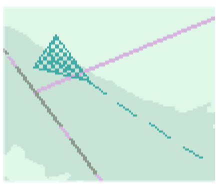
The symbols displayed and described in the following are based on a proposal of the DGON (Deutsche Gesellschaft fuer Ortung und Navigation – German Institute of Navigation)



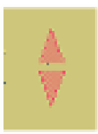
Sleeping AIS target. AIS data available.



Intruder. Target intruding in a guard zone.



Activated AIS target with heading marker and past positions on request.



Lost target (AIS signal no longer received).

7.4.2.1.2 Displaying AIS Target Information

When an AIS symbol is clicked on with the left mouse button an information window opens. In this window the principal information about the target is shown. This information is displayed and updated until

- the target leaves the detection range, or
- the user selects another target from the list, or
- the AIS target display is turned off or
- the window is closed.

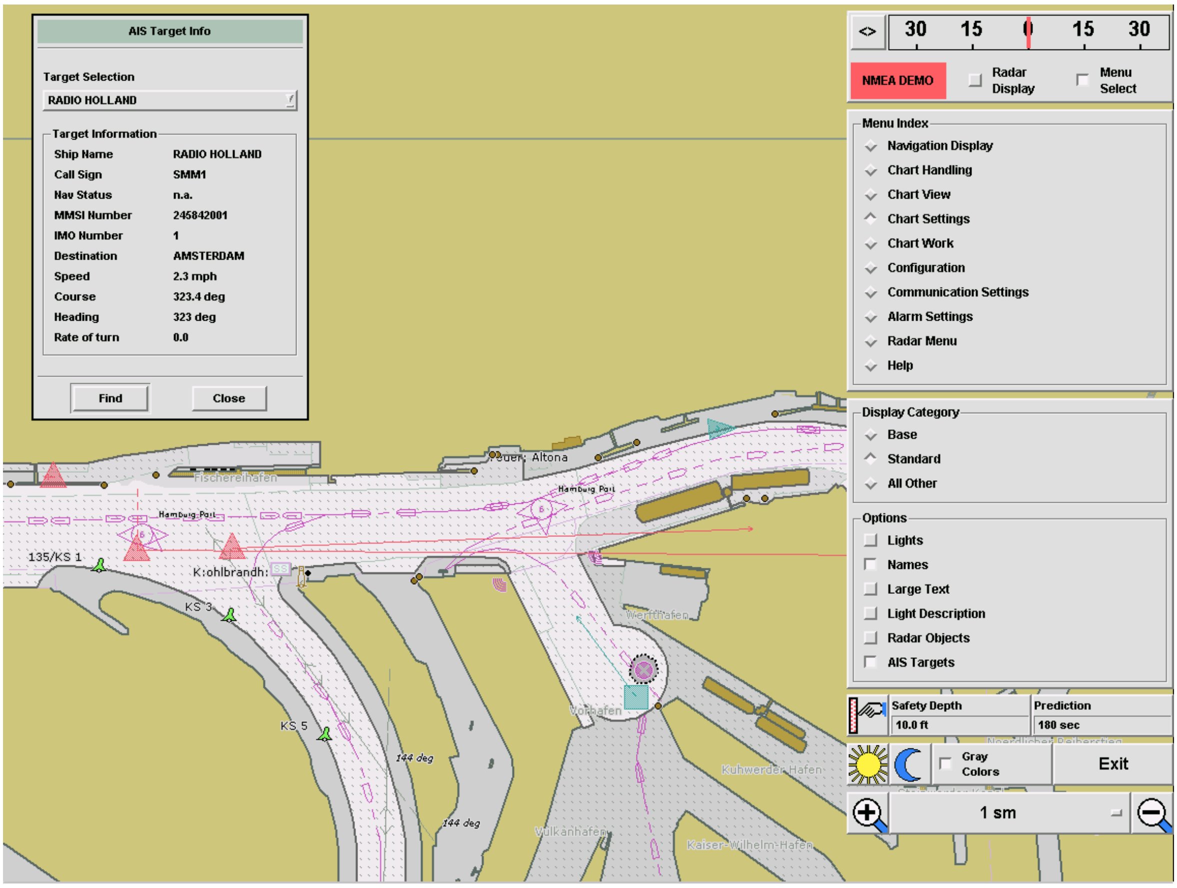


Figure 7.15: Chart Display with AIS Target Info

Another target may be selected by choosing it from the list of available targets. These targets are sorted by ship name, if available. Otherwise the unique MMSI number is shown in the selection box. However, clicking on another target symbol in the chart also selects this target.

Find a Target

Targets within the detection range are listed in the selection box. Depending on the current chart range some of these targets may not be displayed in the chart area.

To locate a target click on the *Find* button in the *AIS Target Info* window (see below). The chart will scroll and the selected target will be displayed in the center of the chart area.

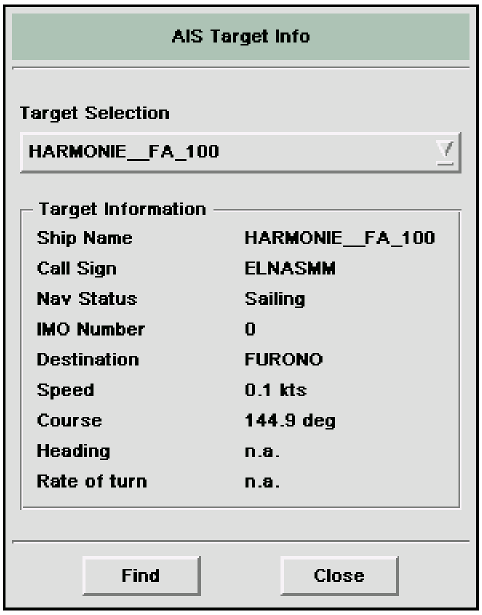


Figure 7.16: AIS Target Info window

7.5 Chart Work

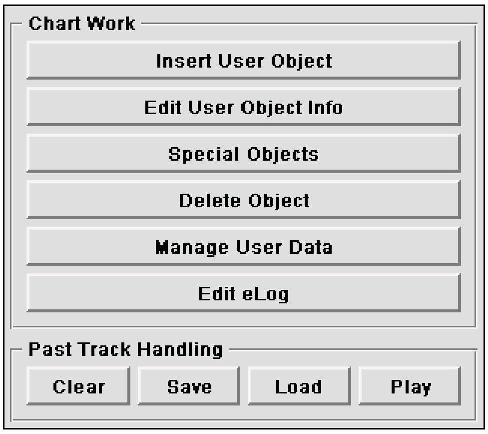


Figure 7.17: Chart Work submenu

7.5.1 Insert User Object

This feature allows the user to create new object areas on the chart such as new fleets, public boat launch ramps, etc. Upon selection the operator creates the text information for the new object. This information can include among other things the name and descriptive information about the area.

Once the *OK* button is clicked, the object can be drawn on the chart using the mouse. Once the new area has been created, the dialog box will open anytime the object is selected allowing unfamiliar users to review the information within.

> **Note:**
>
> The red highlighted area (in the illustration lower right) represents a new user defined area that has been created to represent a new fleet area.

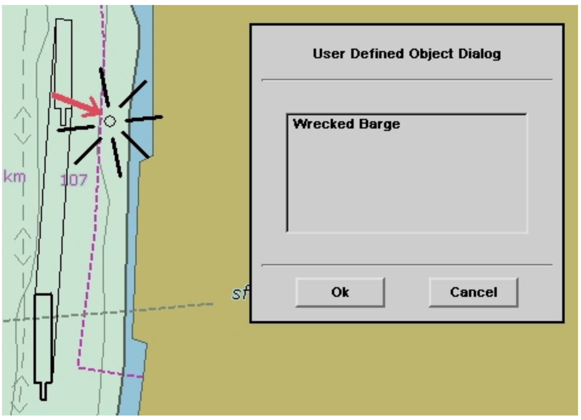


Figure 7.18: User Defined Object Dialog

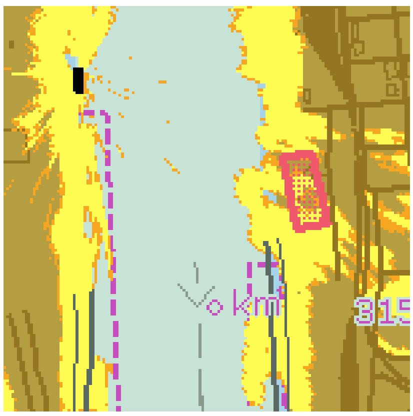


Figure 7.19: User Defined Area

7.5.2 Edit User Object Info

Allows the user to edit the object dialog.

