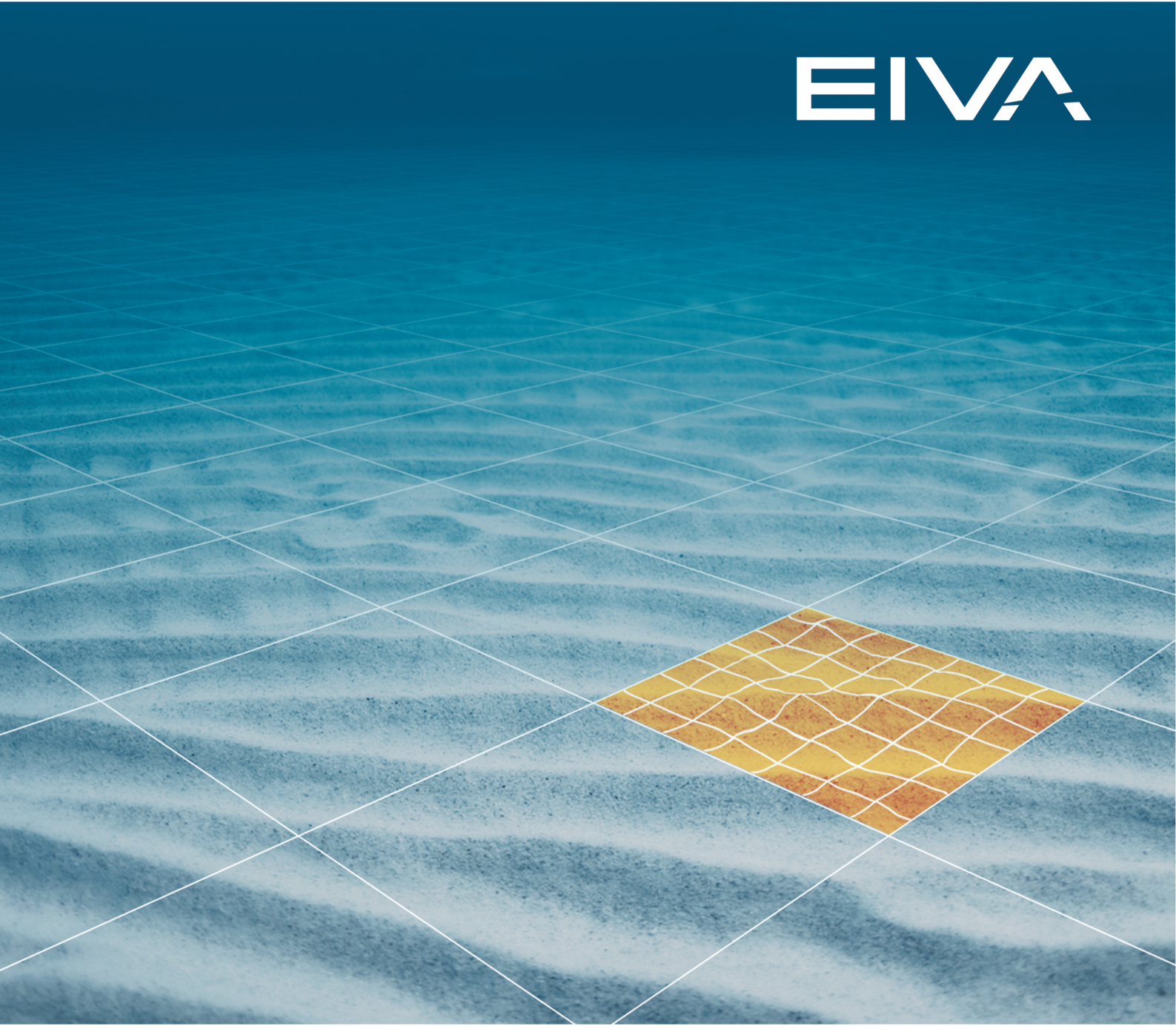


NaviCat User Guide

Last update: 20-04-2022
Version: 4.5

Contents

1 Overview

NaviSuite Beka is a versatile, scalable and user-friendly software solution that increases the efficiency and safety of anchor handling operations during rig move and barge management projects.
NaviCat is part of the **NaviSuite Beka** software package.

The solution combines anchor handling and catenary data acquisition, ROV inspection, and reporting in a single tool that covers both operation planning and execution. This simplifies the work process and reduces the risk of calculation errors that comes with using multiple software tools.

The illustration below shows how NaviCat integrates with other parts of the NaviSuite Beka solution.

Highlights

- Precise positioning through interfacing with NaviPac
- Cable laying through interaction with CableLay
- Advanced 3D display through interfacing with NaviPac or HMD4
- Support for NaviModel DTMs
- And much more...

For further information, please refer to EIVA's website: [NaviSuite Beka]

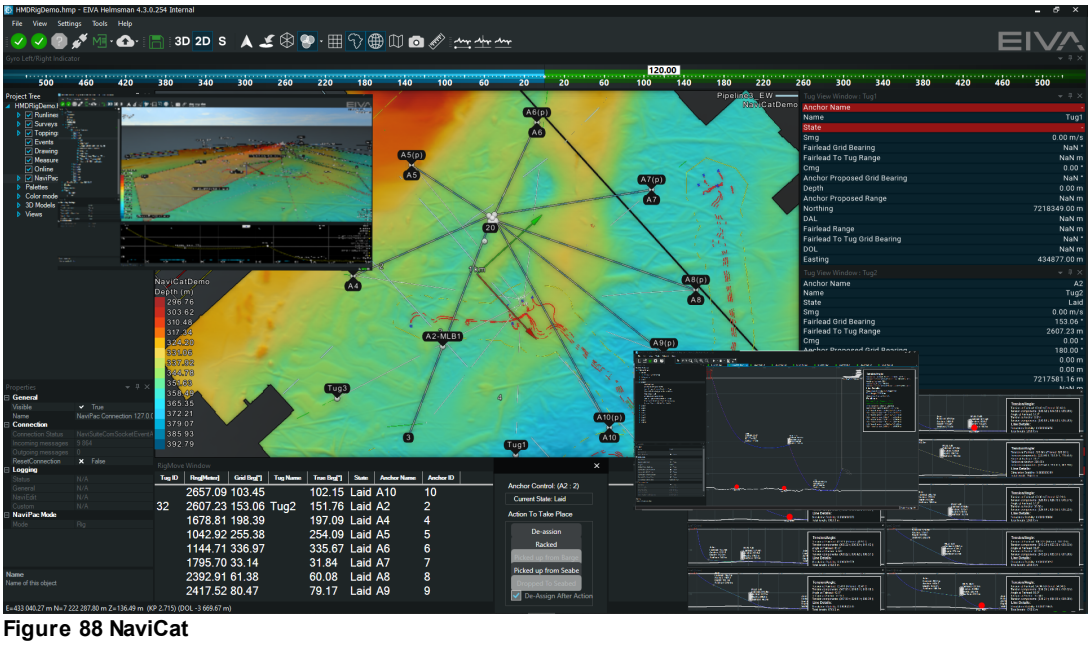


Figure 88 NaviCat

1.1 Installation

NaviCat is distributed as a single installer for Microsoft Windows, supporting all Windows versions from Windows 7 to Windows 10.
Using .NET version 4.7.2, NaviCat offers supports for 64-bit versions of the Windows operating system (OS).

As part of the NaviSuite Beka solution, NaviCat interacts with other NaviSuite applications such as NavPac, Helmsman and NaviModel. More information about NaviSuite Beka can be found on EIVA's website: http://www.eiva.com/products/eiva-software/product-guide/navisuite-beka.

Depending on the requirements and type of job, NaviSuite Beka can run on a single powerful computer or as a distributed solution running on multiple computers. Due to the computational requirements, it is recommended that NaviCat run on a computer of its own. Another rule of thumb is to have one virtual core per catenary being simulated and one reserved for other tasks.

Recommended system requirements for two-computer setup:

Computer 1: NaviPac 4.5 with 2D and 3D visualisation in HMD4

- i5/i7/Quad Core CPU
- Windows 7 64-bit OS
- Graphic Card 1024-MB 3D (Preferably NVIDIA)
- 8-GB RAM or more

Computer 2: NaviCat

- i7 CPU or Quad Core CPU
- Windows 7 64-bit OS
- Graphic Card 512-/1024-MB 3D (Preferably NVIDIA)
- 8-GB RAM or more

Licence
In order to use the full functionality of NaviCat, a hardware dongle should be requested from EIVA a/s. For evaluation, a soft dongle can be requested by sending an email to EIVA Support, please refer to the Request Dongle functionality available from the About box.

For further information and questions about licensing for NaviPac Beka, please contact EIVA a/s.

Silent installation:
In addition to the normal installer NaviCat can be installed silently by invoking the installer with /S. In silent mode the installation directory can be specified using /D. Exemplified below:

NaviCat_4-3.exe /S /? - Display installer options in a message box and exit. No installation is performed.
NaviCat_4-3.exe /S /D=C:\EIVA\NaviCat - Install NaviCat silently in the folder C:\EIVA\NaviCat;
NaviCat_4-3.exe /S - Install NaviCat silently in the system default folder C:\Program Files\NaviCat;
NaviCat_4-3.exe /S /NSM - Install NaviCat silently and skip creation of Start Menu and included shortcuts;

Firewall settings:
When installing NaviCat the installer attempt to add two Inbound rules *NaviCat* to the Windows Defender Firewall. The rule opens for all TCP/IP and UDP ports to NaviCat.exe located in the installation folder. This rule is needed by NaviModel and HMD4 in order to connect to NaviCat and display the catenaries in 3D.

NaviCat is distributed with the IODesiger.exe and SceneServer.exe. Two additional tools for online integration. No firewall rules are added for those applications.

1.2 NaviCat Commandline Arguments

NaviCat can be started using a number of command line arguments for load of project files automatic start of simulation etc. These are mainly used for automated testing of predefined setups as exemplified below:

```
NaviCat.exe /test /autostart /autoclose -itr=75000 -timeoutsec=300
       -resultfile=c:\Test1\NaviCatResult.txt" -reffile=c:
\Test1\NaviCatResult.txt.ref file://c:\Test1\Test1.cat
```

The following commandline parametres are supported for running test simulations:

/test	-Start NaviCat in test mode. Fixed form size of 1024x768 and form caption: NaviCat_UITest <project file loaded>
/autostart	-Automatic start of test run when NaviCat launched and project file or template is loaded.
/autoclose	-Close NaviCat automatically after test run has completed. In case of failure the result file will be loaded in notepad.exe.
-timeoutsec=	-Terminate test run after number of seconds specified, e.g. -timeoutsec=300
-itr=	-Specify number of iterations to run in test, e.g. -itr=50000
-resultfile=	-Test result file, generated whe test run has completes after N iterations, e.g. 50000
-reffile=	-Specify name of reference file to use in test comparer (default = -resultFile + ".ref")
file://	-Specify NaviCat project file to load, e.g. file://c:\nctestfile\test1.cat

The command line properties /autostart and file:// can be used to automatically load and start of project files.

1.3 Documentation and Help

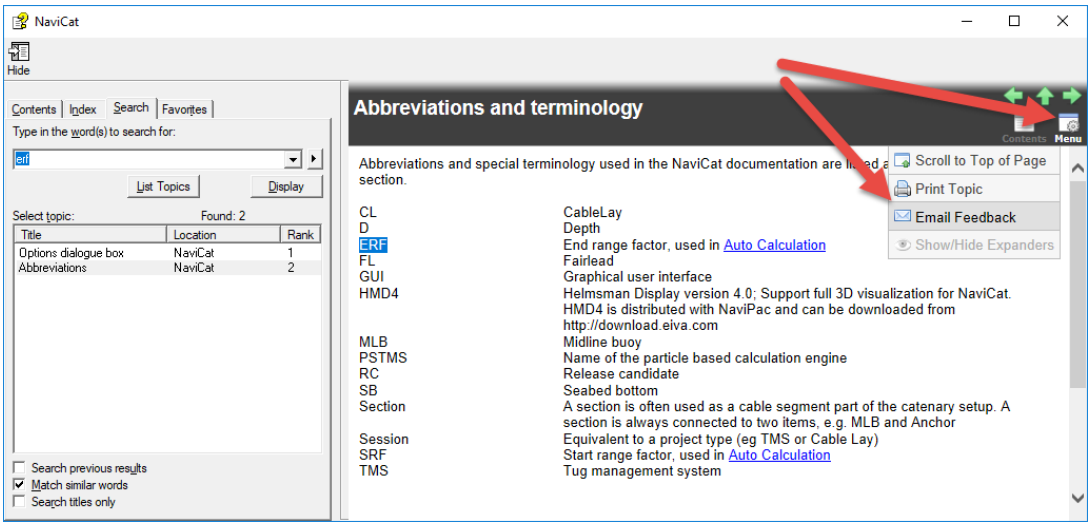
This help documenation is covering NaviCat version 4.5 (Build date:Wednesday, April 20, 2022 00:32:26).

The NaviCat documentation consist of a single pdf file, NaviCat.pdf located in the documentation folder of the NaviCat installation directory.
In addition the latest SceneServer protocol, Online3DProtocol.pdf is distributed with the NaviCat installer too. The SceneServer protocol describe online packages of which some are supported by NaviCat.

NaviCat also support F1 help. F1 context help are supported for certain dialogues, such as libraries and options as well as selected nodes in the project tree such as Line objects.

Improvements of the NaviCat documentation
In case you have comments or requests to the NaviCat documentation, please email support@eiva.com with your comments or suggestions.

On all online help topics, simply click the mail icon as illustrated below. From the launched email client, fill in your comments and send the email.



2 NaviCat

The following paragraphs describe the individual NaviCat components, from GUI layout to supported functionalities, including configuration, modes of operation, network configuration and 3D visualisation.

2.1 Overview

The EIVA NaviCat software option can be used for the simulation of catenary curves part of TMS operations as illustrated below or for simulation of power cables as part of cable lay operations. NaviCat constitutes the calculation core and can interact with other NaviSuite applications such as NaviPac and NaviModel, depending on requirements. All gathered together in the EIVA NaviSuite Beka package.

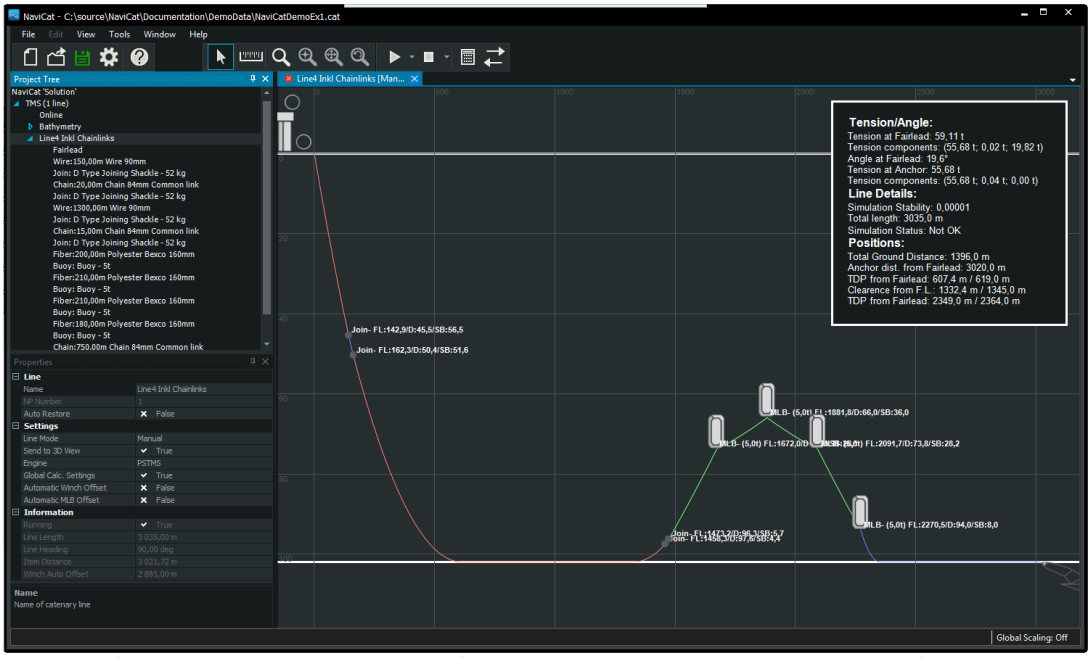


Figure 89 Catenary curve simulation with four MLBs and nine segments containing fibre, chain and wire sections – total length 3,035 metres

NaviCat is easy configurable through its use of predefined **Anchor Library**, **Cable Library**, **Join Library** and **Buoy Library**. NaviCat can operate in manual (planning) mode, where tension, touchdown points (TDP) and numerous other parameters can be investigated, given known anchor or tug positions. All physical parameters such as cable, buoy, anchor types, section lengths, etc can be modified on the fly during the simulation. In manual mode NaviCat can be used to calculate anchor positions, given a known catenary setup and a required angle or tension at the starting base, such as fairlead too.

In online mode, NaviPac can feed NaviCat with online information such as navigational input and anchor states, etc.

Both operational modes manual and online – support visualisation in 3D via NaviPac or NaviModel.

NaviCat supports different types of seabed topography. Fixed depth and NaviModel DTMs can be used for TMS and Cable Lay sessions, and the Cable Lay session furthermore supports profile topography. Also, a single current vector can be applied for the water column, along with pipe structures on the seabed and much more.

2.2 Abbreviations

Abbreviations and special terminology used in the NaviCat documentation are listed and described in this section.

CL	CableLay
CRS	Coordinate Reference System
D	Depth
ERF	End range factor, used in Auto Calculation
FL	Fairlead (Starting Base)
GUI	Graphical user interface
HMD4	Helmsman Display version 4.0; Support full 3D visualization for NaviCat. HMD4 is distributed with NaviPac and can be downloaded from http://download.eiva.com
MLB	Midline buoy
NaviSuite Beka	Software solution for anchor/riser handling and cable/flexpipe lay operations. The software bundle includes the software components: (1) NaviPac Pro, (2) Rig move and tug management option, (3) Catenary and Lay option.
PSTMS	Name of the particle based calculation engine
RC	Release candidate
SB	Seabed bottom
Section	A section is often used as a cable segment part of the catenary setup. A section is always connected to two items, eg MLB and Anchor
SOF	
Session	Equivalent to a project type (eg TMS or Cable Lay)
SRF	Start range factor, used in Auto Calculation
Starting Base	Mandatory root item for a catenary setup. Different item types are supported such as Fairlead, Tug, Winch etc.
TMS	Tug management system

2.3 Geodesy

NaviCat has no support for geodesy eg the user cannot define a project CRS for the anchor spread configured. Currently, no link exists to the EIVA Geodetic repository, the EPSG repository etc.

NaviCat operates in cartesian grid coordinates, x, y and z only. The convention for depth z is positive down. Consequently, all catenary lines hae their position listed as **Position X**, **Position Y** and **Position Z** illustrated below for the anchor object:

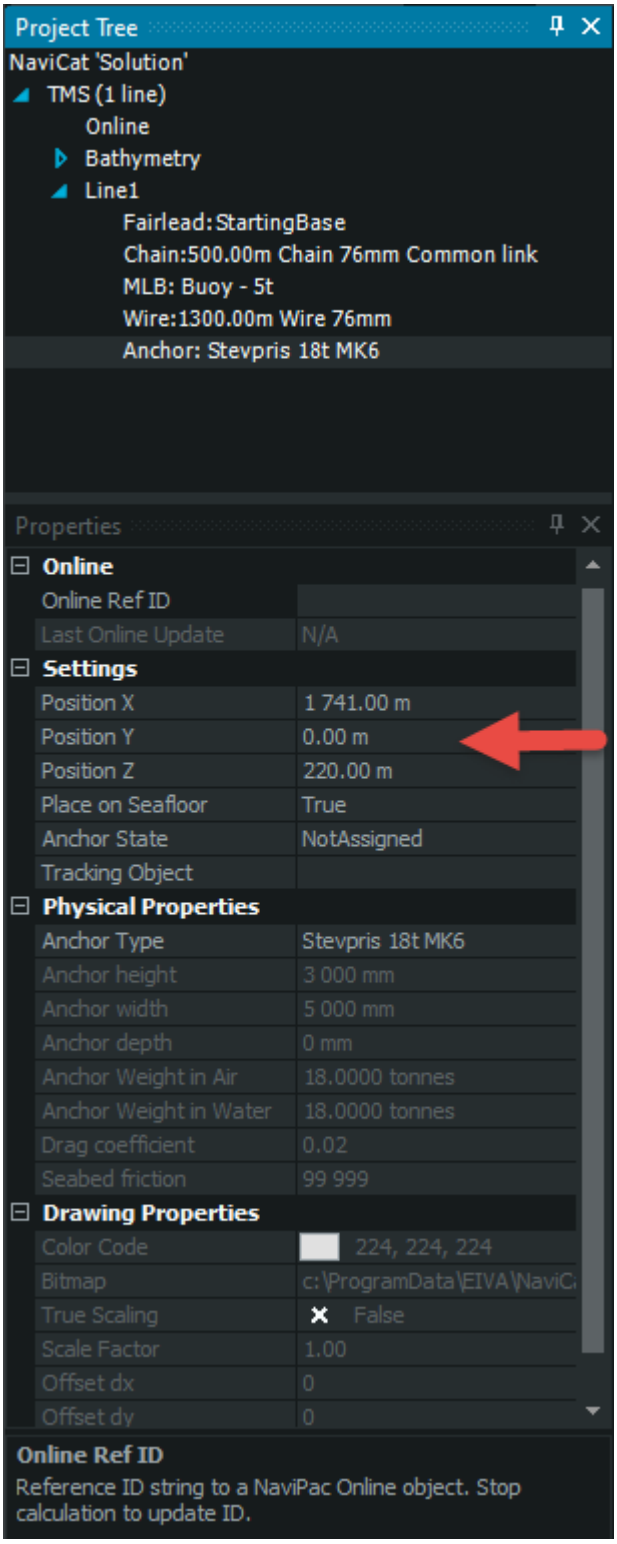


Figure 90 Anchor position in x, y and z

All positions received from NaviPac Online or other sources comply to the Online3D protocol, where coordinates typically are defined as Easting, Northing and Depth. The mapping to the NaviCat coordinates are Position X = Easting, Position Y = Northing and Position Z = Depth.

NaviCat does not support the use of geographic coordinates.

2.4 NaviCat GUI Elements

The NaviCat graphical user interface consists of the elements listed below:

- Main menu
- Toolbar - Collection of tools also available from the Main menu or via the right click context menu in the Project tree.
- Project tree - Project and Catenary Line(s) configuration.
- Property pane - List properties for selected Project tree node.
- Profile view - Catenary display area, including the Calculated parameters display.
- Status bar

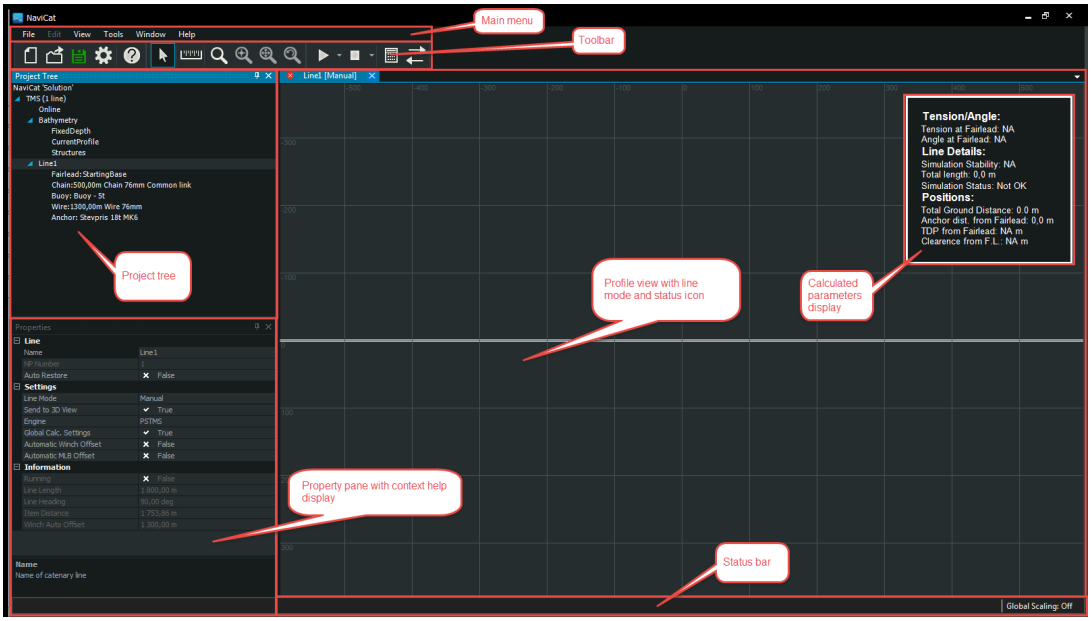


Figure 91 NaviCat GUI elements

2.4.1 Main Menu

From the main menu bar, the operator has access to file specific functionality, view settings, simulation control, global settings, libraries and help. Also, a subset of functionality are accessible from the toolbar and through the right-click shortcut menus and properties of the Project Tree.

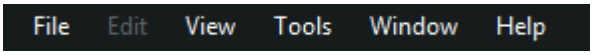


Figure 92 Main menu bar

- File: Provides access to previously loaded projects and the option for creating new project files and templates based on the current configuration, including import and export of zcat archives (*.zcat).
- View: Toggles views of toolbars and the dockable views. Control of calculated parameter displays in the profile view is controlled from this menu too.
- Tools: Start and stop of simulations, input of current and access to anchor estimation. Also, access to the **Anchor Library**, **Buoy Library**, **Join Library** and **Cable Library** as well as global settings for the NaviCat application are provides.
- Windows: Provides options for automatic arrangement of multiple catenary profile and automatic docking functionality.
- Help: Provides access to online Help, release notes and other online resources such as the EIVA training site.

More detailed descriptions of the main menus are presented in the following sections.

2.4.2 Main Menu File

The **File** menu provides access to creation of new TMS and Cable Lay (CL) sessions, including saving and loading of new or existing project files as well as import and export of full projects which includes settings and library references. All of these options are described in more detail below.

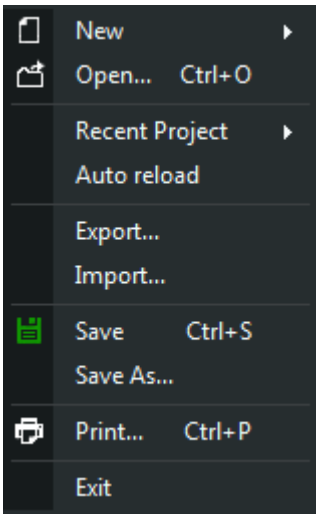


Figure 93 File menu

New
Via the **New** menu command, TMS and Cable Lay sessions can be created. A NaviCat session is equivalent to a project type. Currently, NaviCat supports two types of projects – one for tug management operations and one for cable lay operations. Depending on the

session type, different elements can be used when configuring the project from the right click context menus of the Project Tree.

TMS projects supports multiple catenary lines. Each catenary line can be configured with different types of wires, chains or fibers, MLBs and anchors etc. TMS projects support both modes of operation:

- Planning (manual)
- Online

For planning (manual mode), the operator can manually change the catenary configuration, including length, physical properties and positions for the individual segments or items constituting the catenary line. If changes are made to the configuration, such as adding or removing a MLB or line segment, the simulation must be stopped, the MLB or line segment must be added or removed. Subsequently, the simulation must be restarted. In planning (manual mode) the operator can estimating anchor positions, given at a requested value for tension or angle at starting base, e.g. fairlead too.

Online projects are identical to planning projects, except that online updating takes place for relevant catenary items specified by the user. In order to enter online mode, NaviCat must be connected to a SceneServer, typically running on another NaviPac computer.

Configuration and usage of the different modes of operation supported by NaviCat are described in more detail in the Modes of operation section.

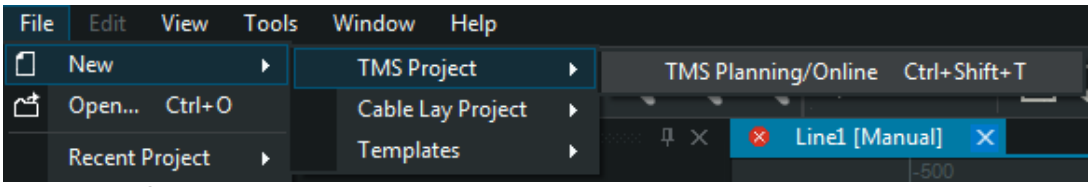


Figure 94 TMS supported project types

NOTE: If a default template has been specified, it will override the default settings for the new TMS Project selected. Default templates are defined in the Options dialogue box in the **Environment Parameters** tab under the **Project Settings** group.

Cable Lay projects contain only one catenary line. Depending on the project type, different calculation engines are supported, as illustrated below.

- CableLay PS: Simulate cable lay using the TMS engine
- CableLay Engine Tension: Simulate cable lay using fairlead tension input
- CableLay Engine Angle: Simulate cable lay using fairlead angle input

In contrast to TMS projects, CableLay projects does not support calculation of anchor position. Also, CableLay projects typically require the use of NaviPac and the CableLay application as well. More information about these topics are found in the Modes of operation section and the NaviCat Cable Lay section.

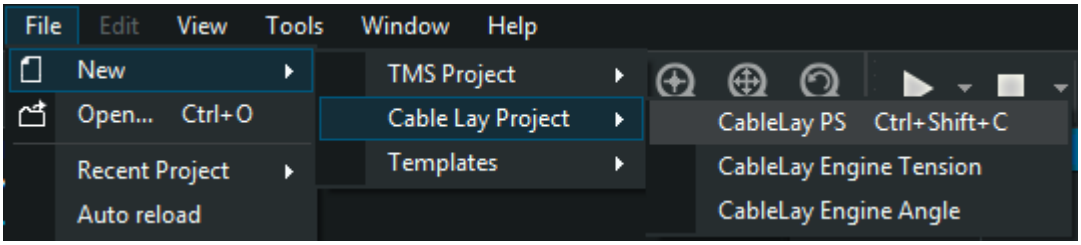


Figure 95 Cable Lay supported project types

NOTE: If a default template has been specified, it will override the default settings for the new Cable Lay Project selected. Default templates are defined in the Options dialogue box in the **Environment Parameters** tab under the **Project Settings** group.

New sessions can also be created directed from a template (.tcat) located in the default template directory. The default template directory is defined in the Options dialogue box in the **Environment Parameters** tab under the **Project Settings** group. All templates located in this directory are accessible by pointing to **New** and then clicking **Templates** in the **File** menu.

Open
Open a standard file browser dialogue box for browsing and selecting a previously saved project file. NaviCat project files have the file extension .cat. If present, the matching .layout file is loaded to ensure that the **Project Tree**, **Properties** pane and line profile forms are placed according to the persisted information.

NOTE: By double-clicking a NaviCat project file (.cat), NaviCat will open and load the selected file.

Recent Project
The **Recent Project** menu command contains a list of project files previously loaded. By pointing to this menu command to open the sub menu, you have easy access to locate and load old projects files.

Auto reload
Auto reload can be toggled on/off. When enabled, the latest project file listed in the **Recent Project** sub-menu will be loaded automatically when NaviCat is launched.

Export
The export function can be used to exchange NaviCat projects between different installations. To use the export function, a project file must be created prior to running the export function. The resulting export is a file named after the project file but given the extension zcat.

The zcat file contains the project file and library files, including the settings in use, from the NaviCat installation from where the export is done.

Import
Import a zcat archive into NaviCat. When doing an import, NaviCat extracts the NaviCat project file to the directory where the zcat file is located.

The library files part of the zcat archive can either overwrite the existing library files, or it can merge into the existing libraries. The operator is prompted for the merge/overwrite option during the import. If the overwrite option is chosen, a backup of the existing libraries is created and placed in the %ProgramData%\Eiva\NaviCat\Backup folder. If a NaviCat project file having the same name as the archive file already exists in the directory containing the archive, the import will fail. In such case, either rename the original project file or copy the zcat archive to a new directory.

Save (Ctrl-S)
Saves changes to the current project file or opens the **Save As** dialogue box if no project has yet been created or loaded.

Save As
A **Save As** dialogue box is provided for saving the current NaviCat configuration to a project file with file extension .cat.

NOTE: When a project file is saved, a layout file is generated next to the .cat project file. Layout files are named after the project file and given the file extension .layout. The file contain layout information for the **Project Tree**, **Properties** pane and profile view forms. The layout file will be loaded automatically when the matching .cat project file is loaded.

NOTE2: When a project file is saved and one or more catenary lines are in **Online Mode** then the each of the Lines in Online Mode is save in Manual mode. This ensure proper start up and initialization of in case the project file is reloaded.

A given setup with one or multiple lines can also be saved as a NaviCat template. NaviCat template files have the file extension .tcat and are used to define default setup scenarios (e.g. when the operator selects to create a new project via the **New** menu command or launches NaviCat without the **Auto reload** function enabled.

The template files can be assigned as the default template for the TMS or Cable Lay session types in the Options dialogue box in the **Environment Parameters** tab under the **Project Settings** group. When located in the default template directory, the template will subsequently be accessible via the **Templates** menu command that can be accessed by clicking **File** and pointing to **New**.

Print (Ctrl-P)
Generate a PDF report for the current Session. An option is provided for loading the PDF file into an associated viewer like the Adobe Acrobat Reader from where the report can be view and printed. PDF Reports can also be generated from the context menu of the Session node by selecting "Print PDF Report...".

Exit
End all running simulations and exit NaviCat.

2.4.3 Main Menu View

The **View** menu controls visibility of the **Project Tree**, **Properties** pane and **Log** window. In addition, visibility of the NaviCat toolbars can be controlled, along with the display of the calculated parameters listed in the profile view.

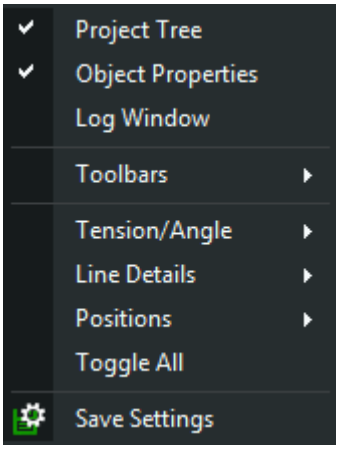


Figure 96 View menu

The terminology used for describing the menu commands in the **View** menu below is based on the illustration describing the NaviCat GUI elements (see paragraph NaviCat GUI elements).

Project Tree
Toggle the view of the **Project Tree** dockable window on/off.

Object Properties
Toggle the view of the **Properties** pane dockable window on/off.

Log Window
Toggle the view of the **Log** window on/off.

Toolbars

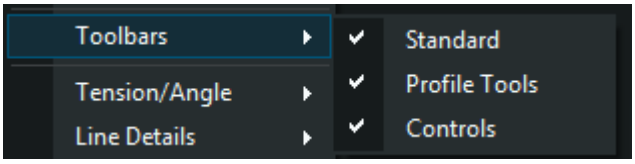


Figure 97 Toolbars submenu

Point to the **Toolbars** menu command to access the **Toolbars** submenu, from which you can toggle the view of the **Standard, Profile Tools** and **Controls** toolbars on/off. The **Standard** toolbar provide easy access to New, Open and Save as well as the Options dialogue and Help. The **Standard** toolbar provide access to the various tools available in the **Profile view,** such as the zooming and measurement tools. The **Control** toolbar provide the option for starting and stopping catenary simulations, enter current vector applied to all running simulations and launch the anchor position calculator dialogue.

Tension/Angle

Toggle parameter display of tension and angles in the profile view on/off.

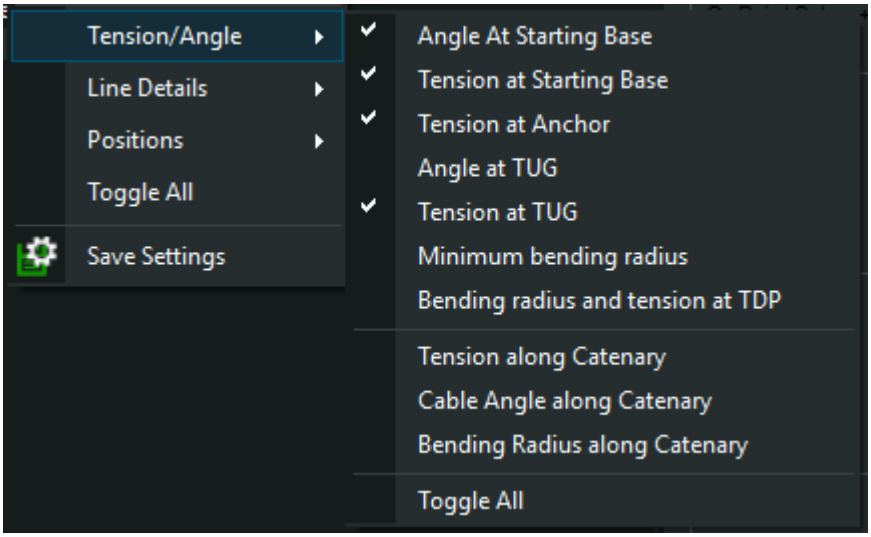


Figure 98 Tension/Angle submenu

The first group of commands in the **Tension/Angle** submenu controls the display of angle and tension at the starting base such as fairlead, anchor and tug. In addition, and mainly used during cable lay operation, the minimum bending radius for the catenary/cable, including bending radius and tension at the first TDP, can be displayed. Tension values are displayed as a total value, followed by its three components – for example, 9.31t (7.92;0.00;4.89)

The second group of commands controls the display of tension, cable angle and bending radius for the individual particle segments along the catenary. Hence, these values are listed along the catenary and not as part of the parameter list displayed in the upper right corner of the profile view.

Clicking **Toggle All** in the **Tension/Angle** submenu toggles all parameters in the **Tension/Angle** submenu on/off.

Line Details

Toggle parameter display of line details in the profile view on/off.

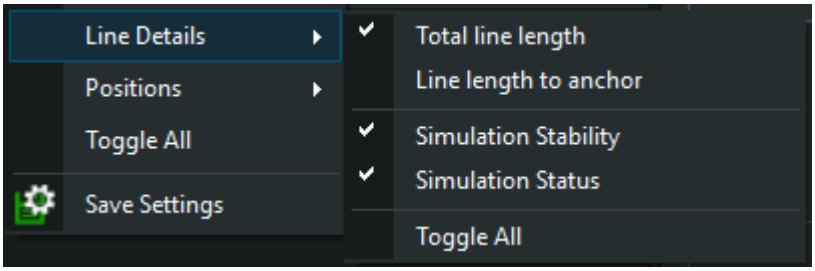


Figure 99 Line Details submenu

Line details provide information about length of the catenary, including length to the anchor, from the fairlead. The total catenary length can also be seen as a property of the **Line** item for a catenary setup listed in the **Project Tree**.

The **Simulation Stability** and **Simulation Status** options provide information about the convergence status for the running simulation. The **Simulation Stability** value is an indication of how much the catenary has moved during a time step. **Simulation Status** is shown as green (acceptable) if the stability is below the defined stability threshold, otherwise it is displayed in black (not acceptable). The **Stability Threshold** value can be adjusted in the Options dialogue box in the **Environment Parameters** tab under the **Particle System** group.

Clicking **Toggle All** in the **Line Details** submenu toggles all parameters in the **Line Details** submenu on/off.

Positions

Toggle parameter display of positions in the profile view on/off.

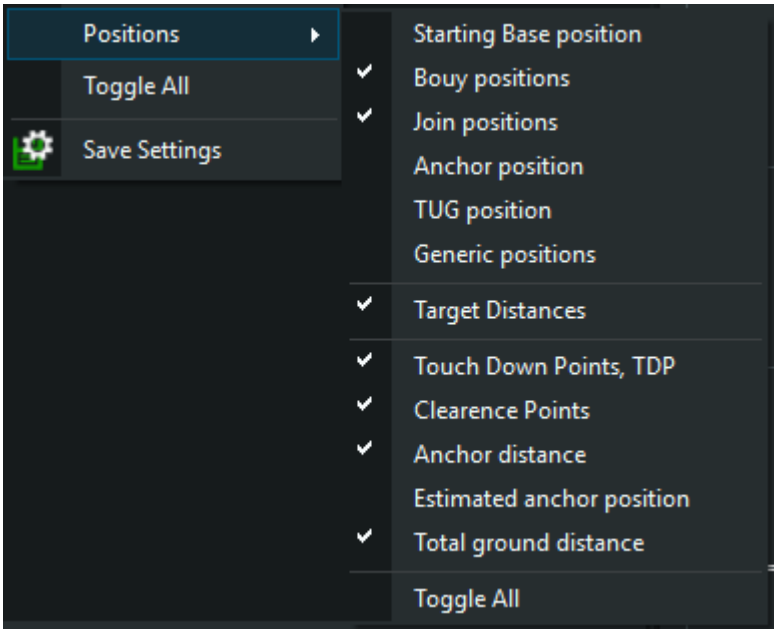


Figure 100 Positions submenu

The **Positions** sub-menu commands are grouped in positions for individual items, such as Starting Base, Anchor, MLBs, Joins etc. As illustrated in Figure 13, the position information is shown next to the item in the profile view in the format:

Item Type, e.g. *MLB: 5.0t*
Horizontal distance to Starting Base, e.g. *Fairlead: 441.2m*
Horizontal distance to Anchor, e.g. *Anchor: 1299.8m*
Item Depth, e.g. *Depth: 212.6m*
Distance to Seafloor, e.g. *Seafloor 7.4m*

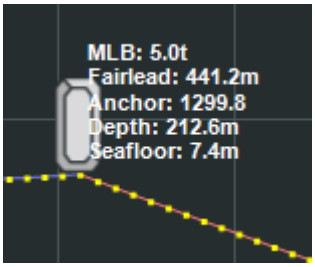


Figure 101 Item position illustrated for a 5-tonne MLB

The absolute position for a catenary item can be found in the **Properties** pane by selecting the catenary item in the **Project Tree**. Absolute positions are often referred to as (X,Y,Z) or (X,Y,Depth).

- X: Easting in metres.
- Y: Northing in metres.
- Z/Depth: Depth in metres. Depth is per definition positive down (i.e. elevations above the water surface are negative).

The next group of parameters contains information about:

- **Touch Down points, TDP**: Distance to TDP point(s), given as two values *Horizontal distance from fairlead* / *Length along catenary to the TDP.*
- **Clearence Points**: Same as for TDP, except that clearance is where the catenary curve leaves the seabed.
- **Anchor distance**: Horizontal distance to the anchor from fairlead.
- **Estimated anchor position**: If the anchor is located in the water columns (eg in the process of being laid). This property indicates the estimated anchor position given in horizontal distance from the fairlead, and a read dot is drawn in the profile view in order to indicate this position.
- **Total ground distance**: Total length of the catenary segments lying on the seabed.

Clicking **Toggle All** in the **Positions** submenu toggles all parameters in the **Positions** submenu on/off.

Toggle All
Clicking **Toggle All** in the **View** menu toggles all parameters in the **Tension/Angle**, **Line Details** and **Positions** submenus on/off.

Save Settings
Click **Save Settings** to save the current selection of parameters displayed in the profile view.

2.4.4 Main Menu Tools

The **Tools** menu provides access to NaviCat libraries used when configuring catenary lines and global settings. It also provide access to basic controls such as start and stop of catenary simulations, estimate anchor positions given a user specified tension or angle value at starting base and the option to apply a current field to the running simulations. Detailed information about the various controls can be found in the Toolbars Controls section.

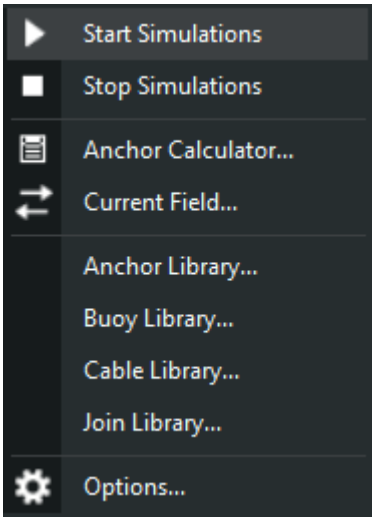


Figure 102 Tools menu

NaviCat supports libraries for anchors, buoys, cables and joins. The libraries are configured with a number of items but can easily be extended to contain user-defined items. Detailed information about each type of library, including how it can be extended, is described in the NaviCat libraries section.

The **Options** dialogue box provides access to global settings for NaviCat. This includes the following tabs:

- **Environment Parameters**: Settings relevant for the calculation engine such as physical constants.
- **Display Settings**: Settings relevant for the profile view such as seabed colour and font settings.
- **Tension Alarms**: Settings for tension and bending radius alarms.
- **Auto Calculation**: Settings used when anchor position or catenary length is estimated given a requested angle or tension at the starting base, e.g. fairlead. These settings are relevant for TMS sessions only when operating in manual mode (planning).
- **Communication Settings**: Settings used when catenary curves are displayed in 3D or when operating in Online mode.

Detailed information about settings can be found in the Options dialogue box section.

2.4.5 NaviCat Libraries

NaviCat supports the creation and maintenance of user-defined libraries for anchor, buoy, cable and join items. All libraries can be accesses from the **Tools** menu.

When NaviCat is initially installed, default libraries are made available. These default libraries can be modified to match requirements. All library files are stored in XML format.

For easy configuration, all library **Repository** items can be cloned, simply by right-clicking the desired item and in the menu that opens, clicking **Copy Anchor**, **Copy Buoy**, **Copy Cable** or **Copy Join**, respectively.

All items from the supported libraries can be selected from a drop-down list during the catenary configuration taking place in the NavCat **Project Tree**.

Anchor Library

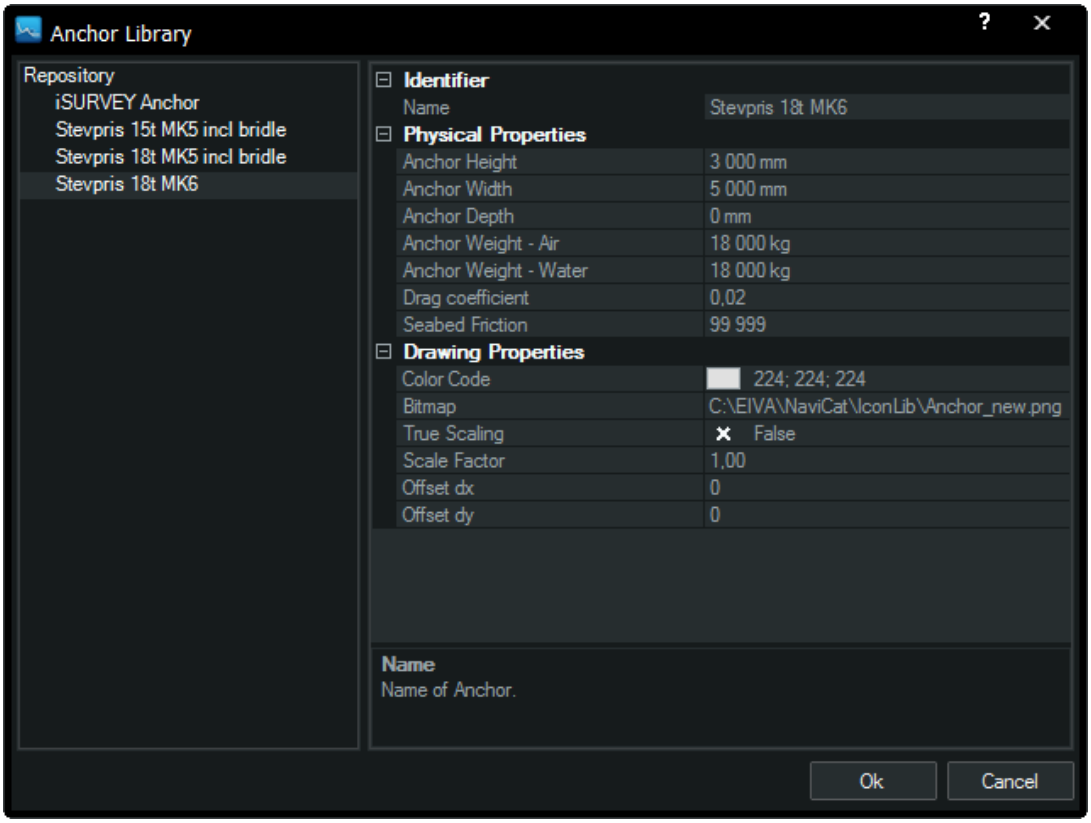


Figure 103 Anchor Library

Identifier

- **Name**: Name of anchor.

Physical Properties

- **Anchor Height**: Upright height of anchor, in millimetres.
- **Anchor Width**: Upright width of anchor, in millimetres.
- **Anchor Depth**: Upright depth of anchor (ie size of dimension into the 2D plane), in millimetres.
- **Anchor Weight - Air**: Weight of anchor, in air kilograms.
- **Anchor Weight - Water**: Weight of anchor, in water kilograms.
- **Drag coefficient**: Drag coefficient in water, dimensionless scalar.
- **Seabed Friction**: Seabed friction coefficient, dimensionless scalar.

Drawing Properties
- **Color Code**: Colour code for anchor symbol. The colour is not applied if a bitmap symbol is assigned.
- **Bitmap**: Bitmap to symbolise an anchor. Fully qualified path must be specified. Formats supported are BMP and PNG, see %ProgramData%\EIVA\NaviCat\IconLib.
- **True Scaling**: Only valid for bitmap usage. Set to **True** to set bitmap size to item size in metres. Set to **False** to use bitmap size in pixels (default = **False**).
- **Scale Factor**: Scale factor is an isotropic factor used for scaling the symbol bitmap according to its true scaling of bitmap size (default = **1.00**).
- **Offset dx**: Offset in centimetres/pixels depending on the **True Scaling** setting.
- **Offset dy**: Offset in centimetres/pixels depending on the **True Scaling** setting.