7.5.3 Special Objects

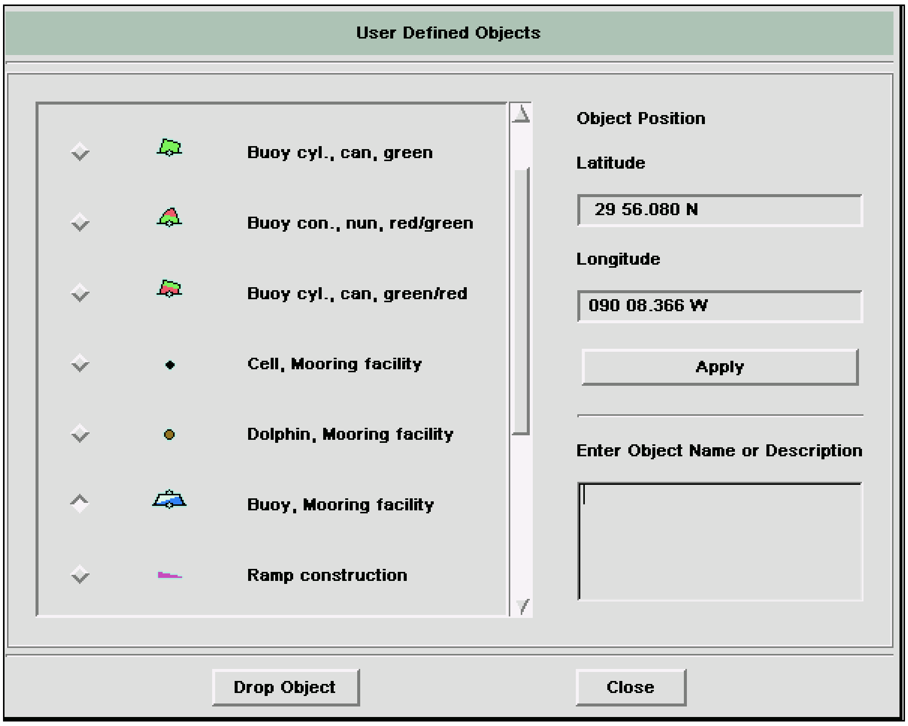


Figure 7.20: User Defined Objects template list

This feature opens a list offering o pool of predefined objects, e.g. buoys, lights, etc. These Objects can be used as templates for the definition of special objects.

7.5.4 Delete Object

Deletes any user object information.

Push the button and click on the object to be deleted. If no deletable object is found at the pick position, a warning message will be displayed. The delete mode is reset after every click on the chart area. Thus, when deleting multiple objects the *Delete Object* button has to be pushed for each delete operation.

7.5.5 Manage User Data

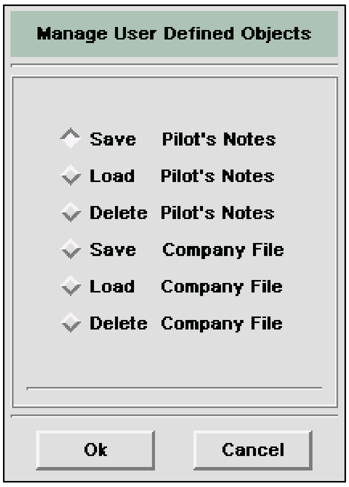


Figure 7.21: Manage User Data

This feature allows to manage user defined data.

Objects Set 1 is intended for data entered by and exclusively managed by an individual, e.g. the Captain.

Objects Set 2 is intended for data provided by the company.

For the time being only Objects Set 1 is enabled.

The functions available are:

Save saves the data, data-backup.

Load loads saved backup data into *CEACT System*.

Delete deletes the data from *CEACT System*.

7.5.6 Edit eLog

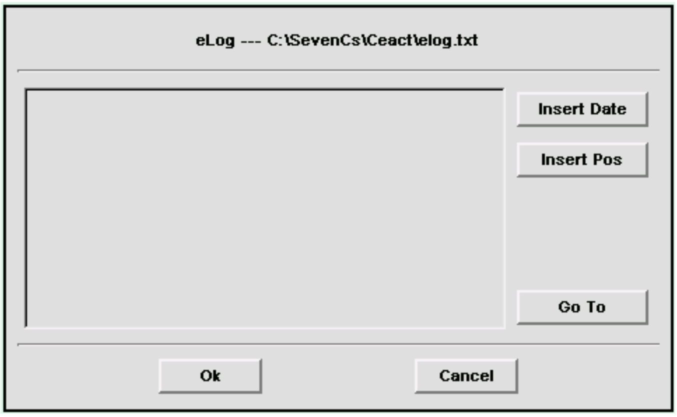


Figure 7.22: eLog input mask

This feature enables e.g. the pilot to create an electronic log of any event that occurs during the pilot's shift.

Insert Date	inserts the current date.
Insert Pos	inserts the current ship's position.
Go To	enables the user to have that chart area displayed that an entry refers to. To do this first highlight the respective position in the Log text, then click on *Go To*.

7.5.7 Past Track Handling

The functions for past track handling allow to

- clear the current past track,
- save the current past track
- reload a saved past track for review
- replay a loaded past track (optional)

Clear

The *Clear* operation needs to be confirmed.

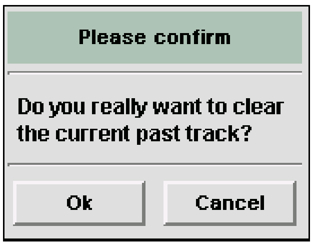


Figure 7.23: Clear Past Track confirmation window

Save

The *Save* function stores the current past track information into one data file. The proposed file name contains the creation date of the file, e.g..

`PST-2003-10-17-1442.PCB`

This name may be changed if desired, but please retain the file extension.

> **Note:**
>
> Only files named `*.PCB` will be shown in the file selection dialog of the *Load* function.

Load

Loading a past track for review deletes the information of the current past track. After confirmation the loaded past track will replace the current past track. The past track is locked and no information is added to this past track.

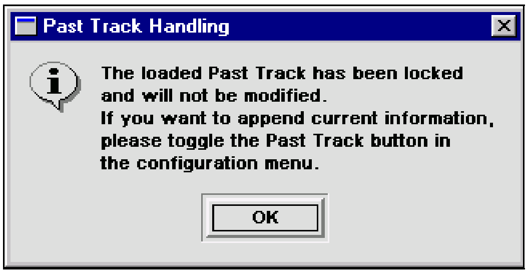


Figure 7.24: Past Track Load Information

Current information can be added to a loaded past track by turning off and on the *Past Track* button in the *Configuration* menu (see chapter **7.6**).

Play

This feature allows to replay a loaded past track.

> **Note:**
>
> This function is optional therefore the button may be disabled.

If the *Play* function is available clicking on the button will open the *Past Track Playback* dialog (see below).

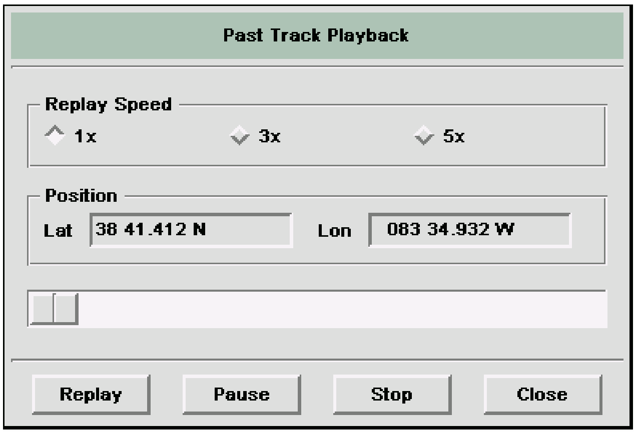


Figure 7.25: Past Track Playback dialog

Past Track Playback

The current position on the track can be selected by moving the slider in the *Playback* dialog. When releasing the slider the corresponding position is displayed numerically, and the ship symbol is moved to this position.

Three different speeds are available for replay. Click on the *Replay* button to start the replay.

Note:

The *Close* button just closes the dialog, but does not stop the replay. In that case click on the *Stop* button instead.

7.6 Configuration

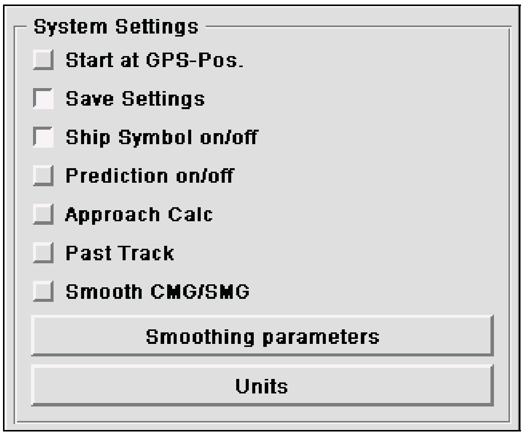


Figure 7:26: Configuration submenu

Start at GPS-Pos	starts at the GPS- Position.
Save Settings	saves the user's current settings.
Ship Symbol on/off	turns the ship symbol on or off.
Prediction on/off	enables or disables the prediction feature.
Approach Calc	supports approaching a destination point.
Past Track	allows the pilot to view his past track line.
Smooth CMG/SMG	smoothes CMG/SMG.

Smoothing Parameters

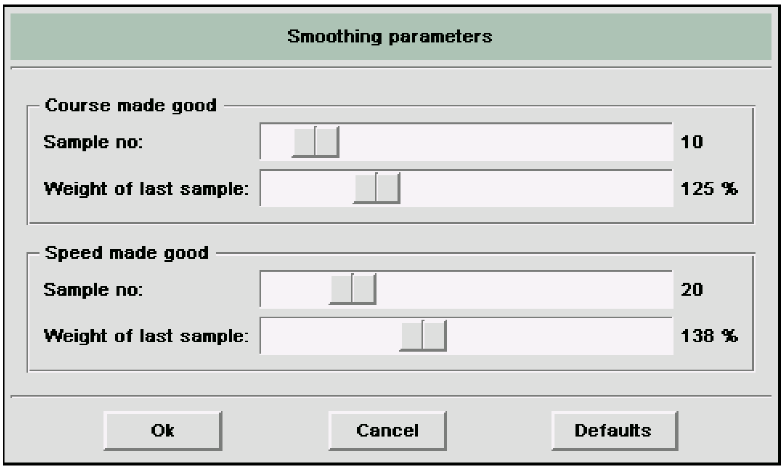


Figure 7.27: Smoothing Parameters window

Note:

For both Smooth CMG/SMG and Smoothing Parameters the Master Password (see chapter **6.5 Changing System Settings**) is required.

Units allows the user to select one of three different chart scales: Kilometers, Nautical Miles and Statute Miles.

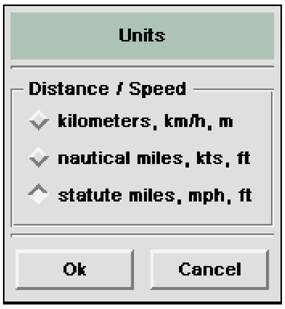


Figure 7.28: Units dialog

7.6.1 Approach Calculation

> **Note:**
>
> This function is only available when appropriate charts are installed.

This function supports approaching a destination point. Distances to this point and the ship’s calculated position are displayed on the screen.

Example:

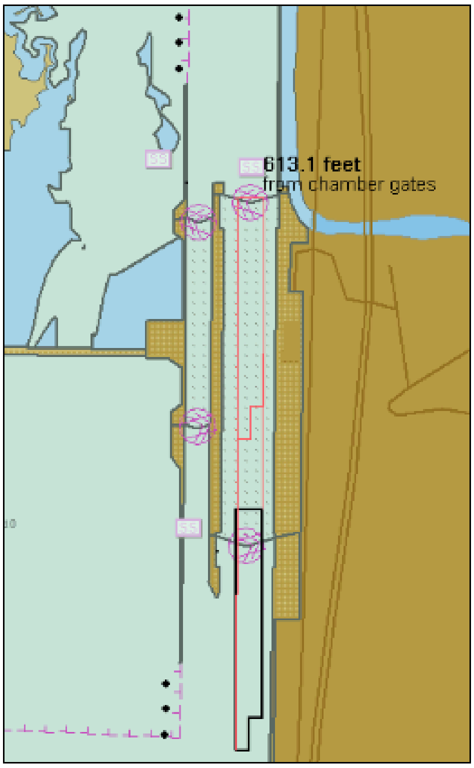


Figure 7.29: Display of approach calculation

7.7 Communication Settings

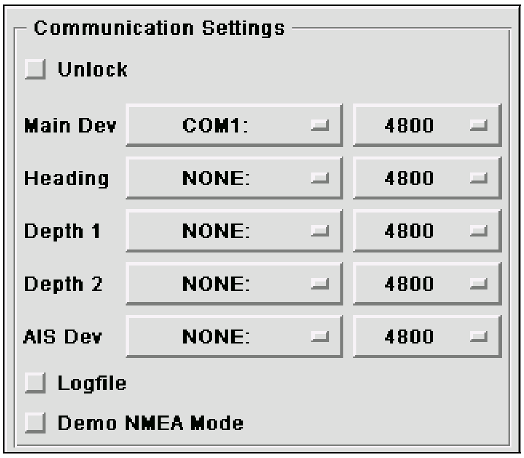


Figure 7.30: Communication Settings submenu

Unlock The values are protected against accidental change. If any changes should become necessary first the *Unlock* check box must be ticked.
To enable this check box the master password is required. See chapter **6.5 Changing System Settings** for details.

There are presently 5 communication ports defined in CEACT version 1.6 which include *Main Device*, *Heading*, *Depth 1*, *Depth 2* and *AIS Device*. The comm ports are preset 8 bits, no parity and 1 stop bit. The speed for each of these ports can be set between 110 and 256000 baud. The default baud rate is set to 4800, the normal NMEA 0183 setting.

The *Main Device* port is used to receive incoming GPS information and can also receive heading and rotation information if a GPS Heading Compass is used. The following NMEA sentences can be parsed on the *Main Device* port.

$GPGGA	NMEA version 2.0	Position
$GPGLL	NMEA version 2.0	Position
$GPVTG	NMEA version 2.0	Velocity
$GPRMC	NMEA version 3.0	Position & Velocity
$GPROT		Rotation
$GPHDT		Heading
$HEHDT		Heading

The *Heading* Port can be used when a separate heading or rotation device is available. When the software detects heading or rotation at this port the information is given priority over heading or rotation information that may be present on the *Main Device* Port. The following NMEA sentences can be parsed on the *Heading* port.

$GPHDT	Heading
$HEHDT	Heading
$GPROT	Rotation
$AGHDT	Heading

The *Depth 1* and *Depth 2* ports are designed to receive NMEA logs from Depth Sounders. The following NMEA logs can be parsed.

$SDDBT	Depth
$SDDBS	Depth

The *AIS* port is activated and several AIS logs are now able to be received provided the content of these logs is in the correct format as specified by the governing agencies.

Main Device	selects the com port number for GPS device.
Speed	selects the baud rate for the GPS device.
Heading Device	auxiliary heading device for additional sensors.
Speed	selects the baud rate for the heading device.
Depth Device 1	selects the com port for the first depth device.
Speed	selects the baud rate for the first depth device.
Depth Device 2	selects the com port for the second depth device.
Speed	selects the baud rate for the second depth device.
AIS Device	provides AIS and other information.
Speed	selects the baud rate for the AIS device.

The names and values displayed can be changed by selecting other ones from a list. This list can be opened by clicking on the button to the right of the respective name or value.

Log File	saves the raw ASCII data from the GPS to the computer’s hard drive when selected.
Demo NMEA Mode	allows to play recorded sensor data in real-time for demo purposes. Demo files are included in the delivery.

> **Note:**
>
> When using *Demo* mode appropriate ship configuration should be used for each demo file.

All of the *Demo* mode GPS Replay files for the Ohio River **except** for the Emsworth file require the following Settings.

Tow Configuration, 5 Rows, 3 Columns

Ship's Position	Tow Center	
Barge Length	195 ft.	
Barge Breadth	35 ft.	
Ship Length	150 ft.	
Ship Breadth	45 ft.	
X- Offset	26 ft.	
Y- Offset	115 ft.	
Safety Depth	8 ft.	
Prediction Time	180 secs.	400 seconds for TONMILES replay

Emsworth Replay

Tow Configuration, 2 Rows, 2 Columns

Ship's Position	Column 1
Barge Length	175 ft.
Barge Breadth	27 ft
Ship Length	75 ft.
Ship Breadth	26 ft
X- Offset	16 ft.
Y- Offset	50 ft.
Safety Depth	8 ft.
Prediction Time	180 seconds

Lower Mississippi Replays:

Tow Configuration, 5 Rows, 5 Columns

Ship's Position	Tow Center
Barge Length	195 ft.
Barge Breadth	35 ft.
Ship Length	156 ft.