All defined anchors are listed in the **Repository** list. The default anchor is the first anchor in the list (eg for the example in Figure 15, the **iSURVEY Anchor** is used as the default. The default anchor is assigned for new setups not based on a template or whether a NaviCat project file is loaded without a matching anchor existing in the library.

Each anchor can be moved up or down in the list by right-clicking the desired anchor and in the menu that opens, clicking **Move Up** or **Move Down**. To select a new default anchor, repeat the process of clicking **Move Up** until the desired anchor is placed as the first one in the **Repository** list. Click **Ok** to save settings.

Buoy Library

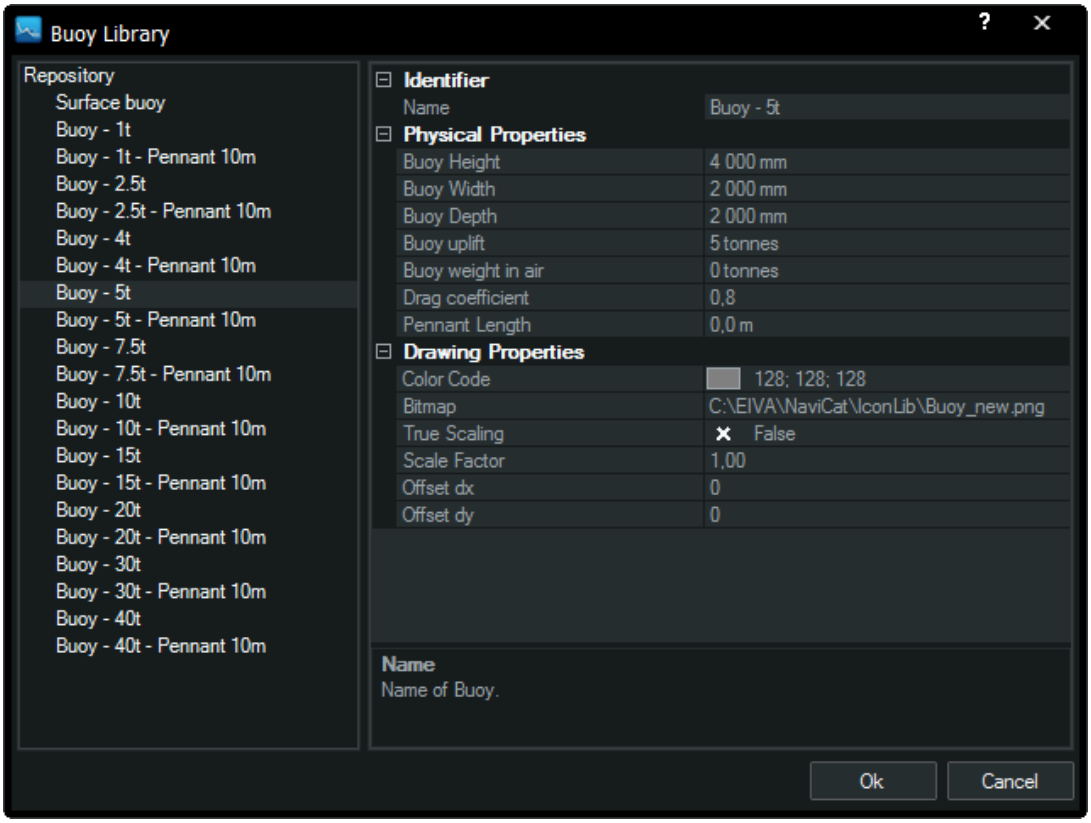


Figure 104 Buoy Library

Identifier
Name: Name of buoy.

Physical Properties
Buoy Height: Height of buoy, in millimetres.
Buoy Width: Width of buoy, in millimetres.
Buoy Depth: Depth of buoy (ie size of dimension into the 2D plane), in millimetres.
Buoy Uplift: Buoyancy in water, in tonnes. Value specified must be positive.
Buoy weight in air: Buoy weight above water, in tonnes.
Drag coefficient: Drag coefficient of the buoy in water, dimensionless scalar.
Pennant Length: Pennant length, in metres.

Drawing Properties
Color Code: Colour code for buoy type. The colour is not applied if a bitmap symbol is assigned.
Bitmap: Bitmap to symbolise a buoy. Fully qualified path must be specified. Formats supported are BMP and PNG, see %ProgramData%\EIVA\NaviCat\IconLib.
True Scaling: Only valid for bitmap usage. Set to **True** to set bitmap size to item size in metres. Set to **False** to use bitmap size in pixels (default = **False**).
Scale Factor: Scale factor is an isotropic factor used for scaling the symbol bitmap according to its true scaling of bitmap size (default = **1.00**).
Offset dx: Offset in centimetres/pixels, depending on the **True Scaling** setting.

Offset dy: Offset in centimetres/pixels, depending on the **True Scaling** setting.

All defined buoys are listed in the **Repository** list.The default buoy is the first buoy in the list (eg for the example in Figure 16, the **Surface buoy** is used as the default. The default buoy is assigned for new setups not based on a template or whether a NaviCat project file is loaded without a matching buoy existing in the library.

Each buoy can be moved up or down in the list by right-clicking the desired buoy and in the menu that opens, clicking **Move Up** or **Move Down**. To select a new default buoy, repeat the process of clicking **Move Up** until the desired buoy is placed as the first one in the **Repository** list. Click **Ok** to save settings.

Join Library

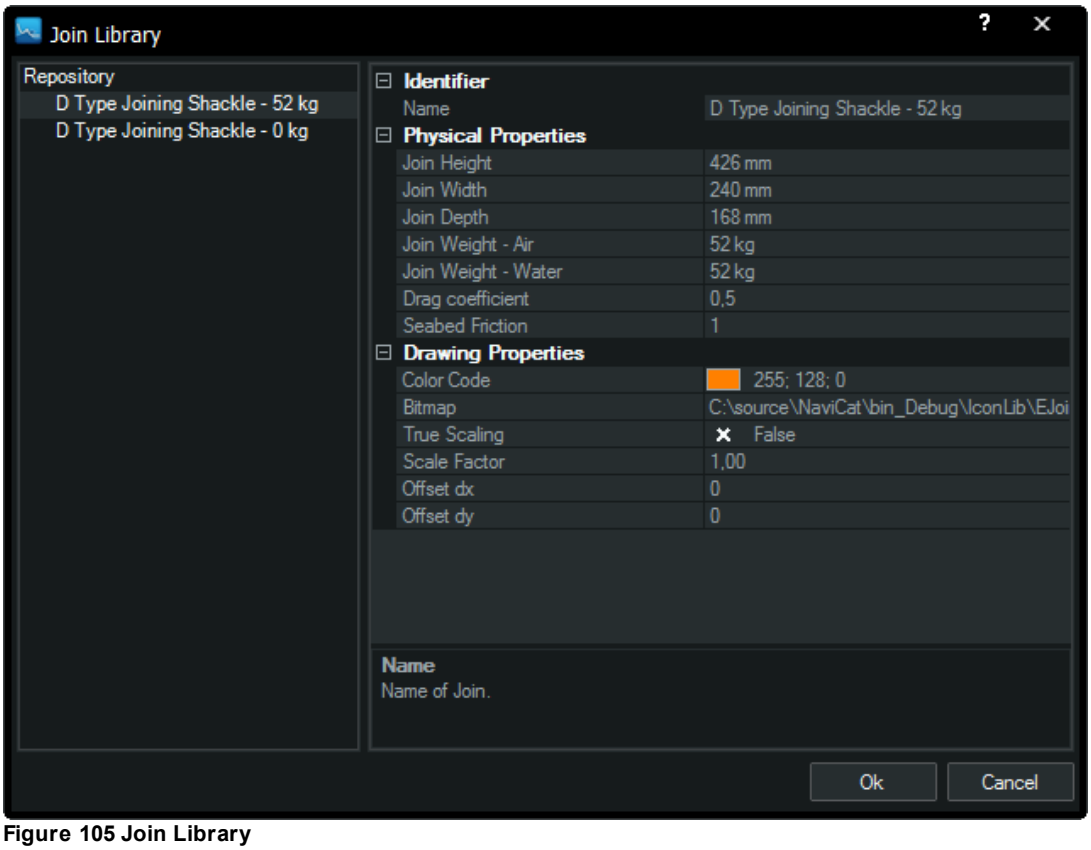


Figure 105 Join Library

Identifier

Name: Name of join.

Physical Properties

Join Height: Upright height of join, in millimetres.
Join Width: Upright width of join, in millimetres.
Join Depth: Upright depth of join (ie size of dimension into the 2D plane), in millimetres.

Join Weight - Air: Weight of join, in air kilograms.
Join Weight - Water: Weight of join, in water kilograms.
Drag coefficient: Drag coefficient in water, dimensionless scalar.
Seabed Friction: Seabed friction coefficient, dimensionless scalar.

Drawing Properties
Color Code: Colour code for join symbol. The colour is not applied if a bitmap symbol is assigned.
Bitmap: Bitmap to symbolise a join. Fully qualified path must be specified. Formats supported are BMP and PNG, see %ProgramData%\EIVA\NaviCat\IconLib.
True Scaling: Only valid for bitmap usage. Set to **True** to set bitmap size to item size in metres. Set to **False** to use bitmap size in pixels (default = **False**).
Scale Factor: Scale factor is an isotropic factor used for scaling the symbol bitmap according to its true scaling of bitmap size (default = **1.00**).
Offset dx: Offset in centimetres/pixels, depending on the **True Scaling** setting.
Offset dy: Offset in centimetres/pixels, depending on the **True Scaling** setting.

All defined joins are listed in the **Repository** list. The default join is the first join in the list (eg for the example in Figure 17, the **D Type Joining Shackle - 52 kg** is used as the default. The default join is assigned for new setups not based on a template or whether a NaviCat project file is loaded without a matching join existing in the library.

Each join can be moved up or down in the list by right-clicking the desired join and in the menu that opens, clicking **Move Up** or **Move Down**. To select a new default join, repeat the process of clicking **Move Up** until the desired join is placed as the first one in the **Repository** list. Click **Ok** to save settings.

Cable Library

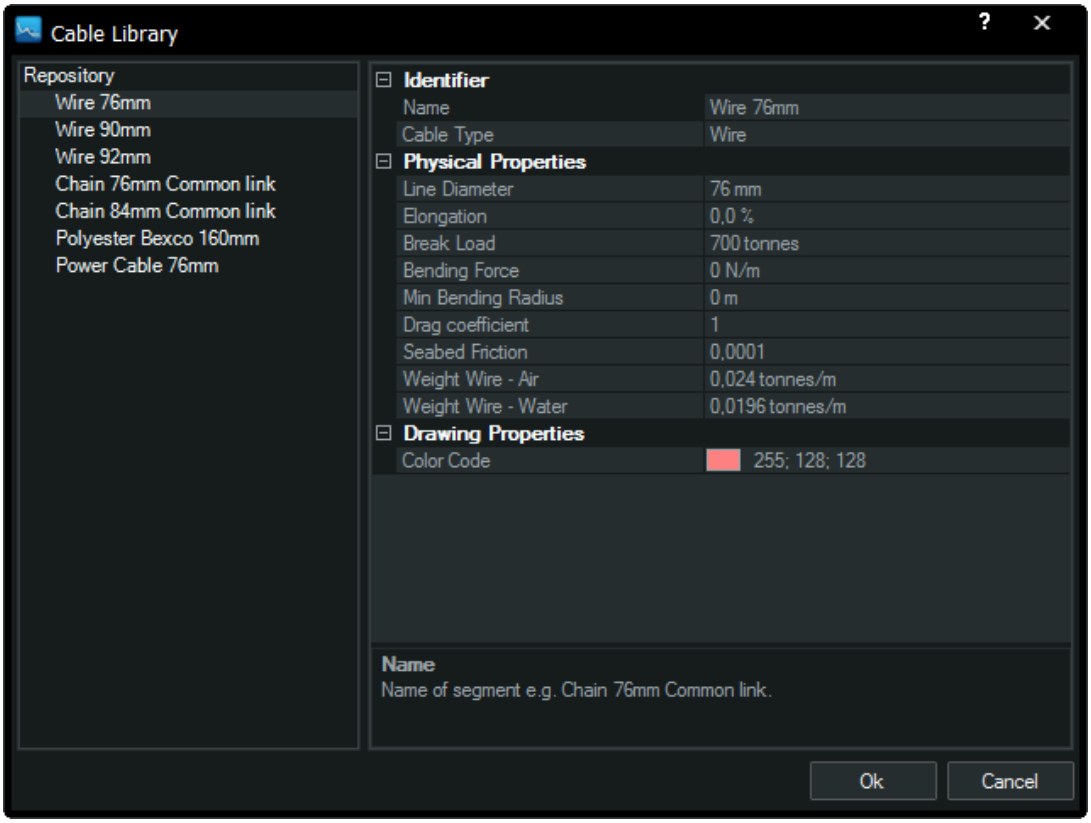


Figure 106 Cable Library

Identifier
Name: Name of segment (eg **Chain 76mm Common link**).
Cable Type: Cable type (eg **Chain**, **Fibre**, **Wire** or **Cable**).

Physical Properties
Line Diameter: Line diameter, in millimetres.
Elongation: Elongation, in percentage. Normally, the elongation is between 0% and 3%. When applied, the original mass for the segment is preserved – that is, the mass per unit length is reduced by the elongation factor.
Break Load: Load at which the cable breaks, in tonnes.
Bending Force: Bending force, in Newton per metre (N/m).
Min Bending Radius: Minimum bending radius for cable, in metres. **Note**: A value of **0.0** indicates that **Bending Force** and **Radius** are disregarded (eg for **Chain**).
Drag coefficient: Drag coefficient in water, dimensionless scalar.
Seabed Friction: Seabed friction coefficient, dimensionless scalar.
Weight *Cable type* - Air: Weight in air per metre of cable type, in tonnes per metre. Cable weight in air must be positive and above 0.001 kg/m.
Weight *Cable type* - Water: Weight in water per metre of cable, in tonnes per metre. Cable weight must be different from 0.0 t/m and outside the range]-0.001 kg/m..0.001 kg/m[.

NOTE: Depending on the setup it might be necessary to decrease the time step settings from its default value in situations where cable weights are close to zero tonnes per metre.

Drawing Properties
Color Code: Colour code for cable section type. The colour can be overwritten by the colour specified for tension or bending radius alarms.

All defined cables, wires, fibres and chains defined are listed in the **Repository** list.The default cable item is the first cable item in the list (eg for the example in Figure 18, the **Wire 76mm** is used as the default. The default cable item is assigned for new setups not based on a template or whether a NaviCat project file is loaded without a matching cable item existing in the library.

Each cable item can be moved up or down in the list by right-clicking the desired cable item and in the menu that opens, clicking **Move Up** or **Move Down**. To select a new default cable item, repeat the process of clicking **Move Up** until the desired cable item is placed as the first one in the **Repository** list. Click **Ok** to save settings.

2.4.6 Options Dialog

Global settings relevant for calculations and UI settings can be configured from the **Options** dialogue box, which is available from the **Tools** menu.

Note: For each property, a descriptive text is provided in the tooltip bar below the dialogue box's properties pane.

Environment Parameters
Define global settings for calculation, angle convention, etc.

Figure 107 Environment Parameters

Particle System

- **Particle Distance**: Distance between particles, in metres (default = **1.0**).
- **Stability Threshold**: Threshold value for the stability criteria of the particle system (default = **5E-5**).
- **Stability Threshold 3D**: Threshold value for the 3D stability criteria of the Particle System used for updating the 3D view. This value must exceed the Stability Threshold value (**default = 1E-2**).
- **Speed Payout**: Payout speed for segment closest to starting base, e.g. fairlead, in metres per second (default = **2.0 m/s**). Note that the speed specified is simulation speed and depends on the **Time Step** setting and the catenary setup.
- **Speed Object**: Speed at which objects are moved when a new position has been specified – for example, when moving an anchor. The velocity is in metres per second (default = **10.0 m/s**). Note that the speed specified is simulation speed and depends on the **Time Step** setting and the catenary setup.
- **Time Step**: Time step, in seconds (default = **0.003 s**). Decrease the value to increase stability. Increase the value for better performance – this can to some extent compensate for drag slowdown in convergence but might also introduce oscillations of the setup being simulated if the **Time Step** value is too large.

- **Subdivision Stability Threshold**: Stability threshold, in metres (default = 1E-4). Control when new particles are inserted and an average distance of particle movement per simulation time step. Values should be in the range of 1E-3 to 1E-6. Note that no further particles are inserted when the Particle Distance (Default=1.0m) is reached.
- **Initial Particles**: Number of initial particles used during catenary initialization (default = 30). For a catenary chain of length 1800 meter, this result in an initial particle distance of 1800m / 30 equal to 60 meters.
- **TDP and Clearance threshold**: Threshold value for TDP and clearance, in metres. Valid range: 0.00001–10.00 metres (default = **0.001 m**). This value indicates how close the catenary segment must be to the seabed before it is regarded as a TDP or clearance point. Using a fixed depth bathymetry, this value can be decreased below the default value for a more accurate estimation of TDP and clearance points. When using a DTM with an undulating topography, this value can be increased to reduce the total number of TDP and clearance points.
- **TDP Stability Offset**: Stability offset to current TDP, in metres (default = **-1.0 m** (ie disabled)). If defined – that is, if the value is higher than 0.0 metre – then all particles at distance length to TDP + offset are regarded as being stable. This value should be defined for Cable Lay sessions.
- **Default Calc Engine**: Default version for catenary calculation engine used. Each line can have individual engines. Refer to online documentation for further information (default = **PSTMS**).

NOTE:
During online simulation a reasonable ration must exist between payout speed and object speed in order to avoid that the catenary get over stretched, e.g. starting base is moving faster that the payout speed.

Physical Constants
- **Gravity**: Gravity, in metres per second squared (default = **9.82 m/s^2**).
- **Air Density**: Density of air, in kilograms per cubic metre (default = **1.20 kg/m^3**).
- **Water Density**: Density of water, in kilograms per cubic metre (default = **1026.00 kg/m^3**).

Length from Tension
Settings used by the Length from Tension regulation, see HowTo - Length from Tension Regulation
- **Position Update Interval**: Online position update interval when using Length From Tension [ms] (default = **30000 ms**).
- **Tension Target Resolution**: Resolution of tension target. Length is adjusted until length match target tension within the specified resolution range [ton] (default = **0.5 ton**).
- **Restart Length Adjustment Factor**: Factor of water depth at Fairlead to be added the initial total segment length given by |Fairlead..Anchor/Tug| distance (Default=**0.1**).
- **Emergency Payout Threshold**: Emergency Payout Threshold [ton] (Default=**300 ton**). When Fairlead tension exceed the threshold value the inner segment length is increased in steps of Emergency Payout Length.
- **Emergency Payout Length**: Emergency Payout Length [m] (Default=**0.5 m**). When Fairlead tension exceed the threshold value the inner segment length is increased in steps of Emergency Payout Length.

- **Emergency Payout Factor**: Emergency Payout Factor (Default=**1.0**). A factor multiplied to the specified Payout Speed when performing Emergency Payout.
- **Fast Payout Factor**: Fast Payout Factor (Default=**1.0**). A factor multiplied to the specified Payout Speed when performing Fast length adjustment.

Project Settings
- **Template Directory**: The location for the NaviCat template directory (default = *%ProgramData%*\EIVA\NaviCat\Templates).
- **Default Template CableLay**: The default template for Cable Lay sessions. Valid template files (.TCAT) must be located in the NaviCat template directory.
- **Default Template CableLay Tension**: The default template for Cable Lay sessions using the **CableLay Tension Engine**. Valid template files (.TCAT) must be located in the NaviCat template directory.
- **Default Template CableLay Angle**: The default template for Cable Lay sessions using the **CableLay Angle Engine**. Valid template files (.TCAT) must be located in the NaviCat template directory.
- **Default Template TMS**: The default template for TMS sessions. Valid template files (.TCAT) must be located in the NaviCat template directory.
- **Default Project Type**: The default project type for new sessions. This setting is overwritten by the default templates.
- **Use Angel convention 90-0**: Set to **True** for angle convention 90-0 (ie 90° = horizontal and 0° = vertical), or set to **False** for the opposite (ie 0° = horizontal and 90° = vertical) (default = **True**).

NOTE:
When operating in Online Mode where length and positions are updated continuously it might be necessary to change the Payout and Object speed to identical values, e.g. 2 m/s.

NOTE2:
Special configuration settings might be required in case shallow water setups, see HowTo - Shallow Water Configuration and in case the catenary length is adjusted online from tension input, see HowTo - Length from Tension Regulation

Display Settings
Define global settings for display, such as font size, colours etc.

Note: Select colours that do not conflict with colours used to represent catenary sections or items, including bitmaps representing items.

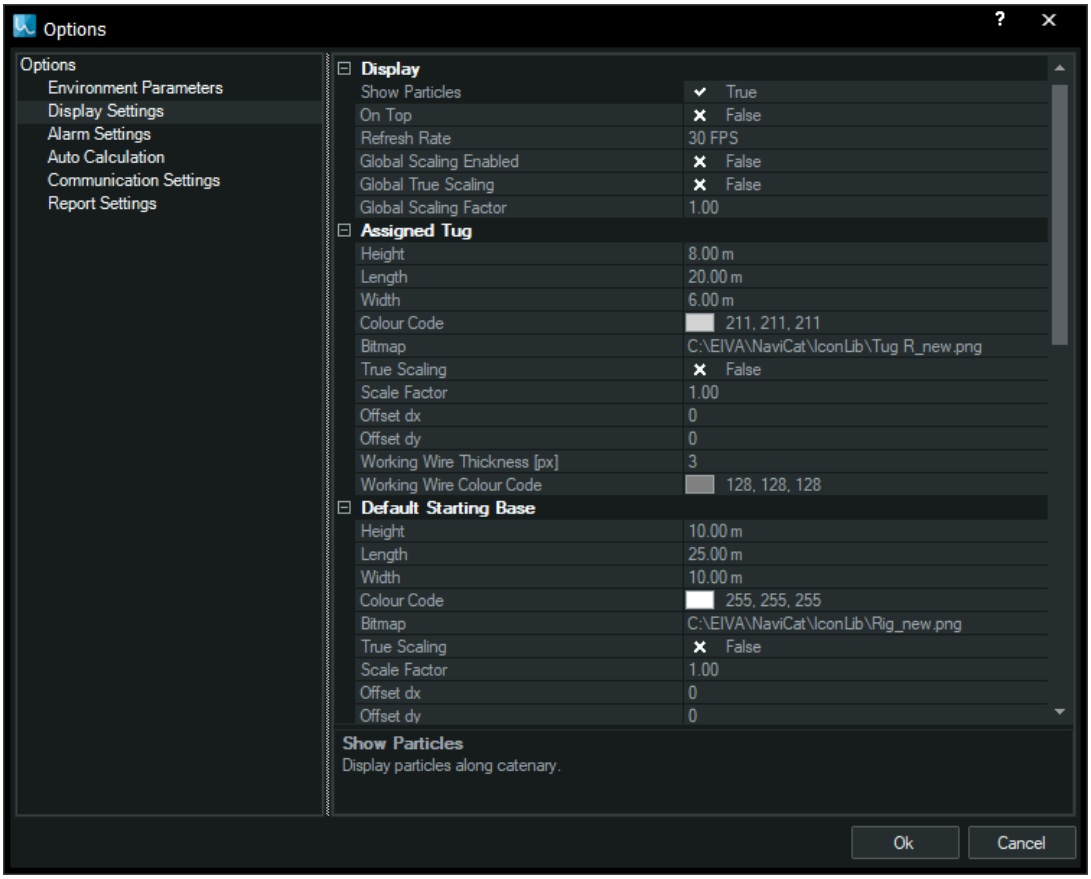


Figure 108 Display Settings 1/2

Display

- **Show Particles**: Display particles along catenary curves. Particles are shown as blue dots.
- **On Top**: Set to **True** to place NaviCat on top of other Windows applications.
- **Refresh Rate**: Update frequency, in frames per second (FPS) for the 2D profile (default = **30 FPS**).
- **Global Scaling Enabled**: Set to **True** to enable the application of global scaling parameters on all line items when displayed (default = **False**). An indicator is located in the bottom right corner of the status bar in the main NaviCat window, as shown in Figure 21.

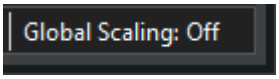


Figure 109 Global Scaling status bar indicator

If **Global Scaling Enabled** is set to **True**, then the **Global True Scaling** and **Global Scaling Factor** settings will overwrite the **True Scaling** and **Scale Factor** settings set for the individual catenary items, such as fairlead, MLBs and anchors.

- **Global True Scaling**: Global true scaling is applied on bitmap symbols only and for all catenary line items if the **Global True Scaling** setting is set to **True** (default = **False**). If **True Scaling** is set to **True** for an individual catenary item, then the associated bitmap or

box will be scaled according to the length and height properties defined for the item. If **True Scaling** is set to **False** for an individual catenary item, then the size of the bitmap in pixels will be drawn directly in the profile view.
- **Global Scaling Factor**: Global scale factor applied for all catenary line items if the **Global True Scaling** setting is set to **True**. (default = **1.00**). If **Global True Scaling** is set to **False**, the scale factor is applied according to the object size in pixels. If **Global True Scaling** is set to **True**, the scale factor is applied according to the object size specified in metres.

Assigned Tug
- **Height**: Height of the tugboat assigned to anchor, in metres.
- **Length**: Length of the tugboat assigned to anchor, in metres.
- **Width**: Width (into the plan of the catenary profile) of the tugboat assigned to anchor, in metres.
- **Color Code**: Colour code for the tugboat assigned to anchor. This colour is used if no bitmap has been specified.
- **Bitmap**: Bitmap to symbolise the assigned tugboat. Fully qualified path must be specified. Formats supported are BMP and PNG bitmaps. If no bitmap is specified, the default startup directory is the bitmap library distributed as part of the NaviCat installer, see % ProgramData%\EIVA\NaviCat\IconLib.
- **True Scaling**: Only valid for bitmap usage. Set to **True** to set bitmap size to item size in metres – the bitmap will then be displayed according to the scaling of the profile view. Set to **False** to use bitmap size in pixels (default = **True**).
- **Scale Factor**: Scale factor is an isotropic factor used for scaling the symbol bitmap according to its true scaling of bitmap size (default = **2**).
- **Offset dx**: Offset in centimetres/pixels, depending on the **True Scaling** setting.
- **Offset dy**: Offset in centimetres/pixels, depending on the **True Scaling** setting.
- **Working Wire Thickness [px]**: Working wire thickness in pixels (default = **3**). Shown when the anchor is being deployed or laid and consequently located between the assigned tug and the seabed.
- **Working Wire Color Code**: Colour code for the working wire used during simulation of anchor handling.

Note:
The *Offset* is in centimetres. Hence, if an object has a length of 100 metres, **Offset dx** must be set to **10000** in order to add an offset equivalent to the length of the object.

Default Starting Base
- **Height**: Default height of fairlead object, in metres. This value is overwritten by project files or templates.
- **Length**: Default length of fairlead object, in metres. This value is overwritten by project files or templates.
- **Width**: Default width (into the plan of the catenary profile) of fairlead object, in metres. This value is overwritten by project files or templates.
- **Color Code**: Default colour code for fairlead object. This value is overwritten by project files or templates.
- **Bitmap**: Bitmap to symbolise the fairlead object. Fully qualified path must be specified. Formats supported are BMP and PNG bitmaps. This value is overwritten by project files or

templates. If no bitmap is specified, the default startup directory is the icon library distributed as part of the NaviCat installer, see %ProgramData%\EIVA\NaviCat\IconLib.

- **True Scaling**: Only valid for bitmap usage. Set to **True** to set bitmap size to item size in metres. Set to **False** to use bitmap size in pixels (default = **True**). This value is overwritten by project files or templates.
- **Scale Factor**: Scale factor is an isotropic factor used for scaling the symbol bitmap according to its true scaling of bitmap size (default = **2**). This value is overwritten by project files or templates.
- **Offset dx**: Offset in centimetres/pixels, depending on the **True Scaling** setting. This value is overwritten by project files or templates.
- **Offset dy**: Offset in centimetres/pixels, depending on the **True Scaling** setting. This value is overwritten by project files or templates.

Note: The offset is in centimetres. Hence, if an object has a length of 100 metres, **Offset dx** must be set to **10000** in order to add an offset equivalent to the length of the object.

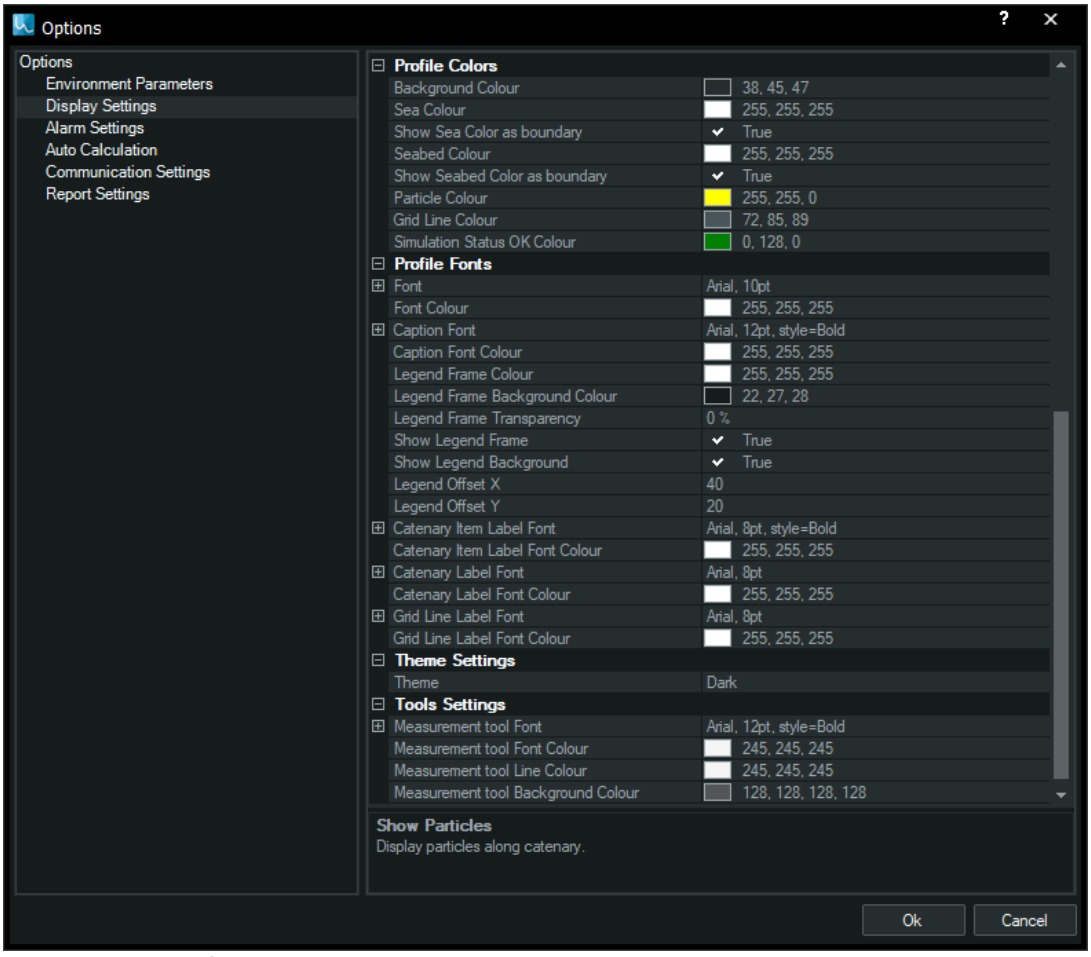


Figure 110 Display Settings 2/2

Profile Colors

- **Background Color**: Background colour for catenary profiles (ie the area above the sea surface).
- **Sea Color**: Colour of the water column as displayed in catenary profiles.
- **Show Sea Color as boundary:** Use sea color as boundary color between air and water column only. (Default=false).
- **Seabed Color**: Colour of the seabed as displayed in catenary profiles (ie the area below the seabed).
- **Show Seabed Color as boundary:** Use seabed color as boundary color between water column and seabed only. (Default=false).
- **Particle Color:** Color applied to particles in catenary profiles when the Show Particles property is enabled.
- **Grid Line Color:** Color applied to grid lines in catenary profiles.
- **Simulation Status OK Color:** Color applied to the Simulation Status label in the catenary profile when status is OK, i.e. below the specified stability threshold.

Profile Fonts

- **Font**: Font for labels shown in the catenary profile legend.
- **Font Color**: Font colour for the catenary profile legend.
- **Caption Font**: Caption font for labels in the catenary profile legend.
- **Caption Font Color**: Caption font colour for the catenary profile legend.
- **Legend Frame Color:** Frame color for catanary profile legend.
- **Legend Frame Background Color:** Background color for catanary profile legend.
- **Legend Frame Transparency:** Legend frame transparency in [%] (Default = 0%, i.e. no transparency).
- **Show Legend Frame:** Show frame around the catenary profile legend (Default=false).
- **Show Legend Background:** Show coloured background behind the catenary profile legend (Default=false).
- **Legend Offset X**: Legend offset X in pixels (default = **20**).
- **Legend Offset Y**: Legend offset Y in pixels (default = **20**).
- **Catenary Item Label Font:** Label font used to display item properties, e.g. MLB, on catanary profile.
- **Catenary Item Label Font Color:** Color of label font used to display item properties, e.g. MLB, on catanary profile.
- **Catenary Label Font:** Label font used to display catenary properties such as tension or angle along the catanary profile.
- **Catenary Label Font Color:** Color of label font used to display catenary properties such as tension or angle along the catanary profile.
- **Grid Line Label Font:** Grid line label font used in catanary profile.
- **Grid Line Label Font Color:** Color of the grid line label font used in catanary profile.

Theme Settings

- **Theme:** Display theme controlling form and menu colors, toolbar icons etc. Default=Dark. Note: The Classic theme is not supported by NaviCat.

Tools Settings

- **Measurement tool Font:** Font used to display measument values on catanary profile.
- **Measurement tool Font Color:** Font color used to display measument values on catanary profile.

- **Measurement tool Line Color:** Color used to display measument lines on catanary profile.
- **Measurement tool Background Color:** Background color for the measurement display box shown on the catanary profile.

Alarm Settings

Define colours and alarm thresholds for tension and bending radius alarms. Tension alarms are specified in percentage of break load. Anchor alarms are used to indicate anchor situations like wire snap, anchor drag, etc and are only applied in online mode where online inputs are being received from NaviPac or other integration applications like **DataMon** or **IODesigner**, which might facilitate winch integration, etc.

Figure 111 Alarm Settings tab

Tension Alarms

- **Level 1 Enabled**: Enable/disable tension alarm level 1.
- **Level 1 Alarm**: Tension alarm level 1, in percentage of cable break load. If the tension for a particle segment exceeds this value, the segment will be coloured according to the colour code specified.
- **Level 1 Color**: Tension alarm level 1 colour code.
- **Level 2 Enabled**: Enable/disable tension alarm level 2.
- **Level 2 Alarm**: Tension alarm level 2, in percentage of cable break load. If the tension for a particle segment exceeds this value, the segment will be coloured according to the colour code specified.
- **Level 2 Color**: Tension alarm level 2 colour code.
- **Level 3 Enabled**: Enable/disable tension alarm level 3.

- **Level 3 Alarm**: Tension alarm level 3, in percentage of cable break load. If the tension for a particle segment exceeds this value, the segment will be coloured according to the colour code specified.
- **Level 3 Color**: Tension alarm level 3 colour code.

Bending Radius Alarms
- **Level 1 Enabled**: Enable/disable bending radius alarm level 1.
- **Level 1 Alarm**: Bending radius alarm level 1, in percentage of cable minimum bending radius. If the bending radius for a particle and its two adjacent particles exceeds this value, the segment will be coloured according to the colour code specified.
- **Level 1 Color**: Bending radius alarm level 1 colour code.
- **Level 2 Enabled**: Enable/disable bending radius alarm level 2.
- **Level 2 Alarm**: Bending Radius Alarm Level 2 in [% of Cable Minimum Bending Radius]. If the bending radius for a particle and its two adjacent particles exceed this value the segment will be colored according to the color code.
- **Level 2 Color**: Bending Radius Alarm Level 2 Color Code.
- **Level 3 Enabled**: Enable/Disable Bending Radius Alarm Level 3.
- **Level 3 Alarm**: Bending Radius Alarm Level 3 in [% of Cable Minimum Bending Radius]. If the bending radius for a particle and its two adjacent particles exceed this value the segment will be colored according to the color code.
- **Level 3 Color**: Bending Radius Alarm Level 3 Color Code.

Anchor Alarms
- **Cable Break Alarm Enabled**: Enable/Disable Cable break alarm.
- **Cable Break Alarm Tension Threshold**: Threshold value in ton. If the fairlead tension drop below the threshold a Cable Break Alarm, CBA is raised. It will turn off when the fairlead tension raise above this value. The CBA respond to online input received from a winch control system. When an Anchor alarm is raised the Profile View start to flash with 1 Hz using the complement color to the water column color specified.

The segment colour is chosen from the highest percentage calculated for tension and bending radius. The highest vale in percent of the two decide which alarm colour scheme to apply. If below the alarm thresholds the cable colour defined is used.

Auto Calculation
Define converges criteria for automatic calculation of anchor position and wire length when using the **Anchor Calculator**.

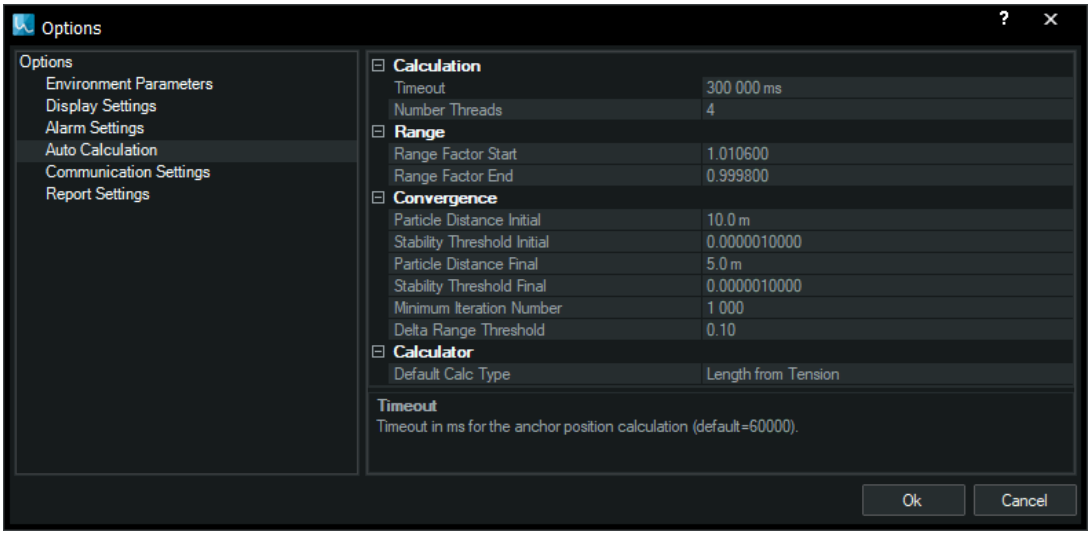


Figure 112 Auto Calculation tab

Calculation

TimeOut: Timeout in ms for the anchor position calculation (default=**60000ms**).
Number Threads: Number of threads used in the anchor estimate calculation (default=**4**). At least 4 threads must be utilized but more can be specified and might increase performance depending on the CPU.

Range

- **Range Factor Start**, SRF : Factor C_start multiplied to Start Offset, SOF given by SOF = (TotalLengt - WaterDepth) * C_start. (Default C_start=1.04).
- **Range Factor End**, ERF: Factor C_end multiplied to the End Offset, EOF given by EOF * C_end = Sqrt(TotalLength^2 - WaterDepth^2). Instability might occur for a fully stretched catenary curve (Default=0.9995).");

Range settings are parameters used for optimization of the test interval when calculating an anchor position given a user defined tension or angle input.

As illustrated below the test range equals [Offset$_{start}$..Offset$_{end}$]. L = total catenary length and h = water depth at the fairlead. When calculating the Offset$_{Start}$ and Offset$_{end}$ the Start Range Factor, SRF and the End Range Factor, ERF are used to adjust the test interval as described below.

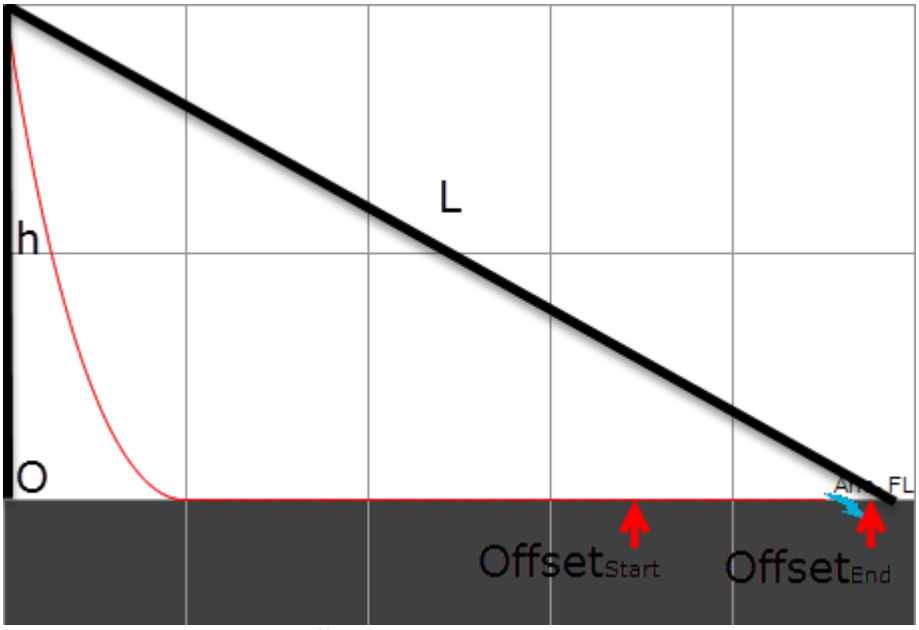


Figure 113 Auto calculation offsets

$Offset_{start}$ = (L - h) * SRF
$Offset_{end}$ = Sqrt(L*L - h*h) / ERF

The default value for SRF = 1.04, For catenary lines without any MLB's this value should be > 1.0.
The default value for ERF = 0.9995. This value should be < 1.0 in order to avoid instability.

If the solver is unable to find a valid result please note that test interval must contain a valid sample space. Try to calculate $Offset_{start}$ and $Offset_{end}$ manually and start a manual simulation with the anchor position set to $Offset_{start}$ and $Offset_{end}$ respectively, and verify that a valid simulation result is achievable.

IMPORTANT:
In case of calculation types Length from Tension or Length from Angle, it might be required to adjust the Start and End Range Factors. To find the length test interval, i.e. not position as the fairlead position and anchor positions are kept constant use:
Length_start = h + Sqrt(L*L - h*h) / SRF - Longest line length with lowest tension
Length_end = L / ERF - Shortest line length with highest tension

Convergence
Particle Distance Initial: Particle distance in meters for first iteration (default=**30.0 m**).
Stability Threshold Initial: Stability threshold for initial iteration using the Particle Distance Initial (default=**1e-5**).

Particle Distance Final: Particle distance in meters for last iteration (Default=**10.0 m**). Decreasing this value will result in more precise calculation results but it will increase the time i takes to find a solution.
Stability Threshold Final: Stability threshold for last iteration using the Particle Distance Initial (default=**1e-5**).
Minimum Iteration Number: Minimum number of iterations between particle adjustments from initial to final (default=**1**).
Delta Range Threshold: Range threshold before root evaluation (default=**1.0**).

For shallow water setups refer to HowTo - Shallow Water Configuration

Calculator

Default Calc Type: Specify the default calculation type selected when the Anchor Calculator is launched (default=**Position from Tension**).

Communication Settings

Define communication settings for NaviPac/HMD4 and the EIVA SceneServer.

Figure 114 Communication Settings tab

SceneServer

- **SceneServer update time interval**: Forced update interval in seconds for SceneServer communication (default=**10s**). Updates send to connected SceneServers or 3D viewers are updated with an approximately rate of 1Hz, i.e. once per second.
- **Catenary Version**: Output version of catenary packages sent to HMD4 or NaviModel. This property can be used to downgrade catenary packages to previous versions to obtain compatability with old versions of HMD4 and Online3D (default=**1.0**).

Online Updating

- **Position Threshold**: Threshold for online position updates [m]. Online position objects are updated if the distance between last update and current exceed the threshold value. Use 0.0m to disable threshold filter (default=**1.0m**).
- **Position Max Range**: Max range for online position updates [m]. Online position objects are updated if the distance update is within the specified maximum range. Use 0.0m to disable range check (default=**0.0m**).
- **Length Threshold, meter**: Threshold for online cable length updates [m]. Cable length objects are updated if the change in length between last update and current exceed the threshold value. Use 0.0m to disable threshold filter (default=**1.0m**).
- **Length Max Threshold, meter**: Min-Max range for online cable length updates [m]. Online cable cable length objects are updated if the length update is within the specified range. Use 0.0m to disable length range check (default=**0.0m**).
- **Length Threshold, tension**: Threshold for online cable length updates [ton]. Cable length objects are updated if the change in tonnage between last update and current exceed the threshold value. Use 0.0t to disable threshold filter (default=**1.0ton**).
- **Length Max Threshold, tension**: Min-Max range for online cable length updates [ton]. Online cable cable length objects are updated if the tonnage update is within the specified range. Use 0.0m to disable tension range check (default=**0.0ton**).
- **Depth Threshold**: Threshold for online depth updates [m]. Online depth objects are updated if the distance between last update and current exceed the threshold value (default=**1m**).
- **Depth Max Threshold**: Min-Max range for online depth updates [m]. Online depth objects are updated if the depth update is within the specified range. Use 0.0m to disable depth range check (default=**0.0ton**).

Online Simulation Result Export

- **Send to SceneServer**: Send simulation results as EIVA Online3D packages to connected SceneServer.
- **Send to UDP**: Send simulation results as EIVA Online3D packages to UDP.
- **UDP URI**: UDP URI for export packages. (default=udp://255.255.255.255:5550).
- **Send TDP Result**: Update SceneServer with C14 TDP package for first TDP (default=**false**).
- **TDP ID Prefix**: ID Prefix used for unique identification of the C14 TDP output packages (default=**NCTDP**).
- **Send First TDP**: Send first TDP only. If enabled only the first TDP will be issued, else all found TDPs will be issued (default=**true**).
- **Include Clearence Points**: In addition to TDP points, issue Clearence points too, i.e. point where the catenary leaves the seafloor (default=**true**).
- **Send TDP as Way Point**: Update SceneServer with Way Points for issued TDP and Clearence points, send as C3 Position Packages (default=**false**).

- **Send Fairlead Position**: Update SceneServer with C3 POSITION packages for fairlead (default=**false**).
- **Fairlead ID Pos Prefix**: ID Prefix for unique identification of C3 POSITION fairlead output package (default=**NCF**).
- **Send Clearence Position**: Update SceneServer with C3 POSITION packages for specified catenary to seafloor clearance threshold (default=**false**).
- **Clearence position ID Prefix**: ID Prefix for unique identification of C3 POSITION clearence packages (default=**NCC**).
- **Clearence Threshold**: Clearence threshold for position (Default threshold = **1.0m**).
- **Send Cable Results**: Update SceneServer with C13 CABLE packages (default=**false**).
- **Cable ID Prefix**: ID Prefix used for unique identification of the C13 CABLE output packages (default=**NCCABLE**).
- **Ignore 3D View clearing**: Option for skipping the clearing of 3D view (default=**false**).

Catenary

- **Catenary 3D Scale Factor**: Scale factor used for resizing the display of catenary curves in the 3D display (Default Scale Factor = 1.0). Diameter = Diameter * 3D Scale Factor + Catenary 3D Offset [mm].
- **Catenary 3D Offset**: Offset in mm used for controlling the display of catenary curves in the 3D display (Default Offset = 0.0 mm). Diameter = Diameter * 3D Scale Factor + Catenary 3D Offset [mm].

Report Settings

Settings used by the PDF Report generation. These settings are applied to all projects and templates loaded.

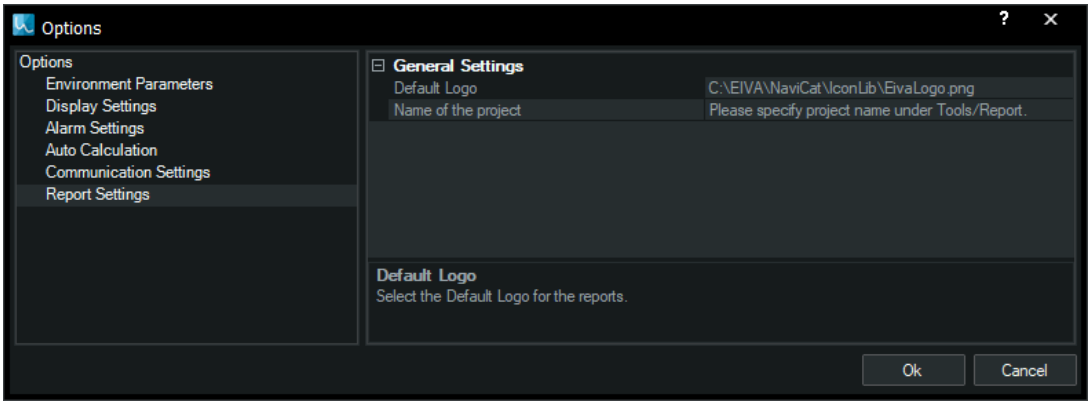


Figure 115 Report Settings tab

General Settings

- **Default Logo:** File path to PDF Report logo displayed on front page (default=% ProgramData%\EIVA\NaviCat\IconLib\EivaLogo.png).
- **Name of the project:** PDF Report title (default=Please specify project name under Tools/Report. Indicating to the user that the text should be updated).