Ship Breadth	45 ft.
X- Offset	30 ft.
Y- Offset	125 ft.
Safety Depth	8 ft.
Prediction Time	180 sec.

Note:

When *Demo GPS Mode* is activated values for SOG, HDG and TIME (see chapter **5.3**) will be displayed. Simultaneously *GPS DEMO* on a red background will be indicated in the *Sensor* display (see chapter **5.2.1**).

7.8 Alarm Settings

Note:

In the current version of *CEACT System* all alarm functions are disabled. Presumably they will be available in the next program version.

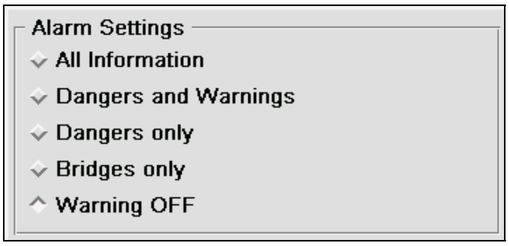


Figure 7.31: Alarm Settings submenu

In this feature it is defined when an alarm shall be set off.

Click on one of the radio buttons:

All Information	alarm whenever any information is available.
Dangers and Warnings	alarm in case spots marked “Danger” or “Warning” are approached.
Dangers only	alarm in case a spot marked “Danger” is approached.
Bridges only	alarm only in case a bridge is approached.
Warning OFF	turns the alarm function off.

7.9 Radar Menu

CEACT System provides to display radar information which will then superimpose the chart display, a so-called *Radar Overlay*.

The *Radar Menu* offers the settings for reception and display of radar information

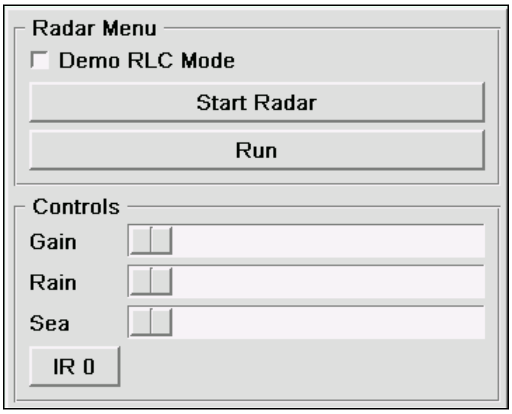


Figure 7.32: Radar submenu

Demo RLC Mode	allows the user to replay a saved RADAR integrator file.
Start RADAR	allows the user to log onto RADAR overlay data network.
Stop Radar	allows the user to log off Radar overlay data network.
Run	retrieves radar overlay data for display overlay when selected.
Standby	places operating RADAR into the standby mode when selected.

Controls

Gain	adjusts the radar video gain.
Rain	reduces clutter caused by rain.
Sea	attenuates target returns located near the vessel thereby reducing the clutter caused by wind driven swells.
IR	Radar Interference Rejection provides a 3 level reduction of noise caused by local radar interference.

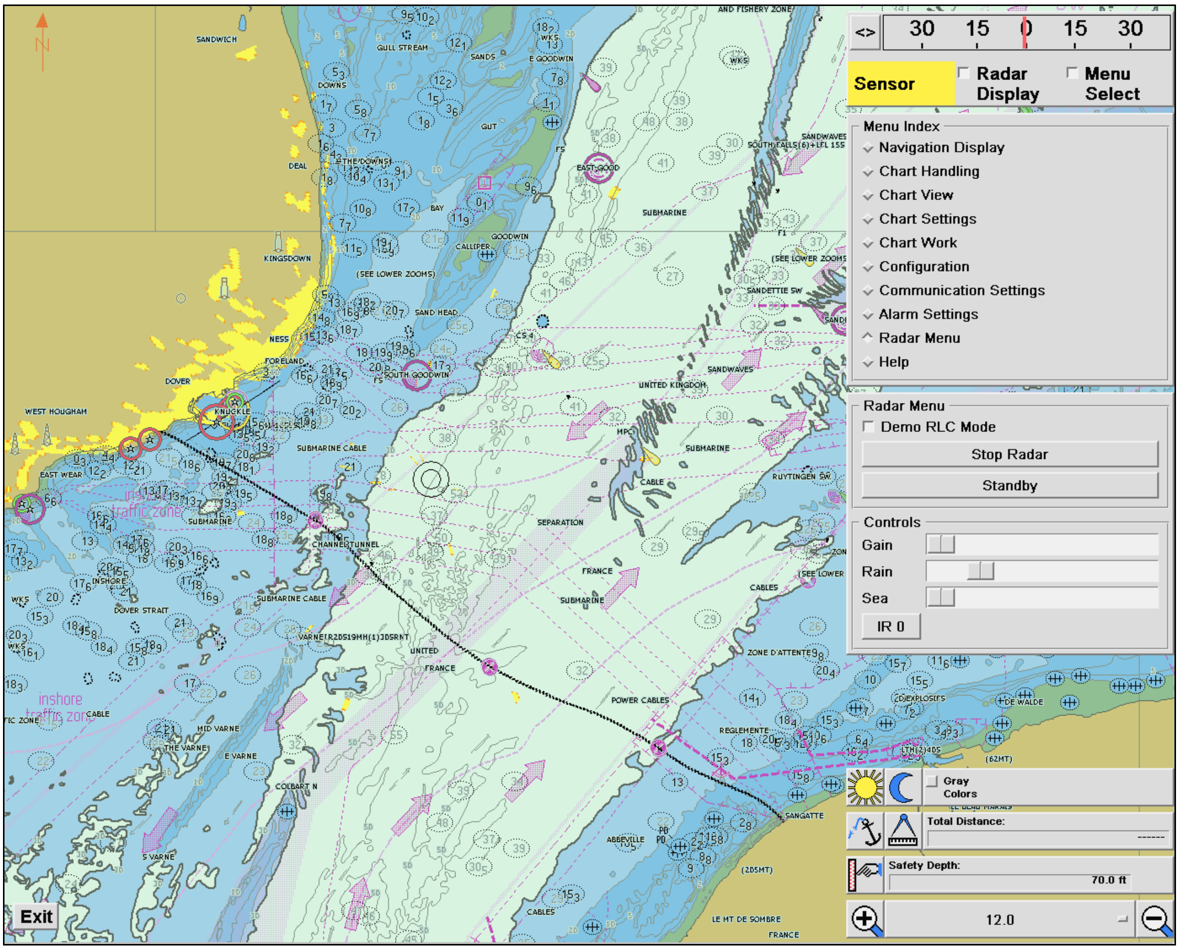


Figure 7.33: Example: Radar Overlay

7.10 Help

Figure 7.34: Help submenu

Online Help	opens the *CEACT* User's Guide.
About	provides the software version.

8 Context Menu

Provided that no function is currently activated clicking the right mouse key in the chart area opens the context menu. The state of functions which can be turned on and off is indicated by a check mark in front of the respective menu item.

Figure 8.1: Context menu

The context menu offers quick access to the following functions:

- Go To Position (see also chapter **4.2 Go to Position**)
- Mark Current Position
- Zoom Overview (see also chapter **4.3 Overview Chart**)
- Mark Destination
- River Mark Display
- Channel CPA Display
- Quick Mark
- Water Level Setup
- Depth Recording
- Show Position
- Ship View Display
- Auto Chart Feed (see also chapter **4.5 Automatic Chart Feed**)

8.1 Go To Position

> **Note:**
>
> *Go To Position*, *Mark Destination* and *River Mark Display* require charts including distance information.
>
> Note furthermore that data must have been provided by either *CEACT*, SevenCs or ChartWorld. Using data from other sources will disable these functions.

Allows to select one of the distance markers of the currently displayed river. The selected distance marker then becomes the center of the chart display.

8.2 Mark Current Position

Marks the current ship's position.

8.3 Zoom Overview

Displays the overview chart. Normal viewing must then be set manually. See also chapter **4.3 Overview Chart**.

8.4 Mark Destination

Allows to set a *Destination Point*. Provided the *Current Position* (see above) and the *Destination Point* are both available and situated on the same river then the Estimated Time of Arrival (ETA), Time to Go (TTG) and Distance (DIST) will be displayed. Otherwise instead of the respective values three dashes (---) will be displayed.