2.4.7 Main Menu Window

The Window Main Menu provide the operator with options for automatic arrangement of the profile views.

All windows of the NaviCat application are dockable and can be placed outside the main window of the application if required.

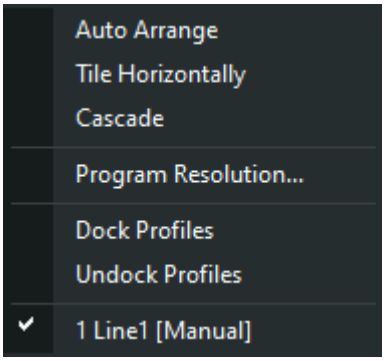


Figure 116 Window menu items of the Main Menu

Auto Arrange
Undock all catenary profiles and place them in a two column full screen layout. If only one catenary profile exist it is expanded to full screen

Tile Horizontally
Undock all catenary profiles and place them in horizontal tiles, i.e. full screen width above each other.

Cascade
Undock all catenary profiles and place them in a cascade view.

Program Resolution...
Launch a dialogue from where the user can specify predefined resolution settings for the main program or for the individual 2D profiles as illustrated below.

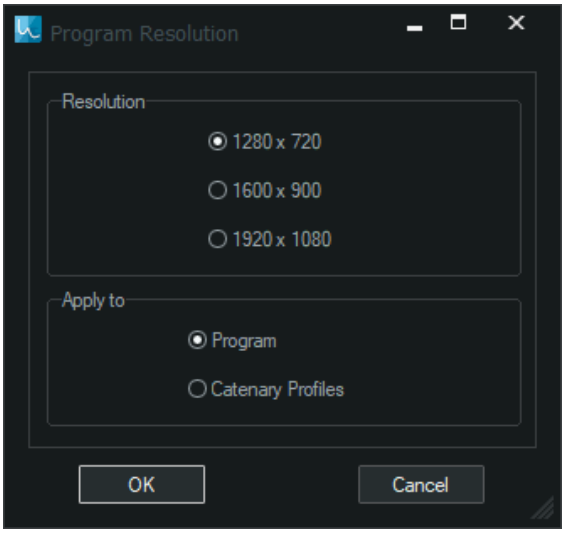


Figure 117 Program Resolution

If the resolution is applied to **Catenary Profiles** then the profiles will undock and resize according to the **Resolution** setting selected.

Dock Profiles
Dock all catenary profiles in the default setup.

Undock Profiles
Undock all catenary profile and place all catenary lines in full height next to one anther.

2.4.8 Main Menu Help

From the Help Main Menu access to various help and support related functionality is provided.

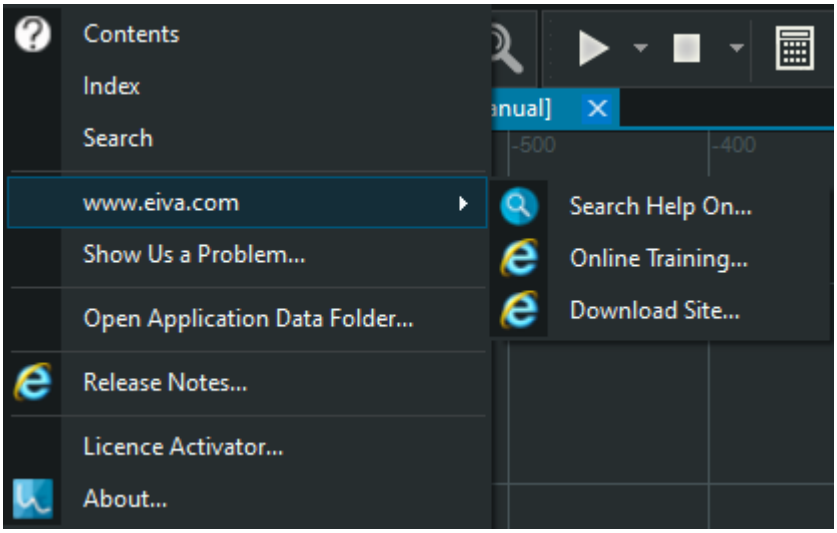


Figure 118 The help main menu

Online help file

The online html help file is accessible from the Help main menu or by pressing F1. The Contents menu item launch the help file and select the Contents tab where as the Index menu item select the Index tab and Search the equivalent Search tab og the online help file.

www.eiva.com contains help menu items related to the EIVA website. It contains the following menu items:
Search Help On, Search Help On show a search dialog and launch a browser with the Google search result from the EIVA web site.
Online Training, Open the EIVA training web site. The direct link to training site: http://training.eiva.com
Download Site, Open the EIVA download web site. This site can also be accessed directly from http://download.eiva.com

Show Us a Problem

Launch a dialog with options for installing or running the Microsoft Problem Steps Recorder as illustrated below:

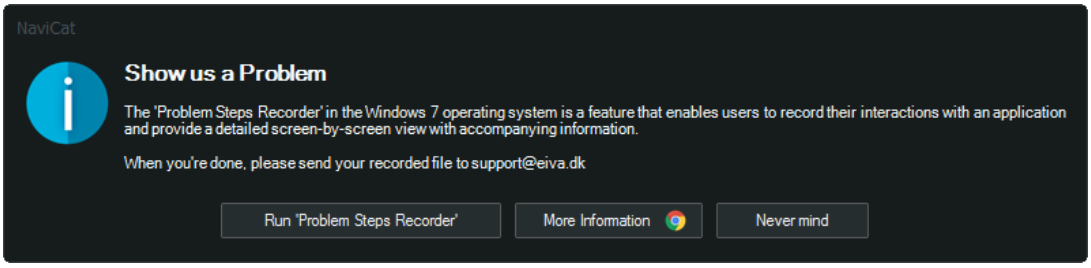


Figure 119 Access to problem steps recorder

Open Application Data Folder

Open the Data folder where all NaviCat ini, log, templates and settings files are located, including the crash log files which are created by the EIVA crash log system. NOTE: These files should only be modified by super users or under guidance from the EIVA Support.

Release Notes

Open NaviCat Release Notes distributed by the installer.

Licence Activator

A dedicated program is launched, from where the user can activate NaviSuite applications when a licence key is obtained.
In case of any questions related to licence purchase or activation, please email support@eiva.com

About

Launch the NaviCat About Box with version number and release date etc.

Figure 120 NaviCat about box.

The About Box also provide information about current Dongle Information and provide options for requesting a Soft Dongle from EIVA Support and accessing various EIVA resources on the internet. To request a Soft Dongle from EIVA Support, click the "License Info" button. This action will launch the EIVA Dongle Info dialogue illustrated below:

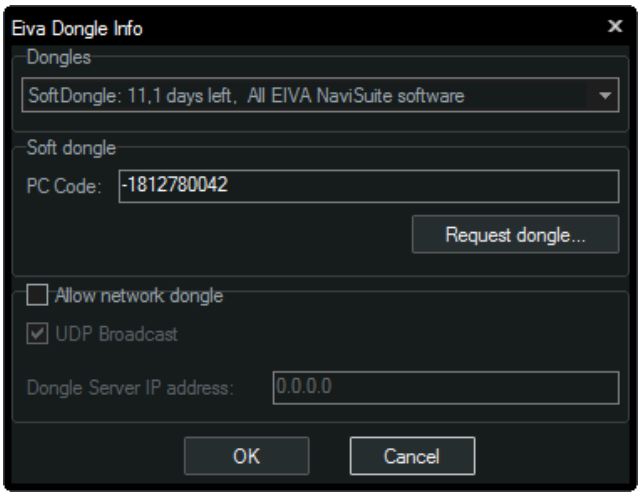


Figure 121 License Info

Request of EIVA evaluation license
By clicking the "Request dongle..." button, the default email client will be launched with populated email address, subject and PC Code. Make sure to specify the start time and the number of days you want the soft dongle to be valid for.

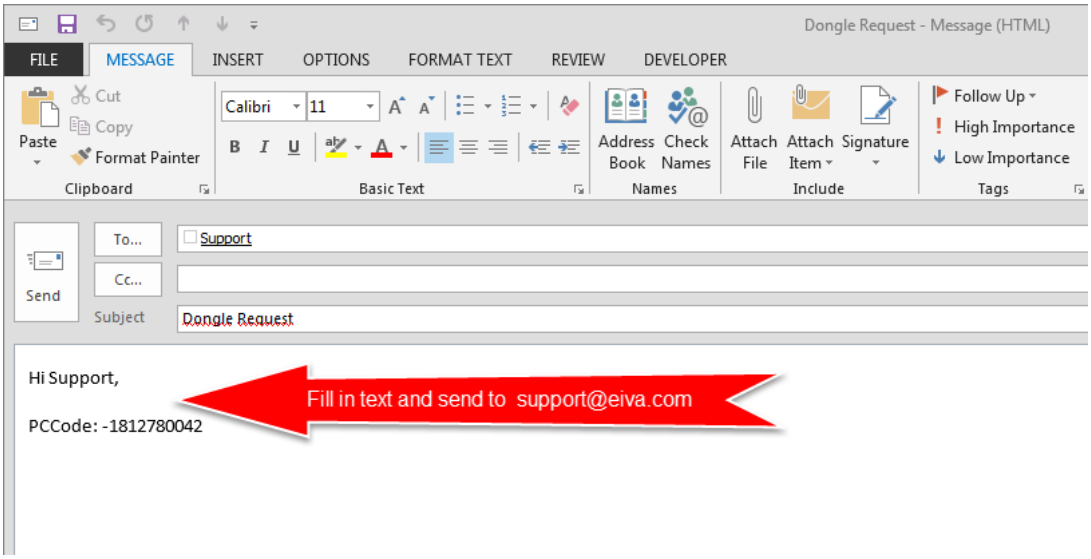


Figure 122 Request an evaluation license by email

If no email client is installed on the PC the PC Code must be provided to EIVA support in a different manner.

When the soft dongle license file, softdongle.txt is received from EIVA support, copy file to the EIVA installation directory, e.g. C:\EIVA and launch NaviCat.

2.4.9 Toolbars

The NaviCat toolbars are located below the Main Menu as illustrated in paragraph NaviCat GUI Elements.

The visibility of each toolbar can be controlled from the Main Menu View/Toolbars. NaviCat supports the following toolbar's:

Standard - Provide easy access to standard functionality such as New, Open, Save, Settings and Help
Profile View - Provide easy access to Zoom and Measurement tools for the catenary profile currently selected.
Controls - Provide easy to start and stop of catenary simulations, calculation of anchor positions and to apply current to the running simulations.

Available toolbar's are described in the subsequent paragraphs.

2.4.10 Toolbar Standard

The Standard toolbar of NaviCat provide easy access to project specific functionality described below.

Figure 123 Standard toolbar

 Create a new default session in NaviCat (Ctrl-N). The default session type is defined in the Tools/Options/Environment Parameters under head line Project Settings, see Options Dialog.

 Open existing project (Ctrl-O). A standard open file dialog is launched, providing the user with the option of selecting an existing NaviCat project file (*.cat).

 Save project (Ctrl-S). If the current NaviCat session is unsaved, then the operator is prompted with a standard save file dialog. Browse to the desired catalog and provide a file name for the Catenary about to be saved. If the a project file has been created already, then the project file will be updated with the current catenary setup.

 Open the Options dialog from where general settings for the NaviCat application are specified, see Options Dialog for further details.

 Open the NaviCat help file. Equivalent to pressing F1 when no dialog supporting context help is selected.

2.4.11 Toolbar Profile View

The Profile View toolbar provide easy access to the zooming and measurement tools available in NaviCat.

Figure 124 Profile view toolbar

Zooming and panning utilize control keys such as Shift and Ctrl. Referring to these keys imply that the respective control key is kept depressed during the mouse operation.
For easy reference to mouse buttons and scroll wheel the following abbreviations are used in the text below:

MB - Mouse Button
LMB - Left Mouse Button
MMB - Middle Mouse Button
RMB - Right Mouse Button
SW - Scroll Wheel, can figure as the middle mouse button too on certain devices.

 Normal mode.

Pane View	- Click and hold down MMB or SW while dragging the mouse.
Normal Zoom In/out	- Scroll the SW forward/backward
Slow Zoom In/out	- Ctrl + Scroll the mouse SW forward/backward
Depth / X Scaling	- Shift + Scroll the mouse SW forward/backward

 Measurement tool provide the operator with a triangular measurement tool as illustrated below. In addition, when this tool is enabled, the depth and distance to the starting base is displayed in the lower left corner of the Profile View. Use the LMB to select the start point for the measurement and drag the mouse while keeping the MB depressed. The distance between the starting point and the current position of the cursor is displayed, including its components in X and Depth distances.

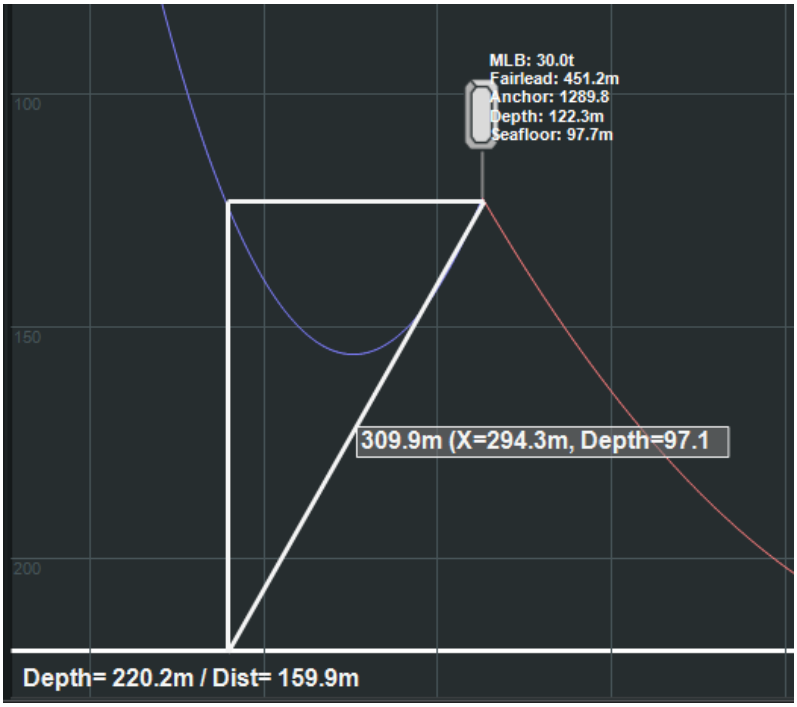


Figure 125 Example of horizontal measurement of distance between a MLB and the catenary

 Zoom tool support the same zooming and panning functionality as the Normal Mode described above. In addition is support a select area function and option for changing the plot center of the Profile View. The full set of options are listed below:

Pane View - Click and hold down MMB or SW while dragging the mouse.
Normal Zoom In/out - Scroll the SW forward/backward
Slow Zoom In/out - Ctrl + Scroll the mouse SW forward/backward
Depth / X Scaling - Shift + Scroll the mouse SW forward/backward
New Plot Center - Ctrl + MMB click. The plot center (origo), will be placed at the cursor position, e.g. this provide an easy way to select and zoom in on a MLB.
New Starting Base Pos - Alt + Scroll the mouse SW forward/backward. The starting base, e.g. fairlead will be placed at the cursor location.
Zoom Area - Click and hold LMB while dragging the mouse from left to right, to select the zoom area where the zoom area will be set according to the x-axis of the zoom box.
- Ctrl + Click and hold LMB while dragging the mouse from left to right, to select the zoom area where the zoom area will be set according to the y-axis of the zoom box.

NOTE: The zoom area is reset by click and hold LMB while dragging the mouse from right toward left.

By selecting the zoom tool three additional tool buttons are enabled as illustrated below.

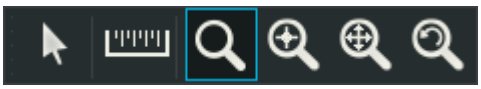


Figure 126 Profile view toolbar in zoom mode

 Auto zoom of selected catenary profile. The selected catenary profile will be scaled to fit the Profile View.
When a new simulation is started it will be auto zoom initially in order to provide the operator with a full overview of the simulation result.

 Auto zoom of all catenary profiles. All catenary profiles will be scaled to fit their matching Profile View.

 Reset zoom. In order to reset the zoom to 1:1, select the catenary line and click the Reset zoom tool button. Consequently, the fairlead will be center of the Profile View.

2.4.12 Toolbar Controls

The Control toolbar facilitate easy access to start and stop of simulation, input of current as well as the calculator used for estimating anchor positions for the selected line setup given required tension or angle at starting base as well as the true heading.

Figure 127 Control toolbar

 Start simulations for all configured lines. The drop down box illustrated below contain a list of configured catenary lines not yet started. From the drop down list simulations can be started individually.

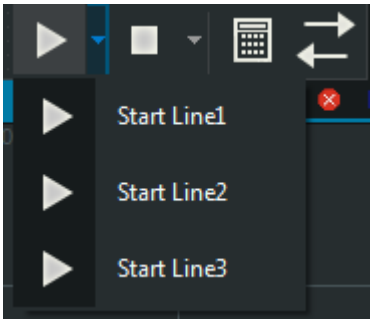
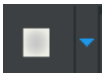


Figure 128 Drop down box with option for starting individual simulations.

 Stop all simulations. Similar to the Start Simulation, individual running simulations can be stopped from the drop down box.

NOTE: Simulations for individual catenary lines can also be controlled from the right-click context menu of the Line and Session node in the project tree.

 Launch the Anchor Calculation dialogue from where anchor positions can be calculated for a catenary setup, given requested tension or angle at the starting base as well as a specified true heading. Also, catenary lengths given fixed starting base and anchor positions can be estimated. See Toolbar Controls for further detail.

 Launch the Current Model dialogue from where a current vector can be specified. When a current model is applied it is applied to all running simulations, see Bathymetry for further detail.

Anchor Calculator
Calculator for estimating anchor positions or section length for created catenary lines. Input parameters are true heading for the calculation as well as a target value for requested angle or tension at the starting base. The dialogue is modal and must be closed when all anchor estimations are complete, in order to return to NaviCat. Also, the calculator support Length estimations of the near fairlead section by keeping fairlead and anchor positions fixed and finding the correct catenary length matching specified tension or angle at fairlead. The length adjustment is always performed on the near fairlead section.

IMPORTANT I:
When using the Anchor Calculator to estimate anchor position ***ensure that Length from Tension is set to false for all Line sections***. Also the Line property Automatic Online Update must be set to false, in case an online connection exists, in order to prevent online over write of the estimated results when the simulation is started. Error messages will prompt the user for those constraints if required.

IMPORTANT II:
Depending on the simulation scenario and setup user defined configuration of the Auto Calculation properties might be required. For shallow water scenarios special settings are required in order for the Anchor calculator to work properly, please refer to HowTo - Shallow Water Configuration. A general description on haw to configure the Auto Calculation properties are described in HowTo - Usage and Configuration of Anchor Calculator.

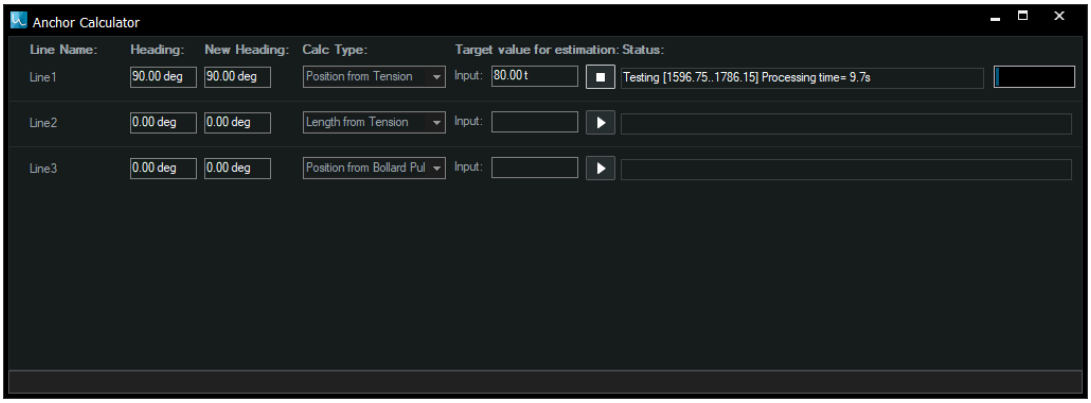


Figure 129 Estimate anchor position for configured catenary lines

Line Name:
Catenary Line

Heading:
Current true heading for the setup, defined by the fairlead and anchor positions.

New Heading:
Option for specifying a new true heading for the spread. Default set to current true heading.

Calc. Type:
Supported calculation types are:
Position from Tension - Estimate anchor position to match specified tension in ton at fairlead.
Position from Angle - Estimate anchor position to match specified angle in degree at fairlead. Angle specified according to angle convention.
Position from Bollard Pull - Estimate anchor position to match specified horizontal tension component at fairlead. Tension in ton. A tug do not normally have a tension meter on-board, but are using the engine force to tension an anchor line. The Bollard Pull is actually the horizontal tension component instead of the total tension.
Length from Tension - Estimate catenary length by adjusting length of inner section to match specified tension in ton at fairlead.
Length from Angle - Estimate catenary length by adjusting length of inner section to match specified angle in degree at fairlead. Angle specified according to angle convention.

The default calculation type is defined in the Options/Auto Calculation Settings - Calculator.

Target value for estimation:
Target value for the specified calculation type, i.e. tension in tonnage or angle in degree.

When a target value has been specified, eg 80.00t, click the Start button for initiating the calculation. When running, use the Stop button to halt the current estimation.

Status:
Status and progress for the estimation process. Range under test including elapsed time in seconds.

2.4.13 Project Tree

The NaviCat project tree contains a graphical visualization of the catenary lines configured and other data items configurable by the operator. Each node can be selected by the mouse. When selected its properties will be listed in the Property Grid. The Property Grid is described in more detail in the subsequent chapter.

In most cases each node in the project tree has a context menu. The context menu is accessible by a single right-click on the node, e.g. to start the simulation of a Catenary Line, first select the Line node, then right-click on the node and select Start Calculation.

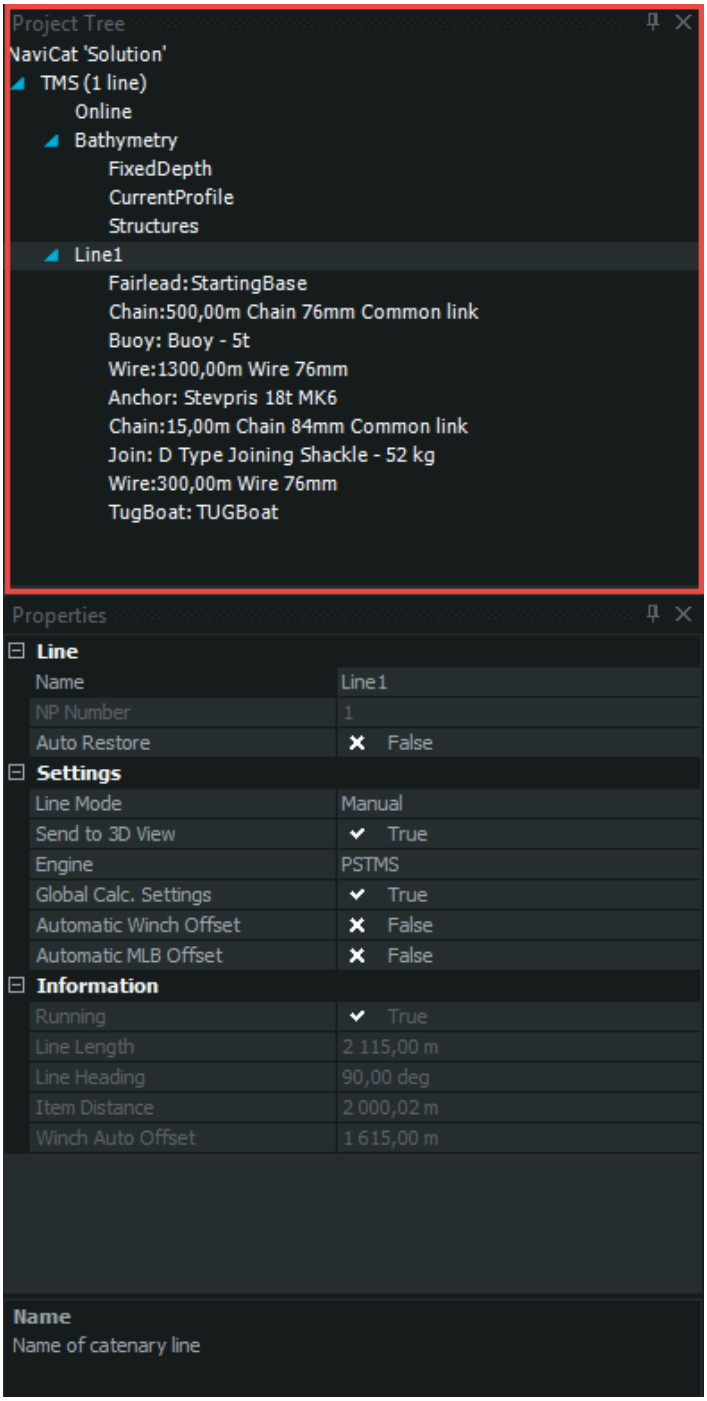


Figure 130 TMS Project Tree, marked by the red square

The over all structure of the Project Tree consist of the following elements:

-NaviCat Solution - The common root node for all types of configuration.

-TMS/CableLay Session - Type of session. The total number of lines are listed in brackets, e.g. (1 line)
-Online - Dealing with connections to other NaviSuite applications, e.g. NaviPac, SceneServer etc.
-Bathymetry - Settings used for all catenary lines such as bathymetry, current and pipe structures.
-Line(s) - In a TMS setup multiple Lines will be listed subsequently as Line 1, Line 2...Line N, where N is the number of lines in the TMS setup.

2.4.13.1 Session

From the right-click context menu on the Session node a number of operations can be executed on all Lines part of the session simultaneously. This includes starting of catenary simulations, sending catenary lines to 3D View as well as adding new Lines either in Manual or Calc Line Mode. In addition, automatic Line configuration can be done, when connected to a valid NaviPac TMS setup via the SceneServer. The result is a setup matching the configuration in NaviPac. All described in more detail below.

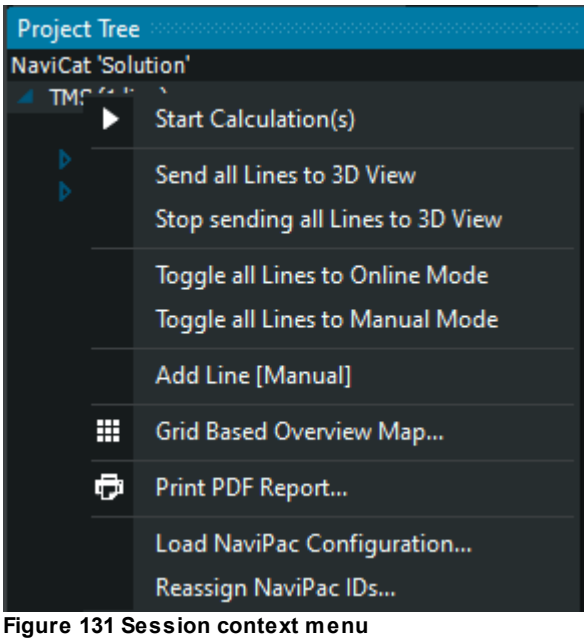


Figure 131 Session context menu

Start Calculation(s):
Start simulation for all catenary lines part of the setup simultaneously.

Send all Lines to 3D View:
Toggle the Send to 3D View to true for all catenary lines part of the setup simultaneously.

Stop sending all Lines to 3D View:

Toggle the Send to 3D View to false all catenary lines part of the setup simultaneously.

Toggle all Lines to Online Mode:
Toggle Line Mode to Online for all catenary lines part of the setup simultaneously.

Toggle all Lines to Manual Mode:
Toggle Line Mode to Online for all catenary lines part of the setup simultaneously.

Add Line:
Append a new Line in Manual Mode to the current Session.

Grid Based Overview Map...:
Launch a simple grid based overview map for the current setup.

Print PDF Report...:
Generate a PDF report for the current Session. An option is provided for loading the PDF file into an associated viewer like the Adobe Acrobat Reader from where the report can be view and printed. PDF Reports can also be generated directly from the File/Print menu or by using the Ctrl-P shortcut.

Load NaviPac Configuration...:
Used for creating a setup matching wheat has been defined in NaviCat RigMon. NaviCat must connect online to the NaviPac SceneServer in order to fetch relevant object information.
Each Line created match the Line defined in NaviPac, Starting base (assigned from winch locations), sections and MLBs and Anchors, including correct Online Ref IDs.

NOTE: As NaviPac only operate in 2D the length of each segment is assigned the value of NaN in order to indicate the the operator must specify a valid length for this segment, see Line, Start Calculation.

Reassign NaviPac IDs...:
As online updating is based on NaviPac IDs, this tool will reset the line IDs for the current setup, e.g. usefull when a Line created by the Auto Configuration tool has been deleted.

2.4.13.2 Online

The Online object is used to control online connections e.g. if NaviCat in Online Mode needs to fetch positions from NaviPac. In order to connect to a SceneServer, right click the Online node and from the context menu select "Connect...". Select the SceneServer to connect to from the Connect Dialog as illustrated below.

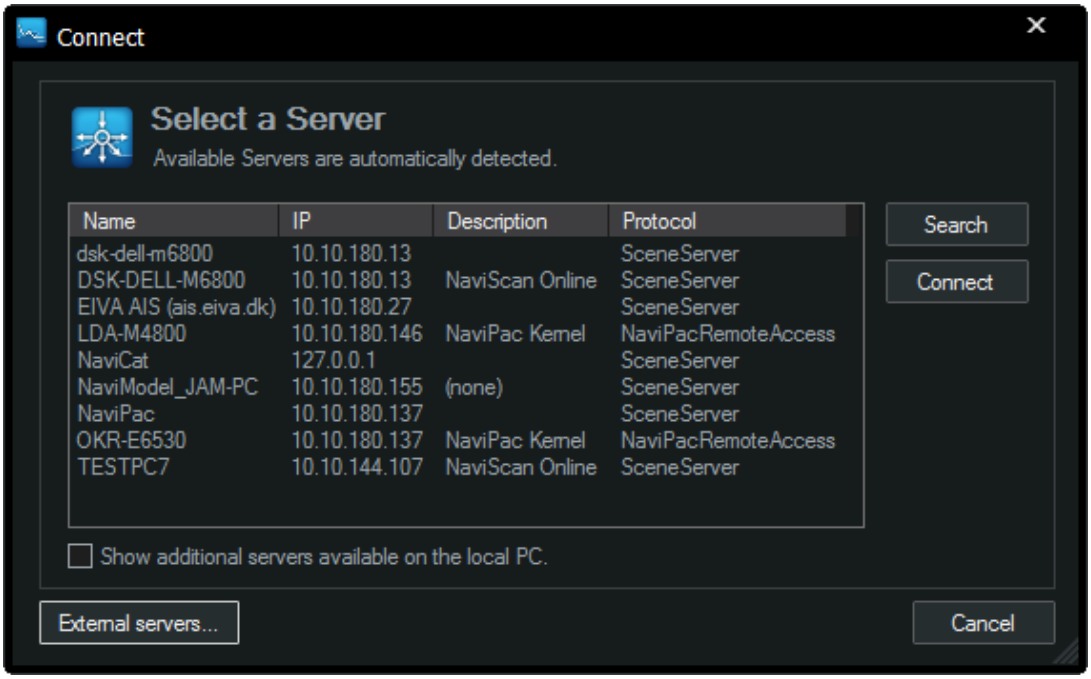


Figure 132 SceneServer connection dialogue

The "Allow Connections" property can be used to control access to NaviCat, e.g. when NaviPac or HMD4 need to connect to a running instance of NaviCat. The default value for this property is true. In order for catenary lines and simulation results to be shown in 3D or send to the connected SceneServer or specified UDP address, the "Send to 3D View" property of the Line node must be sent to true. All Lines added has the "Send to 3D View" property set to true by default.

NOTE: If the connection subsequently is disconnected by the user, the Send to 3D View is automatically toggled to false for all Lines. Hence, in case a new connection is established, the Send to 3D View must be set to true manually. From the Session node in the project tree, the right-click menu provide an option for toggling the Send to 3D View to true/false for all Lines.

The "SceneServer ID" can be used to change the default identifier "NaviCat" to a customized ID string. This string is shown in the SceneServer Connect dialog.

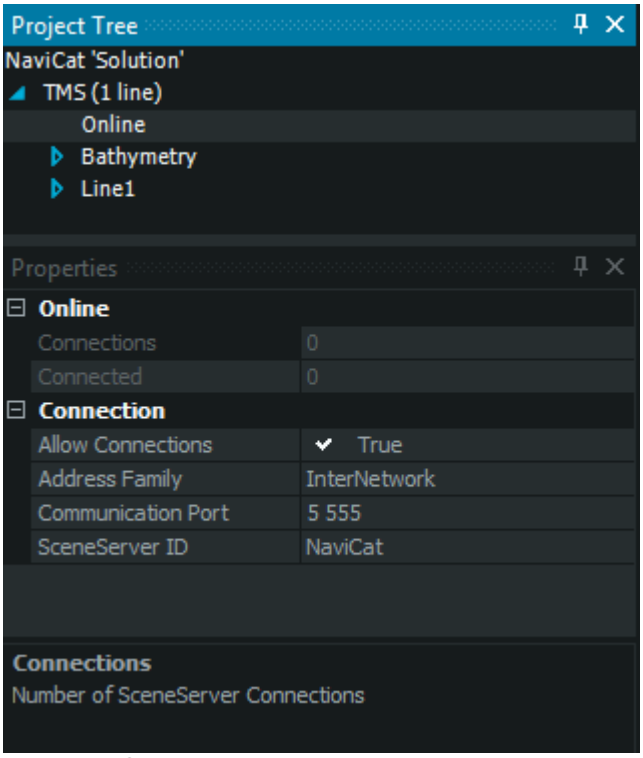


Figure 133 Online properties

2.4.13.3 Bathymetry

From the Bathymetry node the NaviCat operator can choose which bathymetry model to use from the right-click context menu. The Bathymetry model is used for all catenary lines being simulated.

In addition to the Bathymetry model, the operator can apply a current vector from the Current Profile node and import Pipeline structures (.rlx) which can be illustrated in the Profile View according to settings.

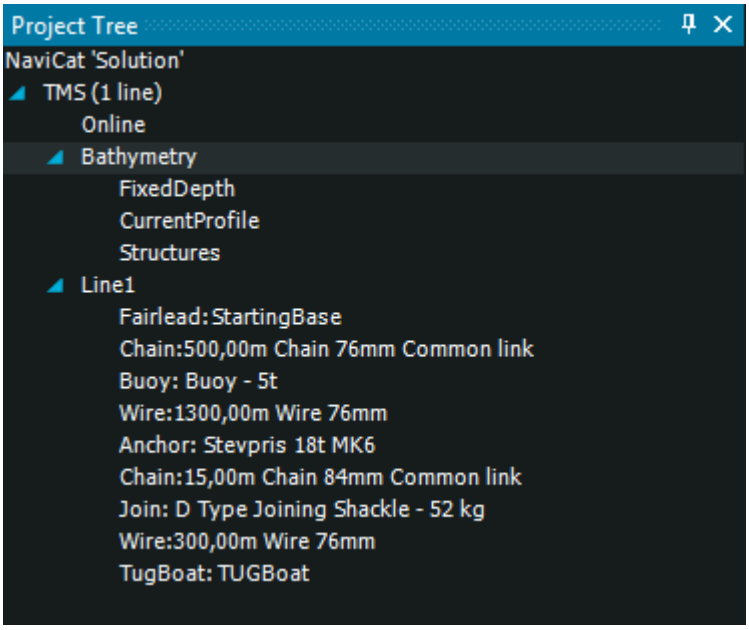


Figure 134 Bathymetry node in project tree

IMPORTANT:
When changes have been made to Bathymetry settings they must be applied by clicking the "Apply Settings" in the right-click context menu of the Bathymetry node as illustrated below.
Changes can be identified by the change of the Bathymetry node from normal to bold.

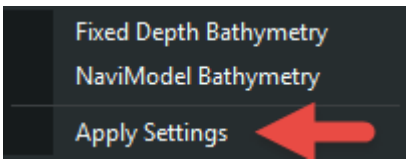


Figure 135 Applying bathymetric settings

Currently the following two bathymetry models are supported for TMS sessions:

- NaviModel - NaviModel DTM
- FixedDepth - Constant Depth, with an option for online updating of depth value.

For CableLay sessions an additional 2D profile can be applied.

NaviModel DTM
Specify the NaviModel DTM (.db) file for all catenary lines being simulated.
Default depth is used for areas outside the DTM (default = 100.0m).
Default cell size indicat the resolution of the DTM being used. This value should be set according to the particle distance specified. (Default = 5.0 m).

DTM Type can be set to NaviModelDTM for direct used of the DTM. For maximum performance set the Type to NaviModelDTMCached.

Fixed Depth
Specify a fixed depth DTM for all catenary lines being simulated. The fixed depth bathymetry is the default type when a new Catenary line is added to a session.

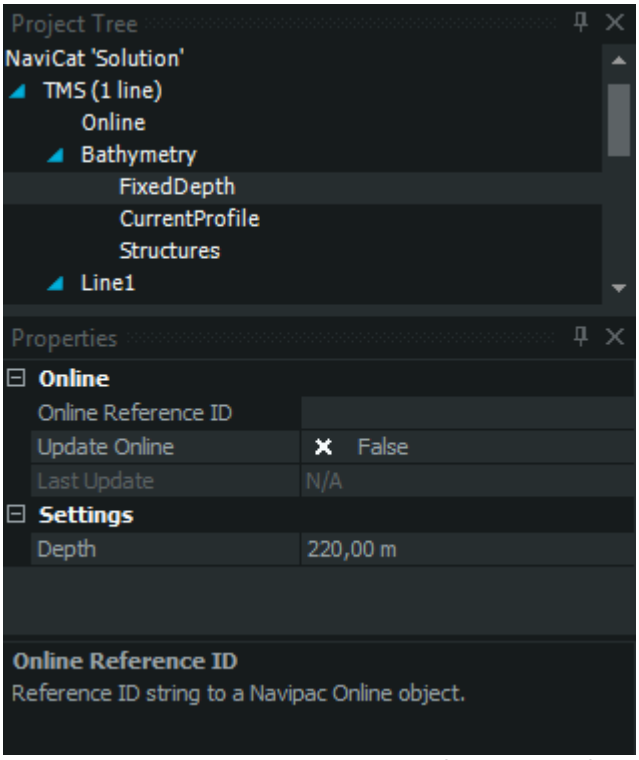


Figure 136 Fixed Depth bathymetry with fixed depth of 220.0 meter

The Fixed Depth can be updated online as illustrated below. In that way the seafloor can be updated dynamically from an external source such as an echo sounder.

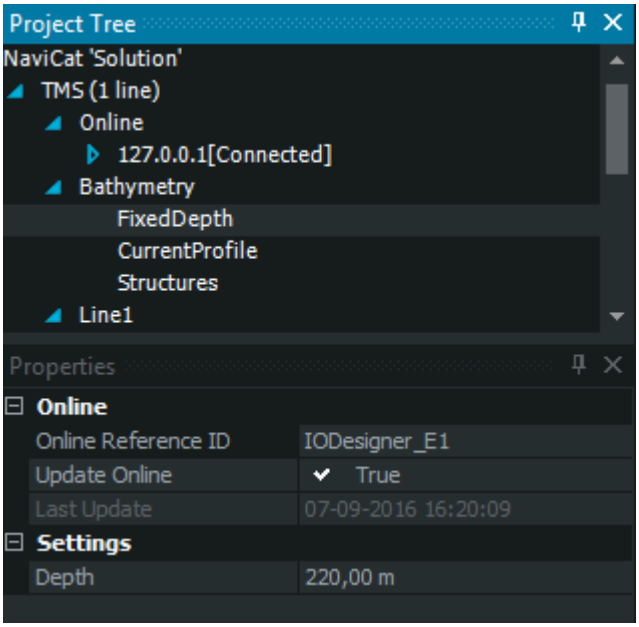


Figure 137 Fixed Depth bathymetry with online updating enabled

When specifying an Online Reference ID the depth value can be updated online via input from the SceneServer C11 Depth package, please refer to the EIVA document Online3DProtocol.pdf for further detail.
This requires a valid online connection and a online packaged of type C11 DEPTH with a matching object ID, e.g. IODesigner_E1.

The IODesigner distributed with NaviCat support the generation of C11 DEPTH packages along with the C3 Position, C13 Cable and C4 Anchor packages.

An anchor placed on a fixed depth DTM with online updating enabled will stay on the seafloor at the specified position.

NOTE: Online3DProtocol.pdf is distributed with the NaviCat installer and is located in the <NaviCat Install Directory>\Documentation

Current Profile
Specify the current vector in its east, north and depth components. Each component must be specified in m/s. The actual current can be set from the Tools main menu, from the Control Toolbar or via the right-click context menu on the Bathymetry node in the project tree, by entering the current components in the modal dialogue:

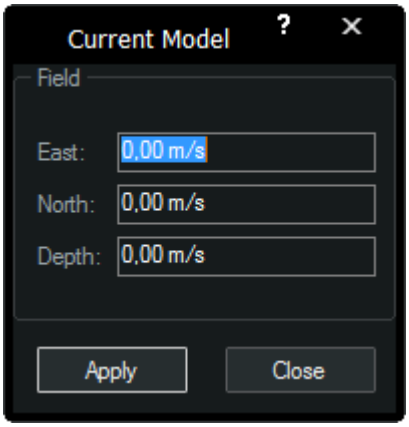


Figure 138 Current model dialogue

East:
Current component in East-West direction. Negative for eastern- and positive for western current component.

North:
Current component in North-South direction. Negative for norther- and positive for southern current component.

Depth:
Vertical current component. Positive for downward and negative for upward.

In order to apply new settings click **Apply.**

The effect of the actual current applied is added to all running simulations and can be inspected by selecting the CurrentProfile node in the project tree as illustrated below:

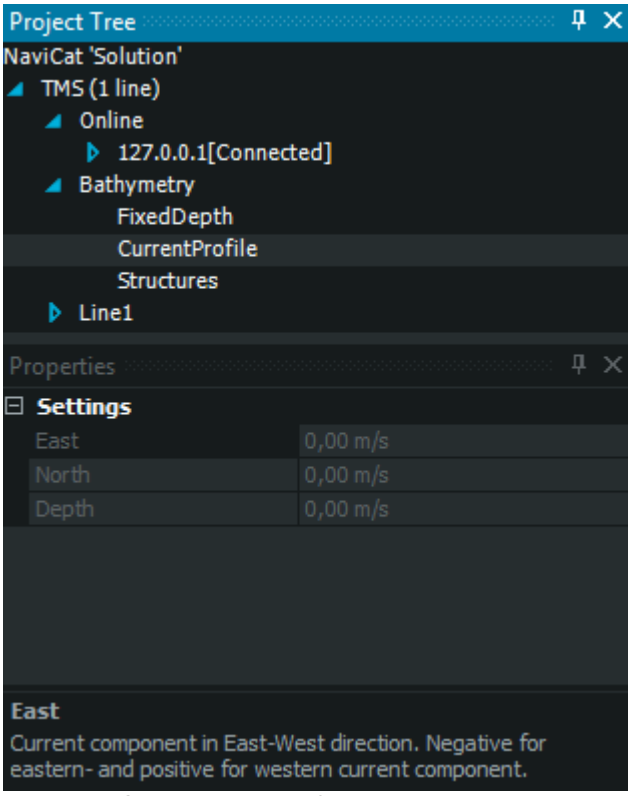


Figure 139 Show current profile settings

When, X,Y or Z is modified Apply Settings must be invoked in order to update running simulations with the new current vector.

Structures

Structure objects can be added to Structures node from its right-click context menu.

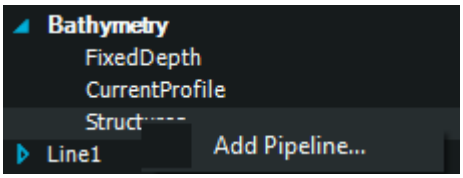


Figure 140 Adding a pipeline structure

When a new Pipeline node is added it must be configured according to its properties.

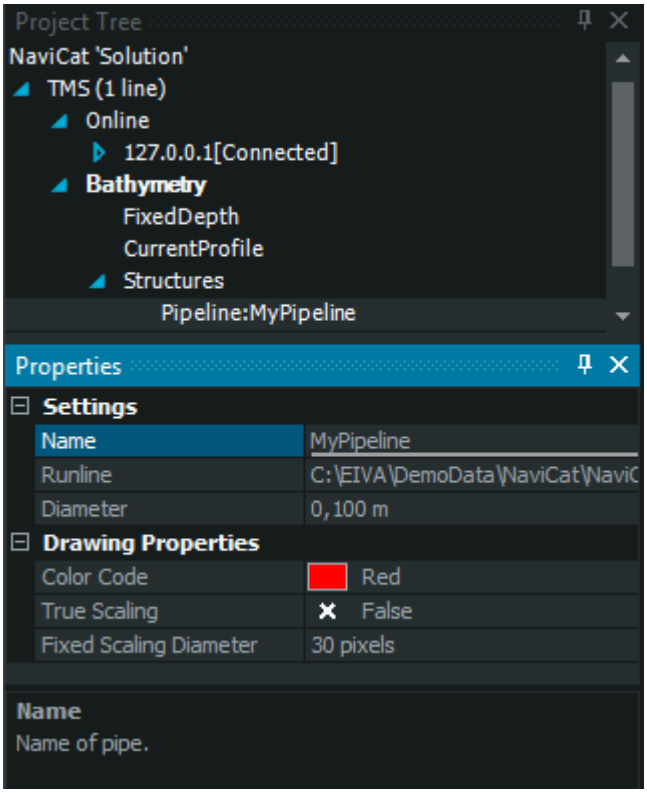


Figure 141 Pipeline settings

Name:
Name of pipe, e.g. MyPipeline.

Runline:
Name of runline file in rlx format. Load file for importing the digitized structure. Currently, only a simple rlx format is supported exemplified from the demo file Pipeline3_EW.rlx:

2015-10-09 13:40:36
"Pipeline3_EW"; 64; 0.0000; "Meter"
430312.675;7218627.475;435877.418;7218608.353;0.0000000;5.5647760;0;1;64
435877.418;7218608.353;435877.418;7218608.353;5.5647760;5.5647760;0;1;64

NOTE:
Currently curves are not supported, only line segments. If curves are contained in the rlx file applications like NaviModel can be used for conversion.

Diameter:
Pipe diameter specified in meters (Default=0.1 m).

Color Code:
Color code for Pipe.

True Scaling:
When true scaling is enabled the pipe is drawn according to the the zoom level and diameter. When disabled the pipe is drawn according to the specified fixed scaling size in pixels (Default=false).

Fixed Scaling Diameter:
Diameter in pixels. Applied only when True Scaling is disabled.

2.4.13.4 Line

The Line node represent a catenary setup and simulation engine and has a profile view associated for visualizing the catenary curve and calculated parameters.

From the context menu of the Line node, simulation can be started and stopped, profile exported, creation of new catenary lines etc. The Session parent node can also be used for certain operations but typically for all Lines included in the Session.

Line
Right click the Line object to launch the context menu as illustrated below.

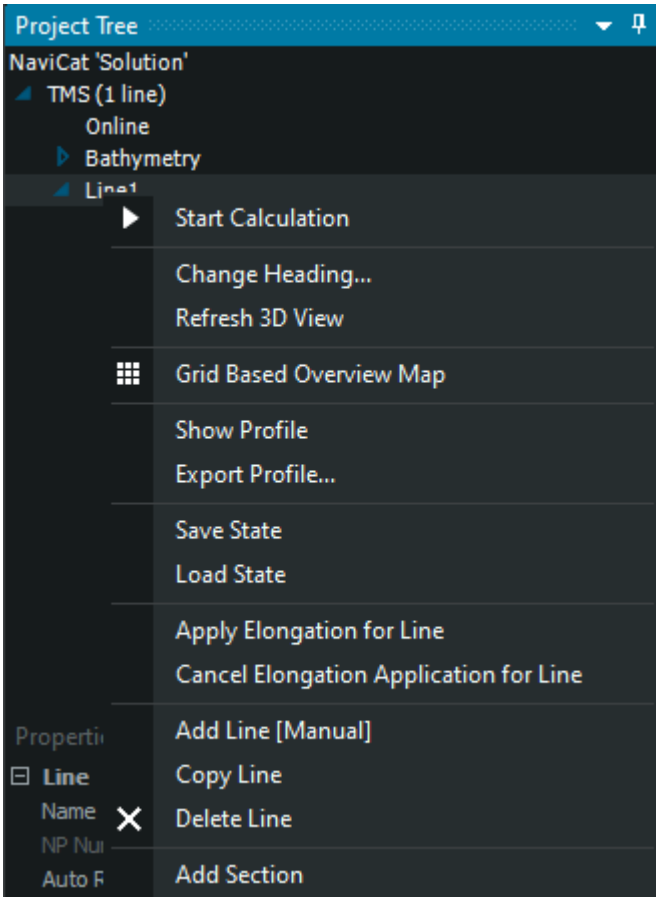


Figure 142 Line context menu

Start Calculation:
Start simulation. When started it change to Stop Calculation.When started the menu item changes name to Restart Calculation and an new Stop Calculation menu item is added.