> **Note:**
>
> There is a chance of the displayed values being incorrect due to e.g. recent changes in the course of the river.

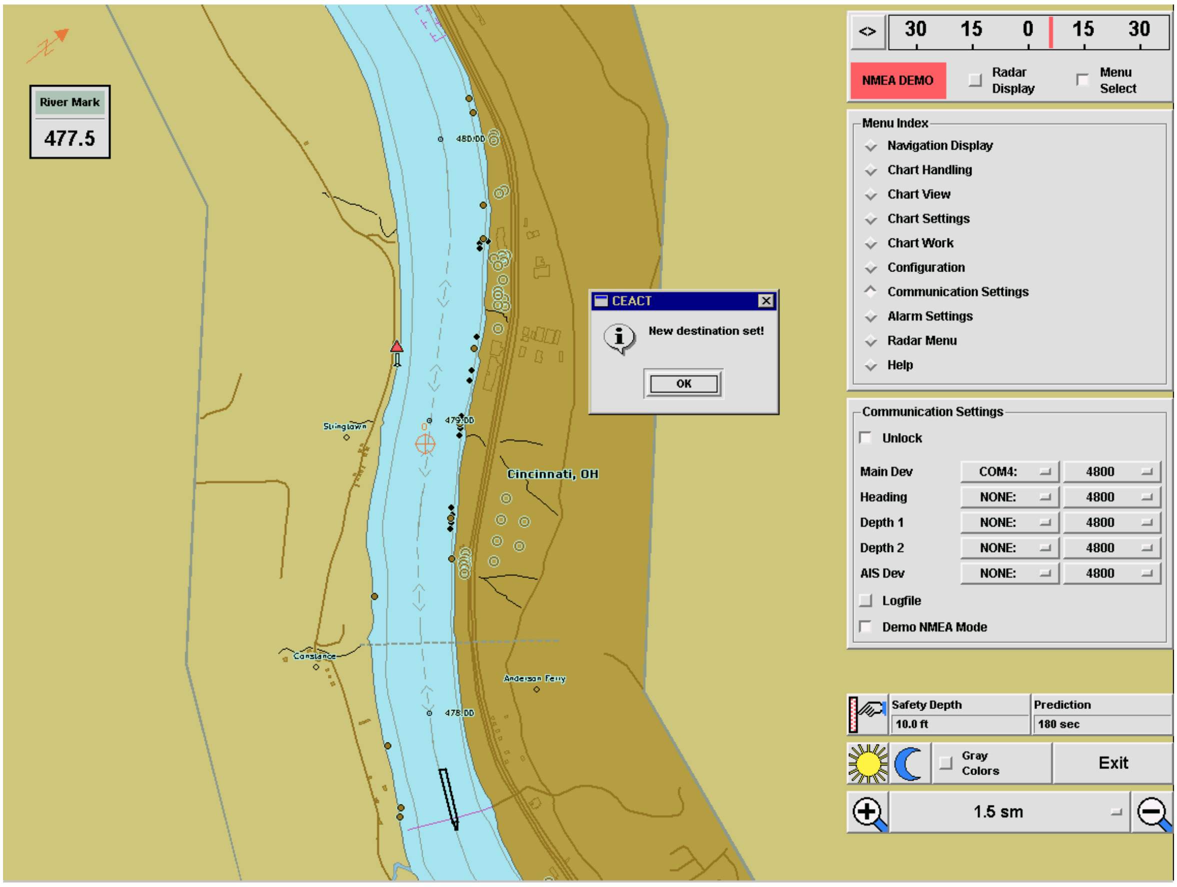


Figure 8.2: Display with newly set Destination Point

How to mark the Destination Point:

1. Use *Go to Position* (see chapter **4.2**), or click the middle mouse button to position the point into the center of the chart display.
2. Select *Mark Destination* in the *Context* menu.
   The *Destination Point* is marked on the screen.

> **Note:**
>
> There can be only one *Destination Point* at a time. To mark a new one you must first clear the existing Destination Point.

A set *Destination Point* is not removed automatically. Instead, as soon as the *Distance* value (DIST) increases this is taken as an indication that the *Destination Point* has been passed. Then a window pops up asking you whether you want to clear the destination.

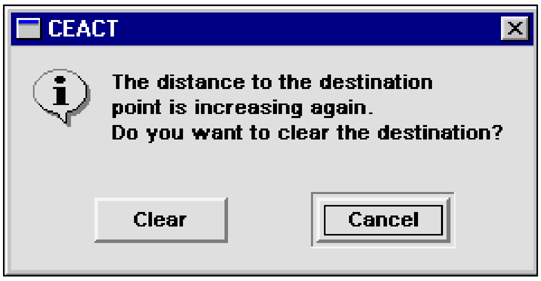


Figure 8.3: Confirmation window Clear Destination

Click on *Clear*, and the *Destination Point* is removed from the screen.
However, if the Destination Point has not been reached yet, e.g. because your ship was moved backward while maneuvering, simply click on Cancel, and the *Destination Point* will remain where it was.

In that case the Destination Point must be removed manually later. This is done by selecting *Mark Destination* in the *Context* menu once again.

8.5 River Mark Display

> **Note:**
>
> This function requires charts including distance information or river marks respectively.

Provided the own ship's position is available this function displays the river mark corresponding to the current ship's position in an extra window. This window can be positioned freely on the screen by the user.

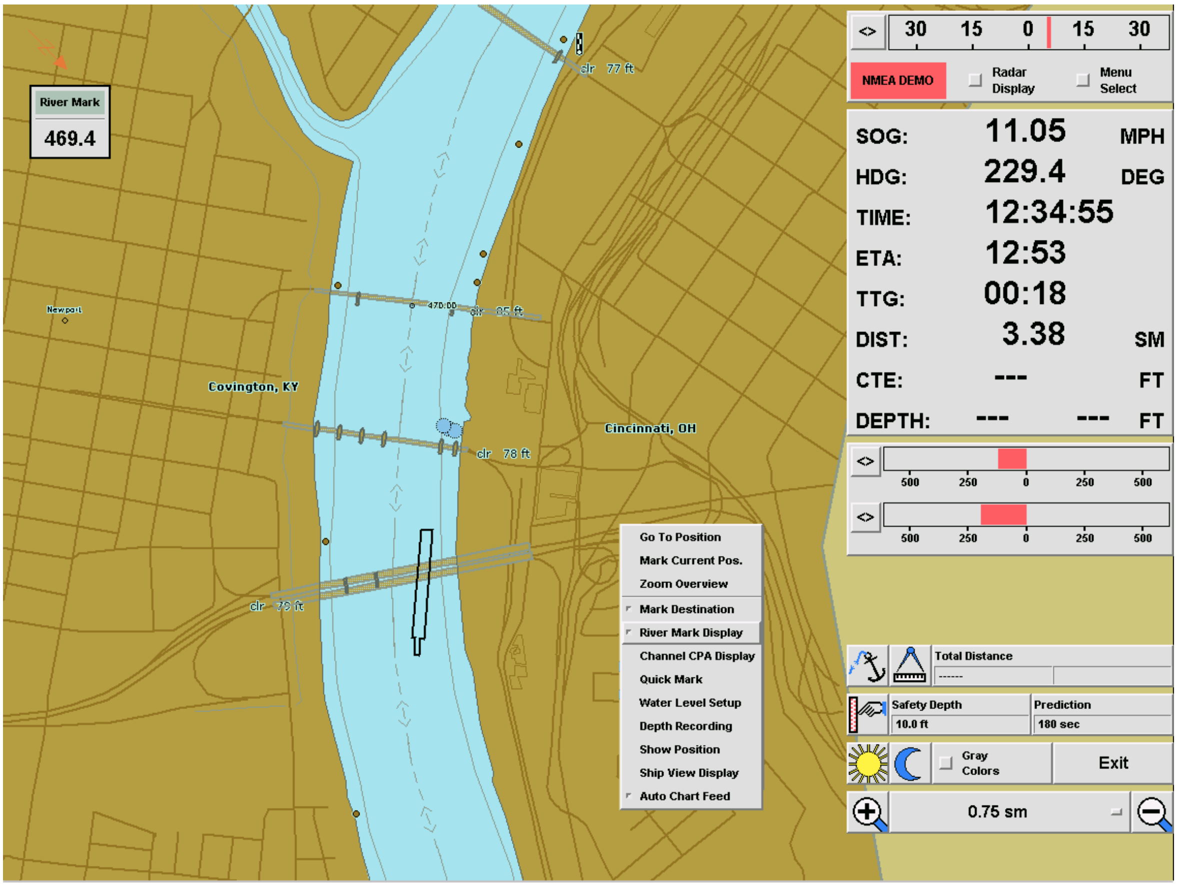


Figure 8.4: River Mark Display

Note that in the *River Mark* display no unit is mentioned. That is because the units used automatically will be the same as are used in the chart proper.