Before a catenary simulation is started, some initial checking on the current configuration is performed:
a) Total catenary length must be longer than the distance between the starting base object and the Anchor/Tug object
b) Segment Lengths must not contain NaN values, which are assigned by the NaviPac Auto Configuration tool, see Session.
c) The individual objects which constitute the configuration must follow the rule Item (Starting Base, e.g. Fairlead)-Section-Item-.....-Section-Item

Setting the property Automatic Online Update to true can be used to initialize catenary items and sections regarding to position and length, see Automatic Online Update below.

NOTE: When a catenary simulation is started, the user can no longer change the Online Ref ID. In order to update the Online Ref ID the simulation must be stopped, the ID updated and the simulation must be restarted.

Grid Based Overview Map:
Show a simple 2D map of the catenary curve display in grid coordinates.

Show Profile:
Show the Profile View if hidden.

Export Profile...:
Export the catenary curve as a text file, x,y,z and depth.

Apply Elongation for Line:
Extend the current catenary line according to the Elongation % specified for the cable segments.

Cancel Elongation Application for Line:
Remove current extension for the catenary line according to the Elongation % specified for the cable segments.

Add Line [Manual]:
Add a new Line in Manual Mode.

Copy Line:
Clone current Line and add it as a new Line to the Session.

Delete Line:
Delete selected Line. Note that the Delete button can be used for this operation too.

Add Section (or other Catenary items):
Append a Cable section to the setup or in case the last item is a Section append a MLB, Anchor etc.

Available properties for the Line object is illustrated below. Manual update of all properties can be issued by pressing F5 during the simulation.

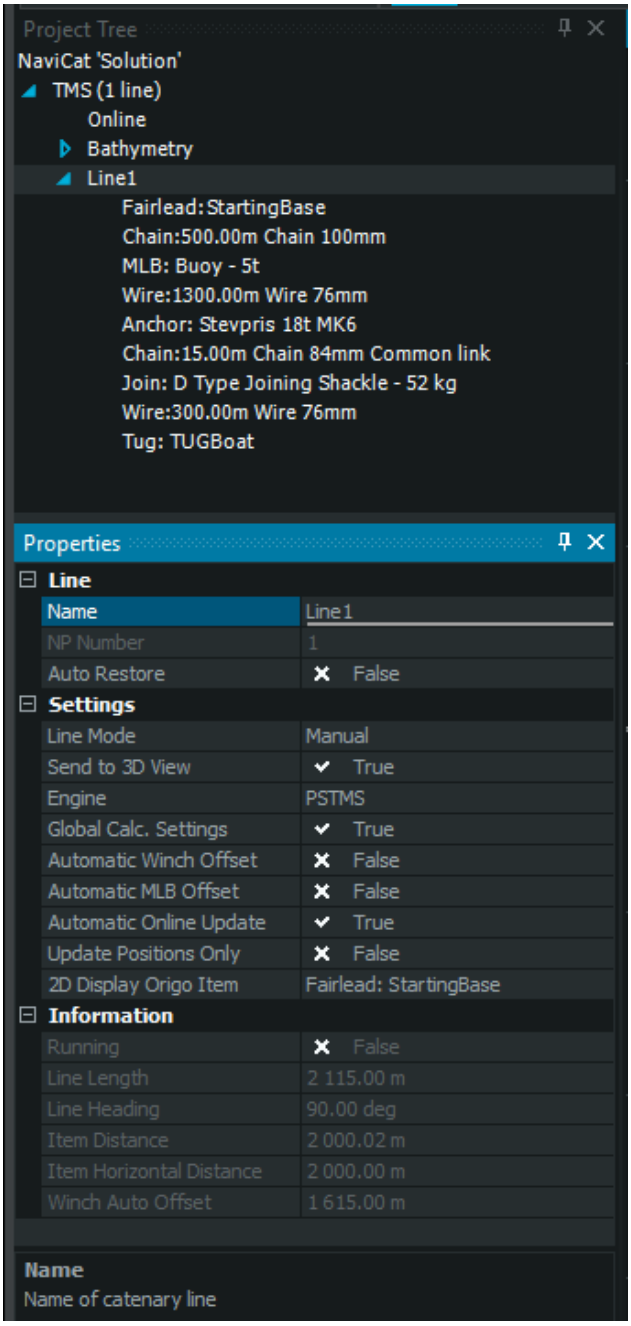


Figure 143 Line properties

Name:
Name of catenary line, e.g. Line1

NP Number:

Used to identify Line according to the setup and object IDs defined in NaviPac. These numbers can be updated automatically from the Session context menu.

Line Mode:
Manual mode for normal planing or estimation of anchor position based on user defined input for requested tension or angle at fairlead. Online mode is used for integration with NaviPac or other data providers such as the bundled IODesigner application. In Online mode all items with an assigned Online ref id will be updated according to matching online objects received online.

Send to 3D View:
Toggle to true for start sending the catenary curve to a 3D display such as NaviPac HMD4 or NaviModel. Also, output of calculated parametres are controlled by this property, see Options/Communication Settings for output options via UDP or SceneServer.

NOTE: If Send to 3D View is set to false no outputs are generated.

Engine
Select calculation engine used by current profile (Default = PSTMS). The PSTMS must be used for TMS or CableLay operations. For CableLay setups additional two other engines are supported.

Global Calc. Settings
True indicating that the Calculation Engine is using the globally defined calculation settings specified under Options. False provide option for specifying local calculation settings for the catenary line (Default = false).

Automatic Winch Offset
Apply automatic offset equivalent to the sum lengths for outer sections, when the near fairlead section is updated online. Only valid in Online Mode when a Online Ref ID has been specified for the near fairlead section, see Cable Section below for further information.

Automatic MLB Offset
Apply automatic MLB offset recieved from NaviPac to control outer section lengths. Only valid in Online Mode when a Online Ref ID has been specified for one or more MLBs part of the Catenary Setup.
When Automatic MLB Offset is enabled the section lengths between the first MLB and the anchor is updated online and calculated based on the offsets received:

For a setup containing N buoys and N+1 sections, the section lengths are calculated according to:
Section1: Not updated. Can only be updated manually or by the Auto MAtic Winch offset
Section2..N: Section_i = Offset MLB_i-1 - Offset MLB_i
SectionN+1: Section = Offset MLB_i

IMPORTANT: Automatic MLB Offset is only supported for setups containing no Join items. Also, MLBs defined in NaviPac RIGMon must be placed according to Anchor Offset as illustrated below.

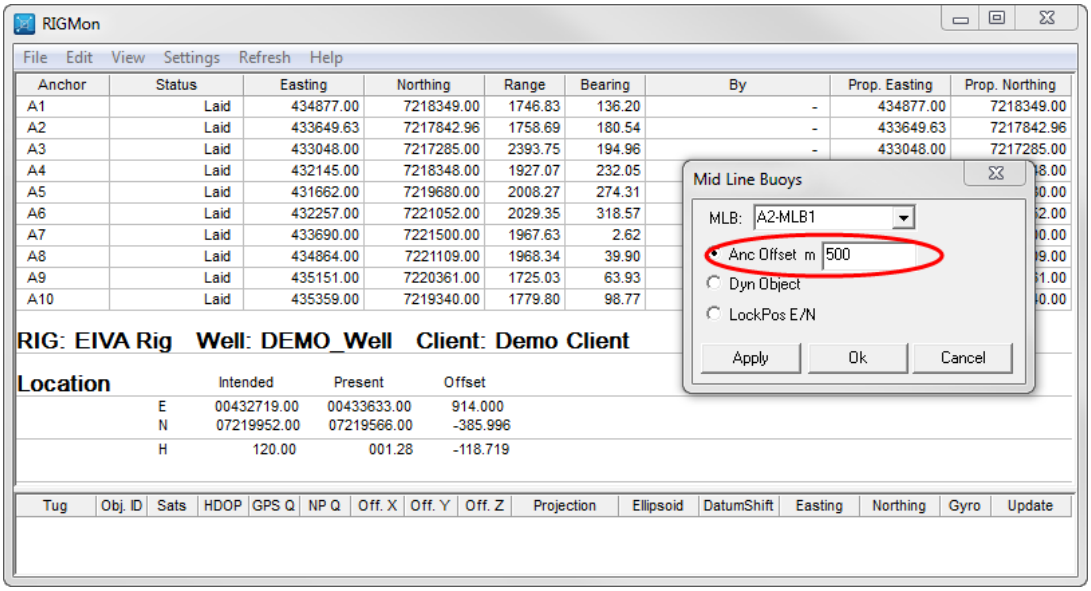


Figure 144 NaviPac Rigmon settings

Automatic Online Update
Apply automatic update of online object settings prior to starting a simulation. Requires an active SceneServer connection and is valid only for catenary lines containing Online Reference IDs. Property toggles the option for updating a line item, such as fairlead, anchor or tug etc with latest positions and length found for Reference ID matching online objects received from an online connection. The property works in both online mode or offline mode.

If true an additional property, *Update Positions Only*, is listed providing the option for updating positions only. If toggled to true section length and anchor states will not be updated from matching online objects, only positions. Default value is false.

In cases where Length from tension is applied the section length will always be calculated from |Fairlead..Anchor| + 0.1 * waterdepth (total catenary length) at fairlead and subsequently assigned to the inner section.

2D Display Origo Item
Specify item used as origo reference for the 2D profile. By default the origo item is set to the Starting Base item, i.e. starting base is located at x=0 in the 2D profile view. To simulate a pre-lay anchor operation the origo item can be assigned to the anchor deployed as illustrated below. A tug prelay anchor template (Default TMS Project - Tug prelay anchor.tcat) is included.

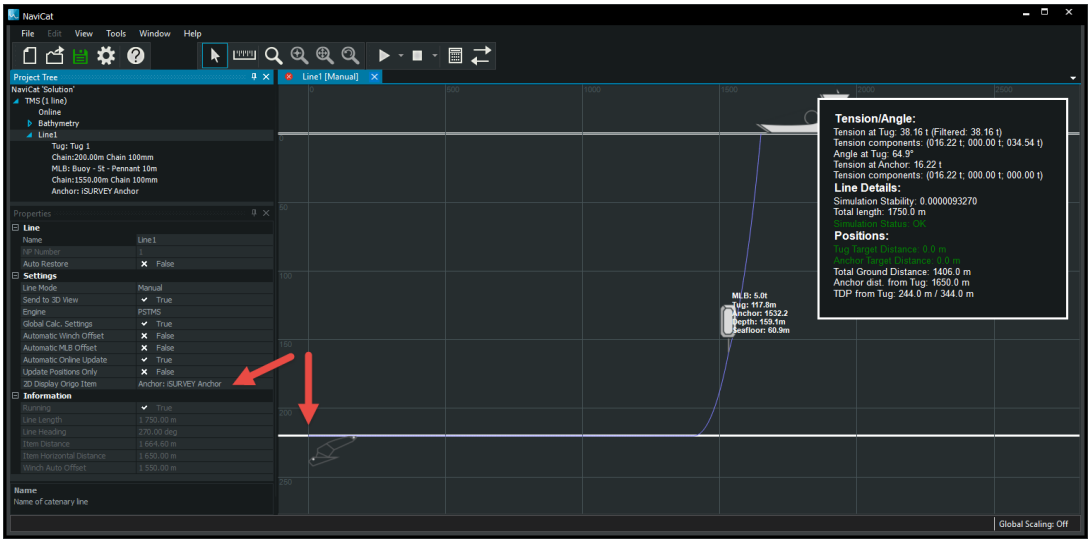


Figure 145 Simulating anchor pre-lay operation by setting the 2D Display Origo Item

In the Information group a number of read only properties are listed.

Running:
Simulation indicator. True if the catenary simulation is running.

Line Length:
Total length of catenary curve. For a valid setup the Line Length must always exceed the Item Distance. If not instabilities will occur and the catenary curve will start to oscillate.

Line Heading:
True heading for the catenary spread. The heading is estimated from the the position of the fairlead and the position of the last item in the setup e.g. Anchor or Tug.

Item Distance:
Total distance in meters between Fairlead and last item object part of the setup, e.g. Anchor, Tug etc. For invalid setups NaN is returned.

Item Horizontal Distance:
Total horizonlat distance in meters between Fairlead and last item object part of the setup, e.g. Anchor, Tug etc. For invalid setups NaN is returned.

Winch Auto Offset:
Offset applied if the Automatic Winch offset is enabled, see description above. The winch auto offset is calculated as the sum of lengths for all sections from but not inclusive the near fairlead section to the anchor.This property can be used by the online updating where a winch counter provide the full length of the catenary curve.

Starting base

The first object part of a Catenary Line setup is the mandatory Starting base item. The Starting base item is the only object which cannot be deleted or moved up/down in the object item sequence. It is named according to <Type>:<Name>, e.g. Fairlead:StartingBase.

Supported starting base item types:

- Base
- Caterpillar
- Fairlead (default)
- J-Lay
- S-Lay
- Winch
- Shoot
- Tug

For adding a new section to the Starting base, right click the Starting Base item and from the context menu select Add Section as illustrated below:

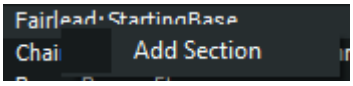


Figure 146 Fairlead context menu

The new section type added is by default the top item listed in the cable library, see NaviCat libraries

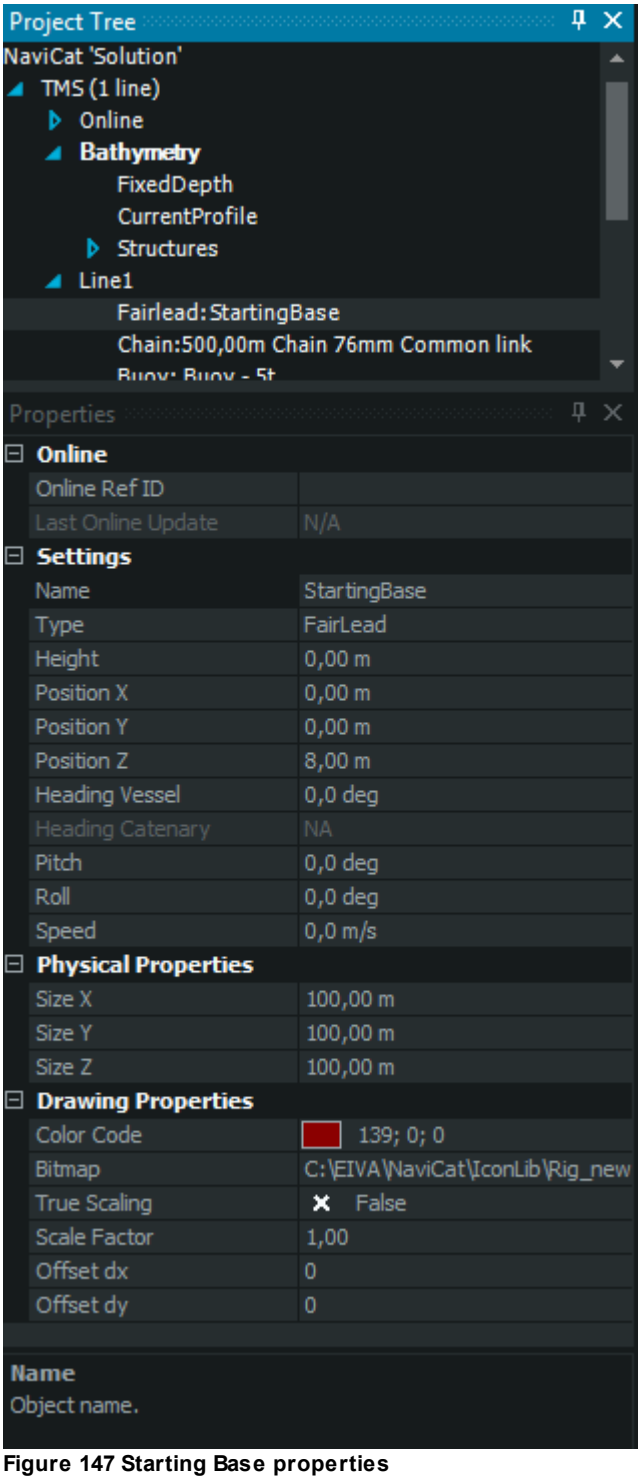


Figure 147 Starting Base properties

Online Ref ID

Reference ID string to a NaviPac Online object. The ID can only be updated when the catenary simulation is Stopped.

Last Online Update
Time of last online position update. Only valid when operating in Online Mode.

Name
Object name.

Type
Type of starting base, e.g. Fairlead. All available options are: Base, Caterpillar, FairLead, JLay, SLay, Winch.

Height
Hight of fairlead [m]. Enter positive value for specifying height above sea level.

Position X
Position X in [m]. Typically Easting (UTM) when operating in an online scenario.

Position Y
Position Y in [m]. Typically Northing (UTM) when operating in an online scenario.

Position Z
Position Z in [m]. Typically Depth. The actual fairlead z position is the sum of Z and Height, where only Z gets updated when in Online Mode.

Heading Vessel
True Heading for Vessel [deg]. Can be set Online, but in general for the catenary simulation only the actual position of the fairlead object is relevant.

Heading Catenary
True Heading for Catenary [deg]. Can be set Online, but in general for the catenary simulation only the actual position of the fairlead object is relevant.

Pitch
Pitch [deg]. Can be set Online, but in general for the catenary simulation only the actual position of the fairlead object is relevant.

Roll
Roll [deg]. Can be set Online, but in general for the catenary simulation only the actual position of the fairlead object is relevant.

Speed
Speed [m/s]. Can be set Online, but in general for the catenary simulation only the actual position of the fairlead object is relevant.

Size X
Object size X [m].

Size Y
Object size Y [m].

Size Z
Object size Z [m].

Color Code
Color code for anchor symbol. The color is not applied is a bitmap symbol is assigned.");

Bitmap
Bitmap to symbolize Starting base. Fully qualified path must be specified. Formats supported are bmp and png.

True Scaling
Only valid for bitmap usage. Set to true for setting bitmap size to item size in meters. False use bitmap size in pixel (Default = true).

Scale Factor
Scale factor is an isotropic factor used for scaling the symbol bitmap according to its true scaling of bitmap size (Default=1).

Offset dx
Offset in cm/pixels depending on True Scaling.

Offset dy
Offset in cm/pixels depending on True Scaling.

Cable / Section
Right click the Cable/Section object to launch the context menu as illustrated below.

The cable section is always placed between two items, e.g. MLB and Anchor or Fairlead and MLB etc. Hence, when adding a new Item to a Cable section only those items are listed for selection.

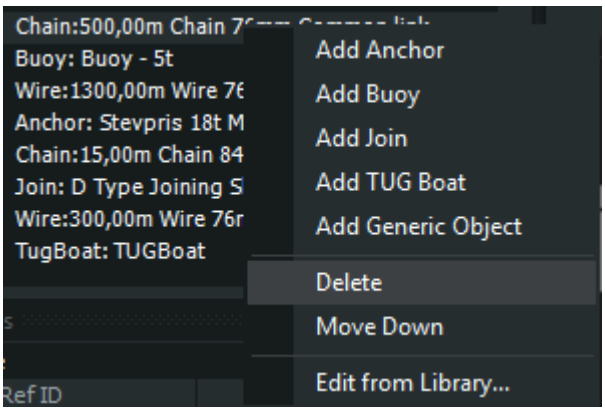


Figure 148 Cable section context menu

Add:
Add items after current section, the following objects are supported:
Anchor - Default anchor assigned is the anchor on top of the list of the Anchor Library.
Buoy - Default MLB assigned is the MLB on top of the list of the Buoy Library.
Join - Used to combine two different cable section types. Default Join assigned is the Join on top of the list of the Join Library.
TUG - Add a TUG boat. No segment can be added subsequent to a TUG item.
Generic Object - Add a multipurpose object which can be used as a static object, MLB, Anchor etc.

Delete:
Delete selected Section. The delete button can be used too.

Edit from Library:
Launch Cable Library with current cable selected ready for editing.

Available properties for the Cable object is illustrated below. Manual update of all properties can be issued by pressing F5 during the simulation.

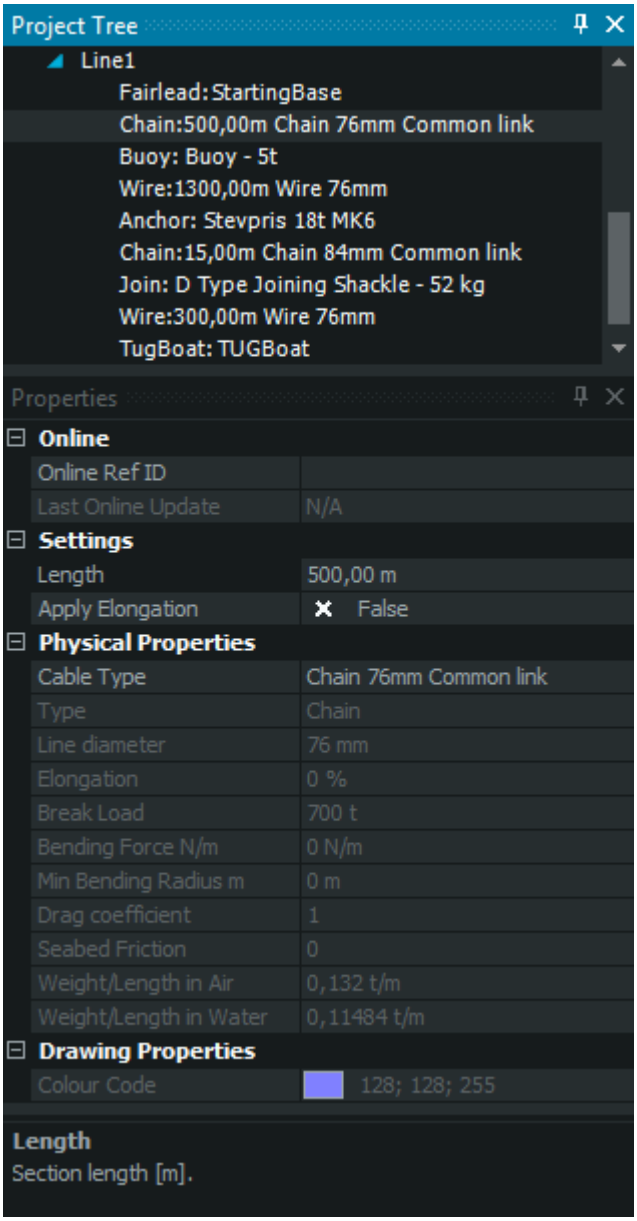


Figure 149 Cable Section properties

Online Ref ID:
Object ID for the a matching online package of type C13 CABLE. The ID can only be updated when the catenary simulation is Stopped.

Automatic Winch Offset:
Read only field displaying the Automatic Winch Offset state. Automatic Winch Offset is controlled on the parent Line node which also provide the current value for this offset. The length of the Automatic Winch offset is the sum of all cable sections for Section 2 to Section N. Only Section 1 closest to the fairlead can apply this offset.

Winch Offset:
Offset applied when the Length value gets updated online according to its Online Ref ID. If Automatic Winch Offset is set to false, this value can be updated manually. NOTE: that the operator must verify valid numbers. Offset is only applied if the total length applied is greater than the offset specified.

Winch Calibration Offset:
Winch calibration offset in meters. Used for adding a user defined offset to online readings, typically in cases where Automatic Winch Offset is used. Default = 0.0m.

Section Length Online = C13 SceneServer Cable Length - Winch Offset + Winch Calibration Offset

Length from Tension:
Toggle to true for online updating of segment length from tension. This requires valid tensional input from the C13 Cable packages received. For detailed information about the Length from Tension regulation, see HowTo - Length from Tension Regulation.

Last Online Update:
Date Time stamp for last online update.

Length:
Length of cable section in meters.

Apply Elongation:
Toggle to true/false for applying/not applying the Elongation % specified for the cable selected:

Cable Type:
Select a Cable Type from the Combo box. The items listed are equivalent to the cable types specified in the Cable Library.

Other Properties:
Other physical properties and drawing properties are updated according to the Cable Type selected.

Buoy, MLB
Right click the Buoy object to launch the context menu as illustrated below.

A Buoy item is always placed after a Section object. Hence, when adding a new Item to a Buoy element only a Section object can be selected.

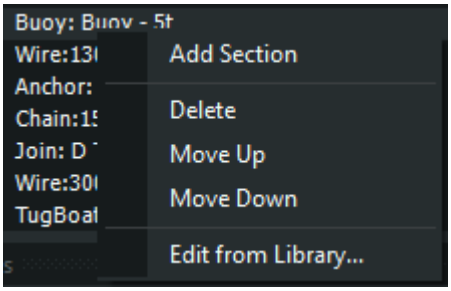


Figure 150 Buoy context menu

Add:
Section - Default cable section attached to the selected Buoy. The default Cable section can be controlled from the Cable Library by moving the preferred default element to the top of the Cable list in the library.