If the chart in use does not contain any river marks a message "No river mark available!" will be displayed immediately after selecting this function.

If, however, only sections of a river do not provide river marks the values will be replaced by three dashes (---) as soon as such a section is entered. The same applies to the values for the Estimated Time of Arrival (ETA), Time to Go (TTG) and Distance (DIST). When river marks are available the values will be displayed again.
Once opened the *River Mark* display will remain open until *River Mark Display* in the *Context* menu is selected again.

8.6 Channel CPA Display

> **Note:**
>
> This function requires charts including distance information or river marks, respectively.

Provided the own ship's position is available this function allows to track an upcoming vessel and to display the expected CPA area for this ship. The required information about the target vessel can be input manually or retrieved automatically from AIS information.

8.6.1 Manual Setup

Usually pilots will communicate in order to clarify where and how two ships may pass each other. At least, the current position and speed of each towboat must be available to the other pilot. In manual mode, the user may input the position or river mark of the target and its speed into the *Channell CPA* dialogue. Additionally, the direction has to be selected.

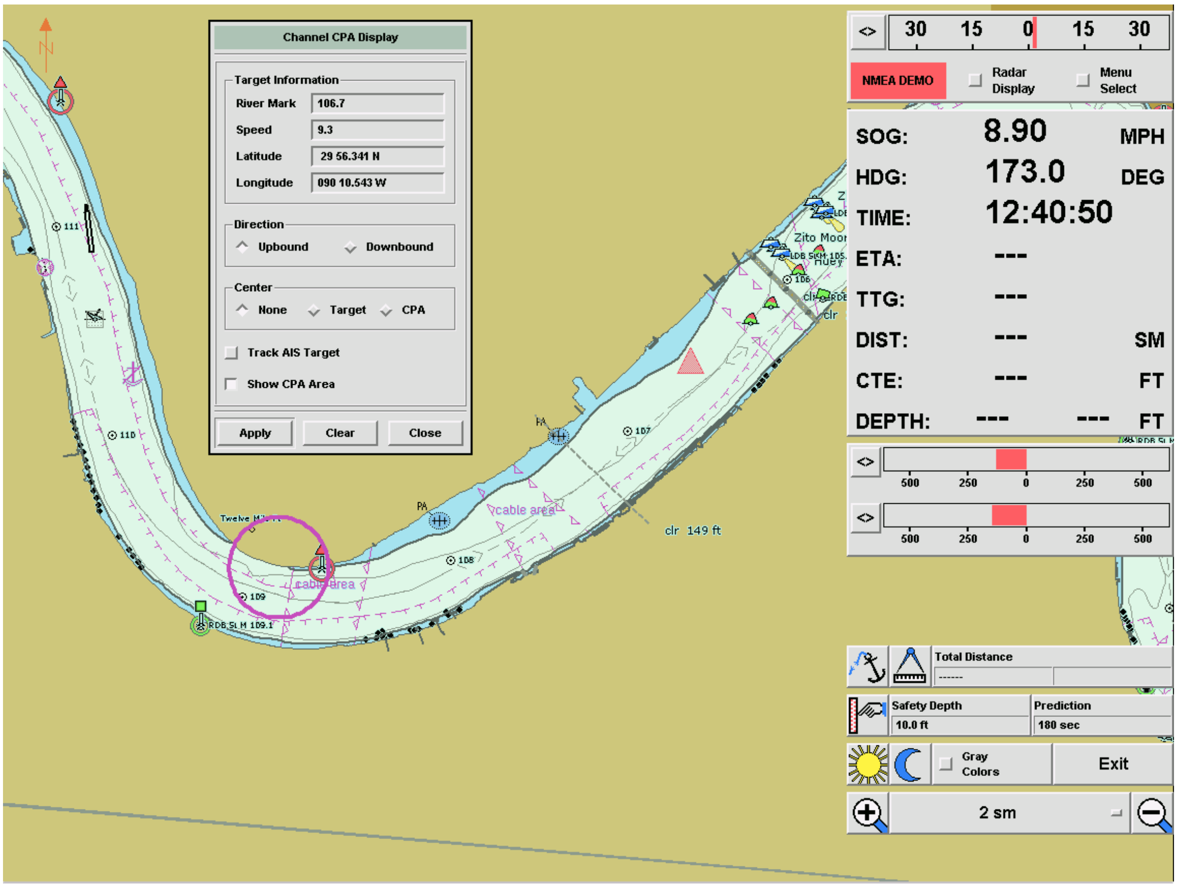


Figure 8.6: Channel CPA Display – Manual Setup

Pressing the *Apply* button stores this information and starts the internal tracking. The calculated position of the target is marked by a symbol for dangerous targets, and an information attribute River Target.

The calculated CPA (Closest Point of Approach) area is shown only when the checkbox for the display has been checked.

8.6.2 Automatic AIS Tracking

Target information may be retrieved directly from the AIS information. When AIS targets are available, simply activate *Track AIS Target* and click on the target of interest. Target information is used for CPA calculation. The detection of the target's direction may take some time.

Usually, the Automatic Chart Feed function is used to keep the ship's position within the view. In some situations the position of an upcoming vessel or the calculated CPA area is of higher interest than the ship's own position. Select *Center Target* or *Center CPA* to keep the current position of the target or the CPA centered.

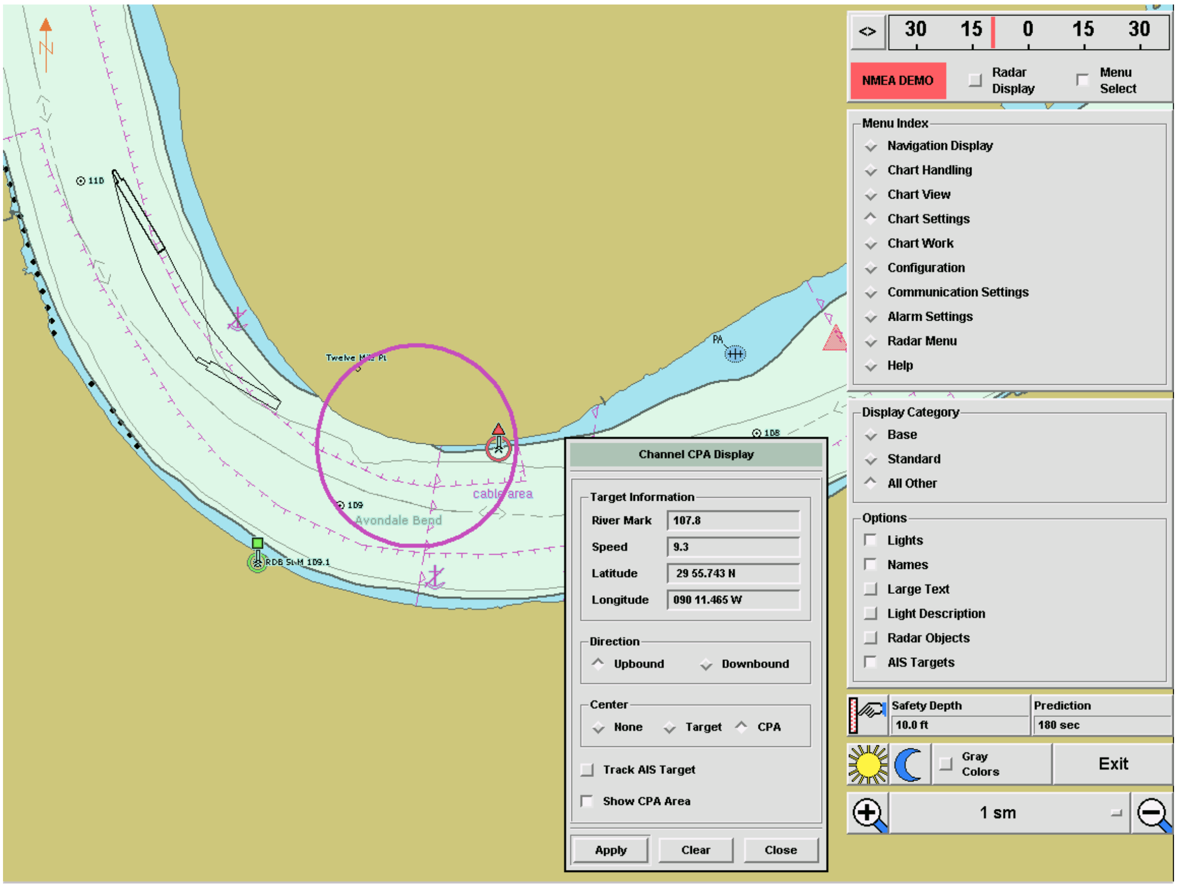


Figure 8.7: Channel CPA Display – Automatic AIS Tracking

Select *Center None* to turn off the tracking.

The CPA Display including tracking and target display is turned off automatically a certain time after both ships have passed each other.

8.7 Quick Mark

Provided the own ship's position is available this function allows to drop user defined objects at a specific location relative to the ship. All object types from the list of predefined objects can be selected by name. The presentation of these objects is depicted in chapter **7.5.3 Special Objects**.

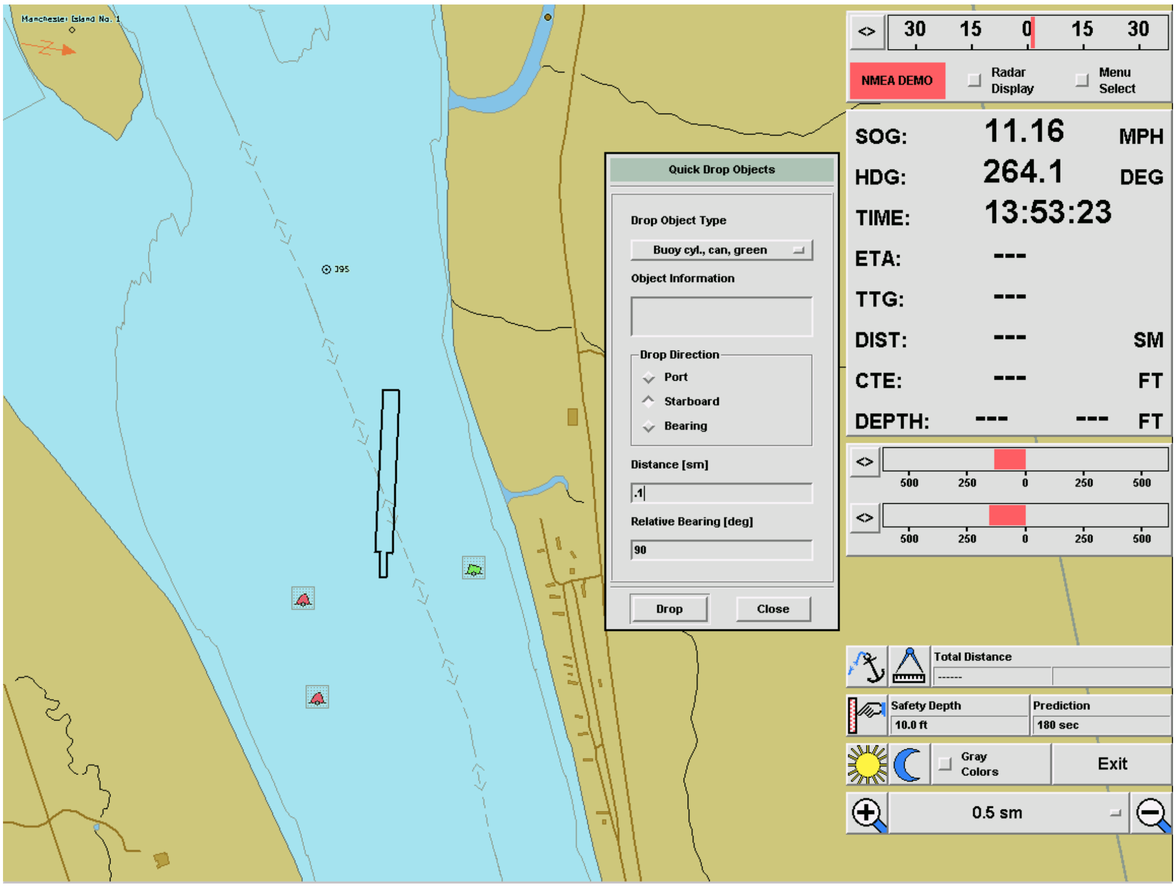


Figure 8.5: Quick Drop Objects

To every object additional text information can be added. When dropping a new object the current content of the text field *Object Information* is stored as an attribute of the object. The new object is created at a location defined by distance and bearing relative to the ship's own position. Selecting *Drop Direction* / *Bearing* allows to enter any valid bearing value. The buttons *Port* and *Starboard* simply define drop bearing values of 270 and 90 degrees for lateral objects.

8.8 Water Level Setup

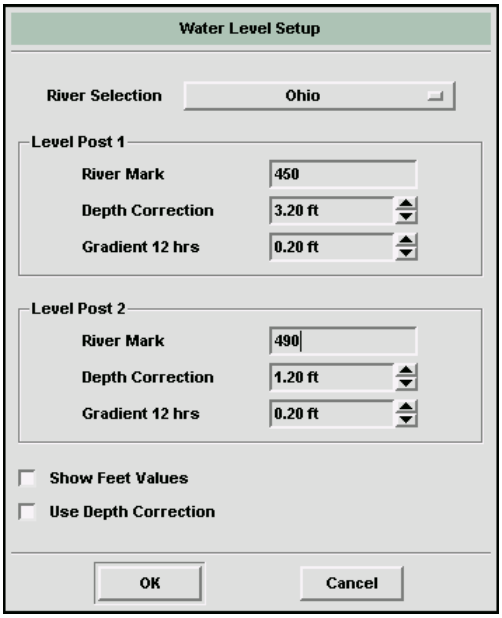


Figure 8.8: Water Level display

The *Water Level Setup* function allows to define depth correction values for two river locations. For each location the river mark, a depth correction value and the gradient for this value can be entered.

When activated, a depth correction value for the ship's position is calculated and applied for display purposes. All objects carrying depth information will be presented depending on the current correction value. However, depth correction can only be applied when the ship is located on the same river and between the two river marks.

NOTE:

The depth correction value only affects the display on screen. Depth values in the Pick Report and in depth log files are **NOT** corrected.

8.9 Depth Recording

Allows to record depth information provided by one or two depth sounders. The data is stored into the selected file and contains the following information:

Sounder ID, timestamp, latitude, longitude, depth in ft, depth in meters.

<u>Examples:</u>

DS1 1065798943 39.1123959 -84.4842698 71.90 ft 21.90 m

DS1 1065798949 39.1122359 -84.4844431 71.90 ft 21.90 m

DS2 1065799047 39.1147475 -84.4819252 71.90 ft 21.90 m

DS2 1065799063 39.1145825 -84.4820786 71.90 ft 21.90 m

The position and depth values are calculated based on the sounder offset setting in the *Ship Configuration* menu (see chapters **6.2.1** or **6.2.2**, respectively. Positive vertical offset values for the sounder will reduce the effective depth value displayed and stored in the file.

8.10 Show Position

This function displays the geographic position of the pointer position on the chart area. Latitude and longitude are shown in a small label next to the pointer. However, this label appears only when the mouse is not moved.

8.11 Ship View Display

The *Ship View* function provides an additional window that shows details at the ship's current location. This ensures that the pilot can always see the current ship situation, even while he is perhaps working on another chart.

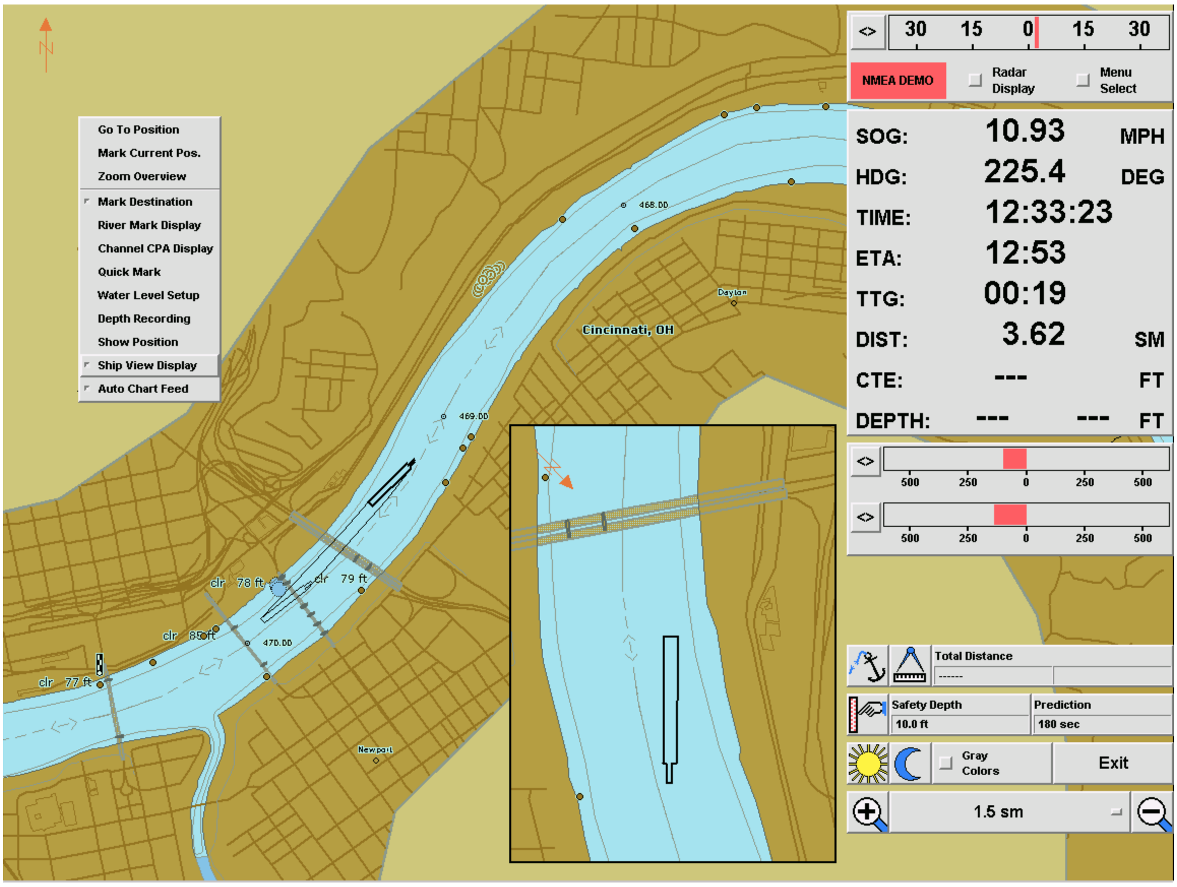


Figure 8.9: Ship View Display

The ship view has fixed display ranges and uses Head Up orientation only. The range can be changed through the context menu of the window.

The window can be moved to any position on the main screen. Just click on the window and keep the left mouse button pressed while dragging the window to the new position.

8.12 Auto Chart Feed

Ensures that the chart displayed is shifted according to the movements of the ship symbol. See also chapter **4.5 Automatic Chart Feed**. For more information on this subject see chapter **7.3.3 Chart View – Other Functions**.

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9 Recommended and Approved Equipment

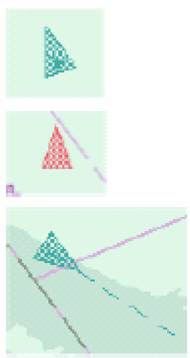
9.1 CEACT Integrated Bridge Solution

Today's pilot house is nearly full of electronic equipment displays. CEACT is designed to integrate with and display information from DGPS, Mechanical Heading Compasses, DGPS or WAAS Enabled GPS heading compasses, Two Depth Sounders, and Rate of Turn Sensors, provided these devices output the accepted standard NMEA compatible data logs.

CEACT Software is PC based, and therefore the PC that is chosen must have the appropriate number of COM ports, or must be supplied with a compatible USB to Serial Port Converter. If a GPS heading compass is the only device connected, and if the GPS heading compass can output NMEA data at RS-232 then it is typically more cost effective to simply choose a PC that has at least one serial port. If more communication ports are necessary, then the proper integration cables, and USB to Serial Port Converter will need to be defined.

The standard electronic interface for NMEA is RS-422. This format was specifically chosen for maritime data, because it is less susceptible to interference and it can communicate over much longer distances than RS-232 which is limited to approximately 25 feet of cable. For this reason CEACT Information Systems recommends the use of USB to RS-422 Serial Port Converters and RS-422 interface cables for connecting multiple sensors to the CEACT PC when the cables are routed directly to the sensor electronics.

Several new products on the market such as smart depth transducers operate on milliwatts of power by using an embedded DSP. These products output the data messages directly from the Processor embedded within the transducer, and therefore are the perfect choice for wireless depth transponders. No more Transponder Cables! Communication solutions for these devices are presently being evaluated. Hopefully their quality, and compatibility will meet the requirements for Channel Navigation.



AIS (Automated Information System) is a new type of shipboard electronics which will soon be a mandatory carriage on many commercial vessels. Several AIS devices are presently available for purchase in the US and Internationally. These devices output data for use in ECDIS systems in a standardized or open format. CEACT Channel Navigation Software can read and display this information. Custom applications that will allow the AIS information to be utilized extensively for Channel Navigation are currently under development.

Although the integrated bridge solution is relatively simple, and equipment is readily available off the shelf, some key factors should be kept in mind. Equipment must be provisioned properly, and knowledge of RS232 / RS422 electrical interface requirements must be understood. Also with all of this information available for display, choose a nice big display, especially one that can be rotated 90 degrees to display in portrait mode as the river views will be longer and wider.

Most laptops today come with two or more USB ports and an external video port and are small, easy to ship, easy to hook up, and designed for relatively rugged mobile applications, they can provide the best overall solution. Since they are battery powered, there is little need for an un-interruptible power supply. Most come complete with a Kensington cable lock port, can be put into a laptop locking bracket, stored in a locking file cabinet or removed from the vessel when the pilot house is unattended making laptops probably more secure than desktop PCs which would inevitably be left in place when the pilot house is unattended.

9.2 Custom PC Solutions for CEACT Cannel Navigation

Integrating powerful navigation solutions into the limited space confines of the wheelhouse is very important to most vessel operators and pilots. This can be achieved with the latest innovations in the PC. The MINI Cube PC typically occupies less than 1 cubic foot of space allowing it to be mounted in virtually any location and is powerful enough to be one of the first 64 bit PC computing systems on the market. When combined with a 19 inch or larger flat panel LCD monitor with a vesa mount and portrait pro display orientation software it provides the perfect space saving solution for channel navigation.

CEACT Channel Navigation Software automatically configures its chart and menu display areas to take full advantage of portrait mode display systems which allows longer ranges to be utilized.

A simple low cost display filter specially tailored to fit the flat panel display can be Velcro attached to the front of the panel to reduce night-time glare caused by most LCDs available today.

The graphic below shows a mini cube PC outfitted with a 19 inch SXGA flat panel, running CEACT in 1024 X 1280 resolution. CEACT software is set to display in night-time colors with the range presentation set at .25 statute miles. The towboat in the above image is making an approach at Greenup Lock & Dam.

When there isn't enough room to turn around but you still need a really powerful CEACT system a Notebook PC can provide the perfect solution. These rugged little devices built for mobility recently moved ahead of the desktop PC in worldwide sales, and can provide a level of unparalleled flexibility. They can be more secure than a conventional system because there are several methods to prevent theft. Most Notebooks now come standard with a Kensington lock port creating a method to attach steel lanyards. Special lock down mounts made of high strength steel are also available that can be installed between the mounting surface and Notebook. Additionally, when the crew leaves the ship, they can simply lock the unit away in a filing cabinet, or take it with them.

Most Notebooks have an external video output allowing them to drive larger monitors if desired and can be connected to external mouse and keyboards if you prefer these types of devices over those typically installed on the Notebook itself. For power users who want to integrate all of their depth, AIS, and satellite compasses but worry about the number of communication ports the solution can be found by integrating the laptop with a USB to serial port converter. These devices are available in 1 to 16 port configurations and support RS232 or RS422 communication protocols.

Because Notebooks are battery powered, it is not essential to provide battery backup. While display back lights on these devices can cause night-time glare the problem can be solved by Velcro attaching a custom fit filter for night-time use that can simply be removed during daylight hours.

Custom Display Filters can be constructed by laminating 1/8 inch smoked Plexiglases with 5% window tint.

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