Delete:
Delete selected Buoy object. The delete button can be used too.

Edit from Library:
Launch Buoy Library with current MLB selected ready for editing.

Available properties for the Buoy object is illustrated below. Manual update of all properties can be issued by pressing F5 during the simulation.

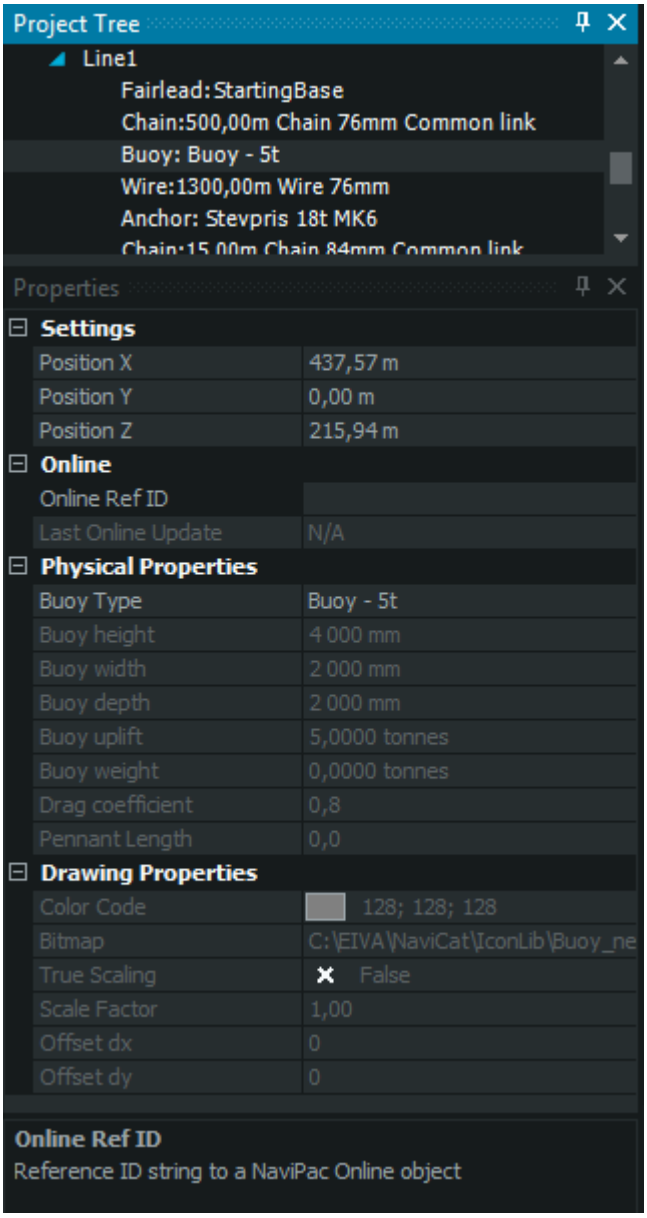


Figure 151 Buoy properties

Online Ref ID:
Object ID for the a matching online package of type C8 MLB. In order to apply Automatic MLB Offset one or more MLBs part of a catenary setup must be updated online with a correct Online Ref ID matching the MLB defined in NaviPac RIGMon. The ID can only be updated when the catenary simulation is Stopped.

Last Online Update:
Date Time stamp for last online update.

NOTE: Position can not be updated manually or by a online position object received from NaviPac. For NaviCat all MLB positions are given as a result of the simulation. If for some reason a fixed object position is required, the Generic Object provide such functionality.

Other Properties:
Other physical properties and drawing properties are updated according to the Buoy Type selected.

Anchor
Right click the Anchor object to launch the Anchor context menu illustrated below.

An Anchor item is always placed after a Section object. When adding a new Item to an Anchor element, only a Section object can be selected.

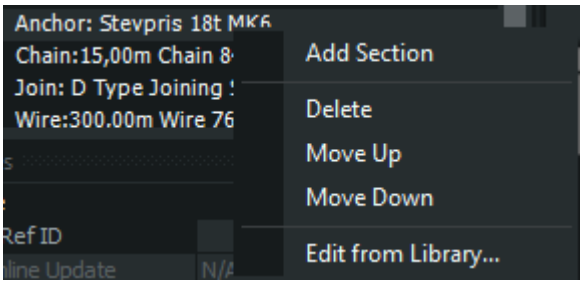


Figure 152 Anchor context menu

Add:
Section - Default cable section attached to the Anchor. The default Cable section can be controlled from the Cable Library by moving the preferred default element to the top of the Cable list in the library.

Delete:
Delete selected Anchor object. The delete button can be used too.

Edit from Library:
Launch Anchor Library with current Anchor selected ready for editing.

Available properties for the Anchor object is illustrated below. Manual update of all properties can be issued by pressing F5 during the simulation.

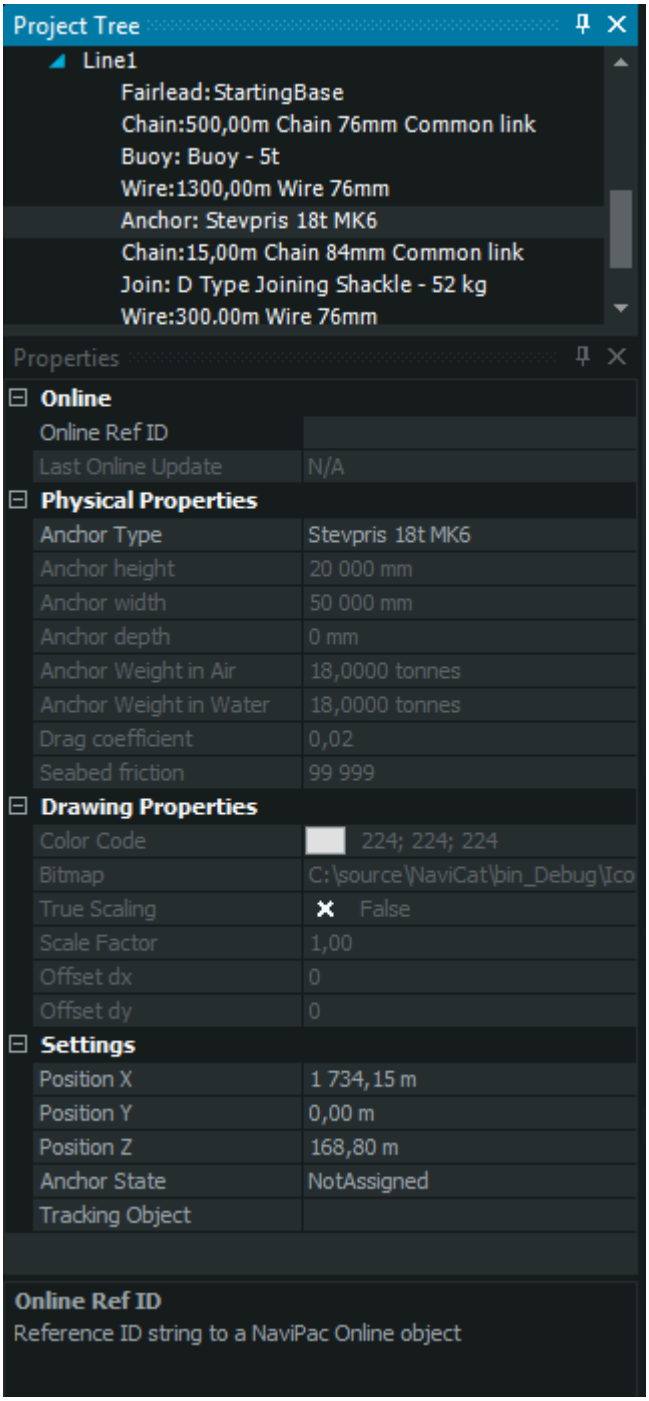


Figure 153 Anchor properties

Online Ref ID:

Object ID for the a matching online package of type C4 ANCHOR. When set matching online packages received from NaviPac will control position, anchor state as well as assigned TUG. The ID can only be updated when the catenary simulation is Stopped.

Last Online Update:
Date Time stamp for last online update.

Anchor Type:
Selected Anchor type. From a combo box available Anchors from the Anchor library can be selected.

Other Properties:
Other physical properties and drawing properties are updated according to the Anchor Type selected.

Position X;
Position X in meters.

Position Y:
Position Y in meters.

Position Z:
Depth position Z in meters. A specified depth value can only be specified in Place on Seafloor is disabled.

Place on Seafloor:
If set to true the anchor is placed on the seafloor at its position specified by X and Y independent on the Z value specified. If false the Z value is applied when simulation is started.

NOTE: This property is only visible when the Anchor object is the last object part of the Catenary setup specified. If the Anchor object is part of a TUG setup, i.e. a TUG object constitute the last object in the setup the the Place on Seafloor is forced to false and is consequently not visible.

Anchor State:
The operational state of the Anchor. This property is only relevant when operating in Online Mode where the Anchor states set in NaviPac controls the anchor position.

The default value is NotAssigned which should be used when in Manual Mode. The following states are available:
Racked = 0
Tracking = 1
Laid = 2
NotAssigned = 99

Please refer to relevant NaviPac documentation for further information about the various anchor states.

Tracking Object:

Object ID of Anchor tracking object, such as a TUG boat. The Tracking object property is only relevant when operating in Online Mode. When a TUG is assigned to an Anchor, the matching TUG will be displayed on the Catenary Profile at its projected position. It requires that the TUG position is available from the list of Online packages too.

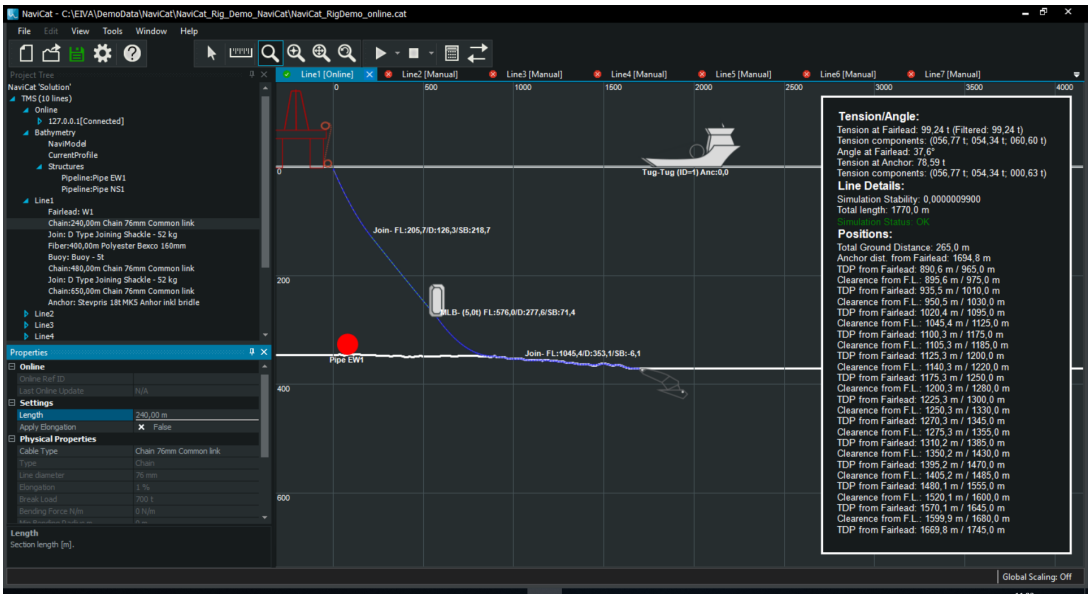


Figure 154 Tug assigned to Anchor.

IMPORTANT:
The control of TUG positions sent to the SceneServer is done from the NaviPac Config, Instrument output as illustrated below.

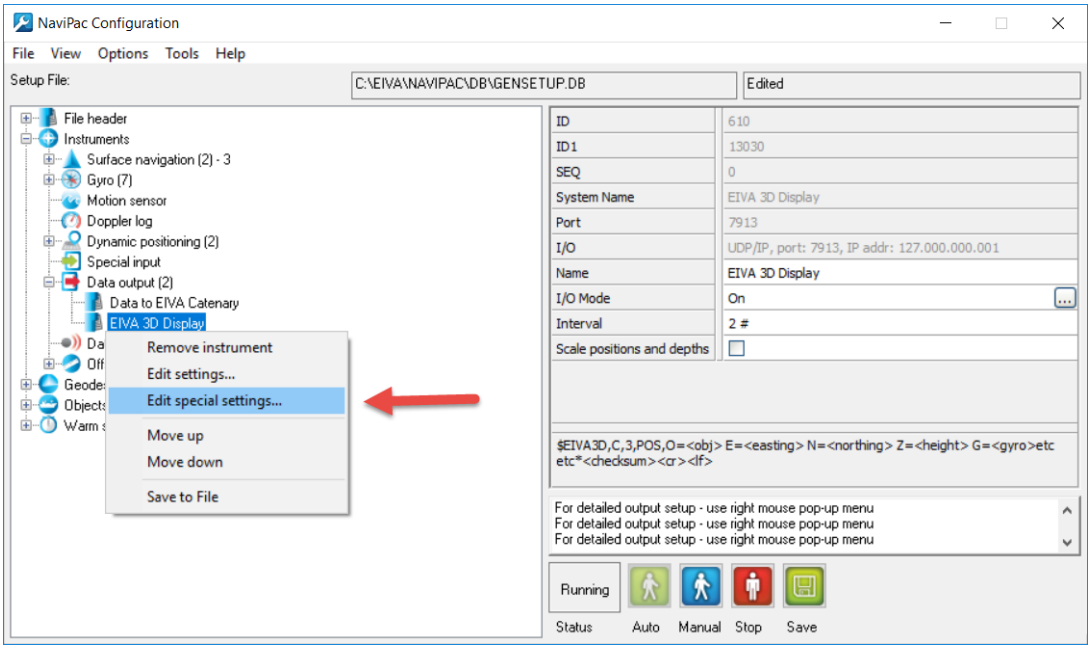


Figure 155 NaviPac Config Data Output control EIVA 3D Display output packages.

From the Special settings for the data export select the Tug objects used as illustrated below. When included Tugs are assigned to an Anchor those Tugs will be displayed on the Catenary Profile according to its display setting.

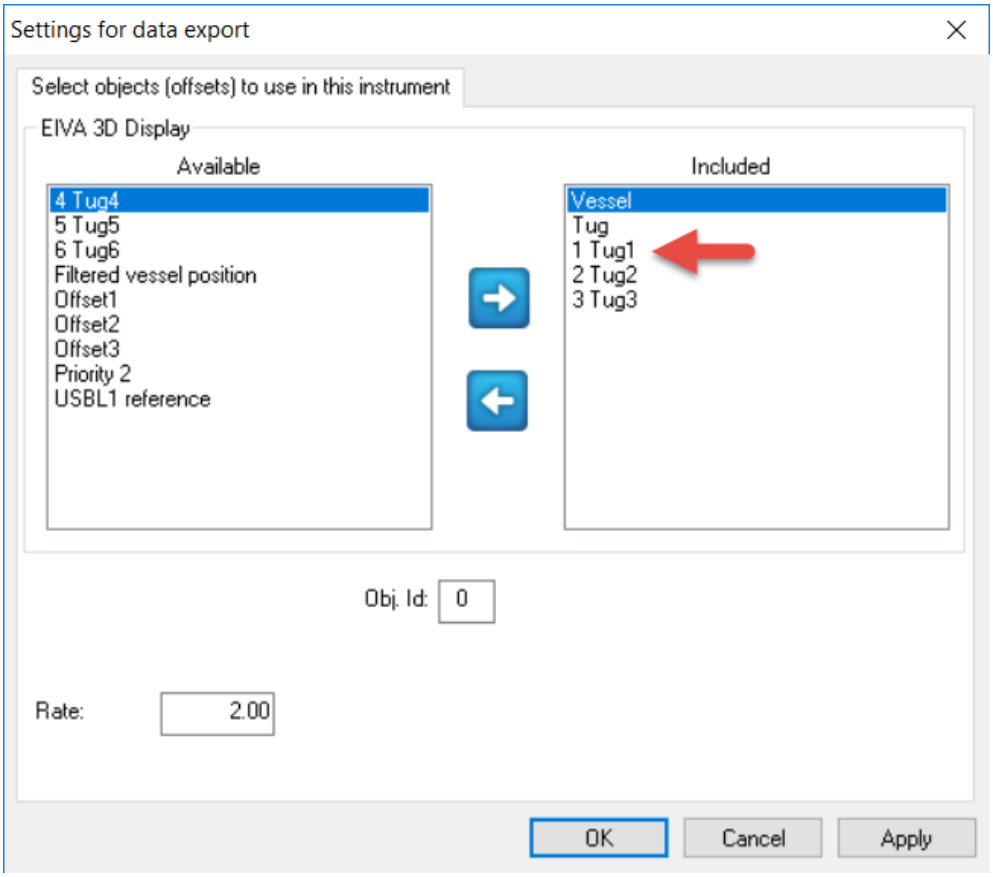


Figure 156 NaviPac Config Data Output control EIVA 3D Display data packages to be included in the export, e.g. Vessel, Tug, Tug 1, Tug 2 and Tug 3.

2.4.14 Property Grid

The Properties window contains the Property Grid which provide input and status fields for the object item selected in the Project Tree, illustrated below by Line1:

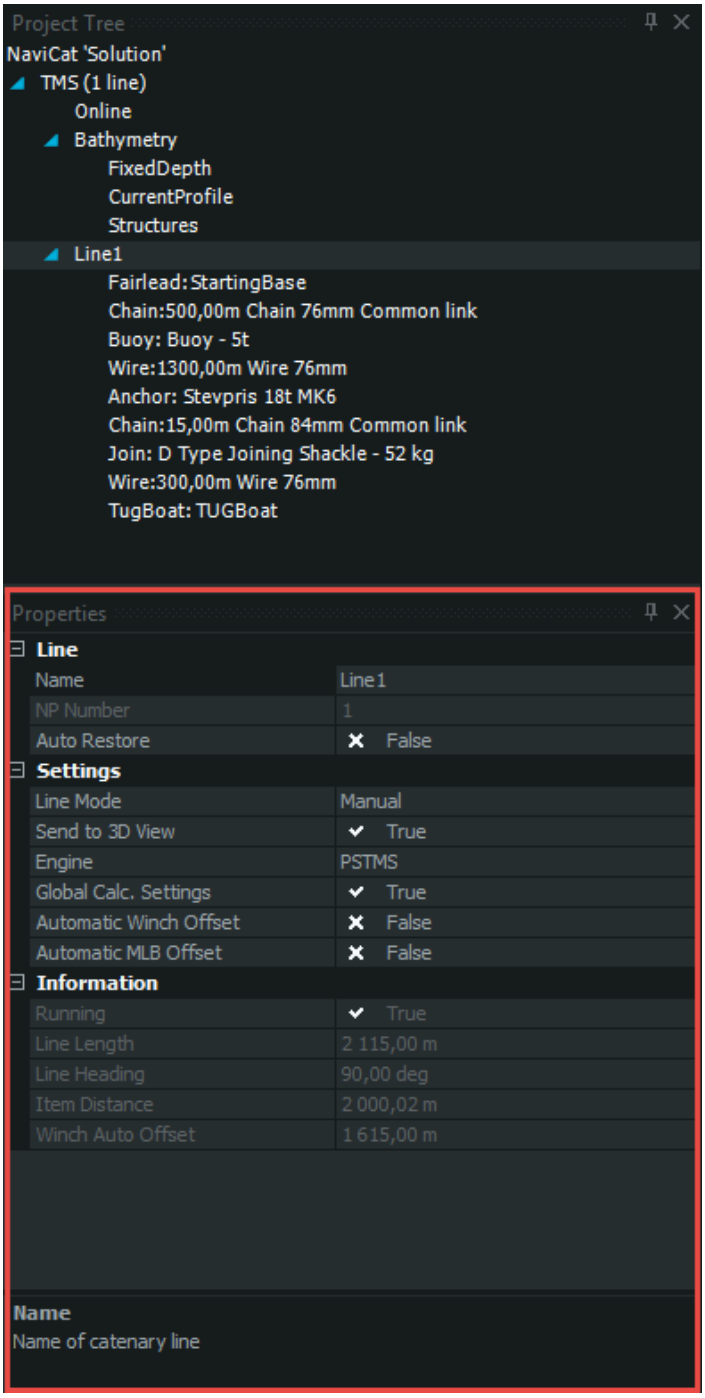


Figure 157 Property grid, marked by the red square containing settings for the selected Line1 object in the Project tree

Each property has its own help text associated. When a property is selected the help text is shown in the gray text field below the property grid, illustrated above for the "Name" property.

Some properties have input dialogs associated illustrated by the small button right aligned to the input field. Other properties providing status information only are ready only, such as the "Line Length" property.

NOTE:
Properties are not necessarily refreshed automatically during the simulation. Hence, to ensure that the latest and most correct value is displayed in the property dialog, select the object from the Project Tree, e.g. Line1 and press F5.

2.4.15 Profile View

Each catenary line, such as Line1, has its own profile view associated. If a Line object or one of its child objects is selected in the Project Tree the associated Profile View is shown and/or selected. Docked Profile Views can also be selected from the Window main menu.

The view visualize the catenary profile along the catenary curve and draw the matching seafloor underneath. The colors can be customized from the Options Dialog. Zoom, drag and other functionality is described in Toolbar Profile View section.

The profile view has it distance axis as X and depth axis as Y. Depth is always positive down, whereas height is positive up. The starting point or origo is always at x = 0.0 meters despite the actual coordinates set for each item such as starting base and anchor.

NOTE: By default origo is assigned to the Starting Base, but origo can be assigned to other catenary items, e.g. the anchor item form the Line object in the project tree.

In addition to the actual catenary curve, including the item display, the profile view have three areas of interest:

Upper Left including the profile view caption: Provide information about "Line Mode" and the simulation status, indicated by either a green, yellow or red button.
Lower Left: Cursor area, used for display of cursor position. Visibility of this area depend on the tool in use.
Upper Right: Parameter display showing calculated parameters based on the selection defined in the View Main Menu.

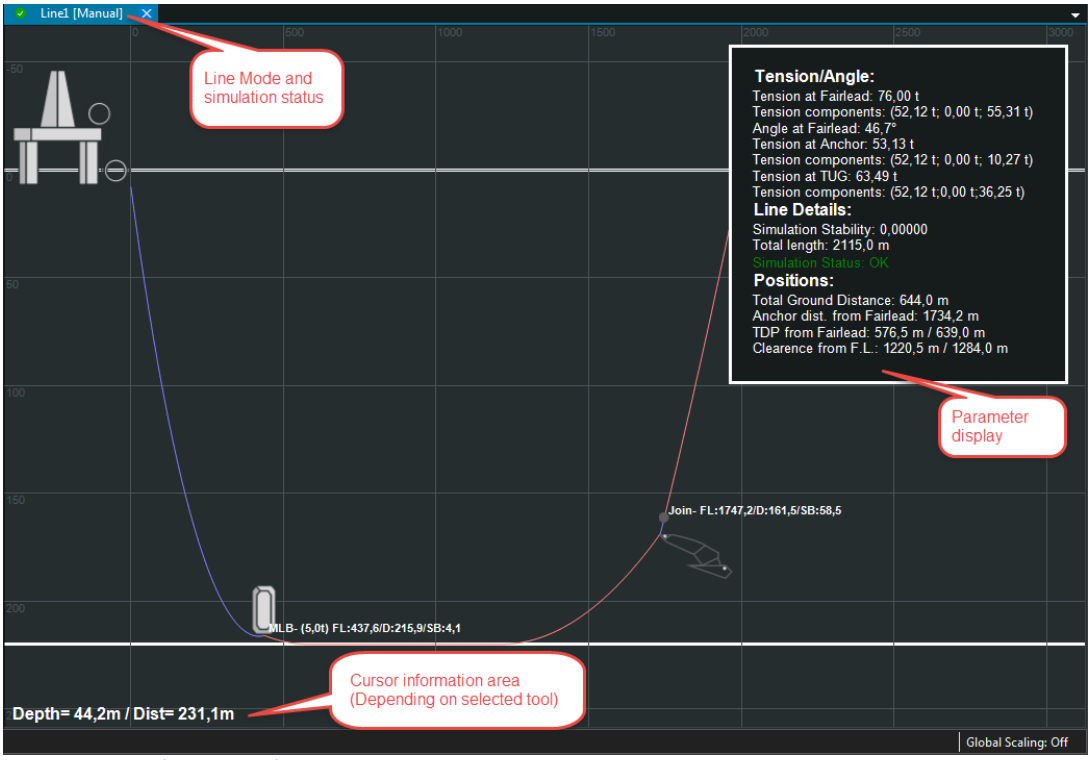


Figure 158 Profile view of a Tug deploying anchor scenario

2.5 Modes of operation

A catenary line can operate in the following three Line Modes: Manual, Calc and Online. The Line Mode is controlled by selecting the Line object from the Project Tree

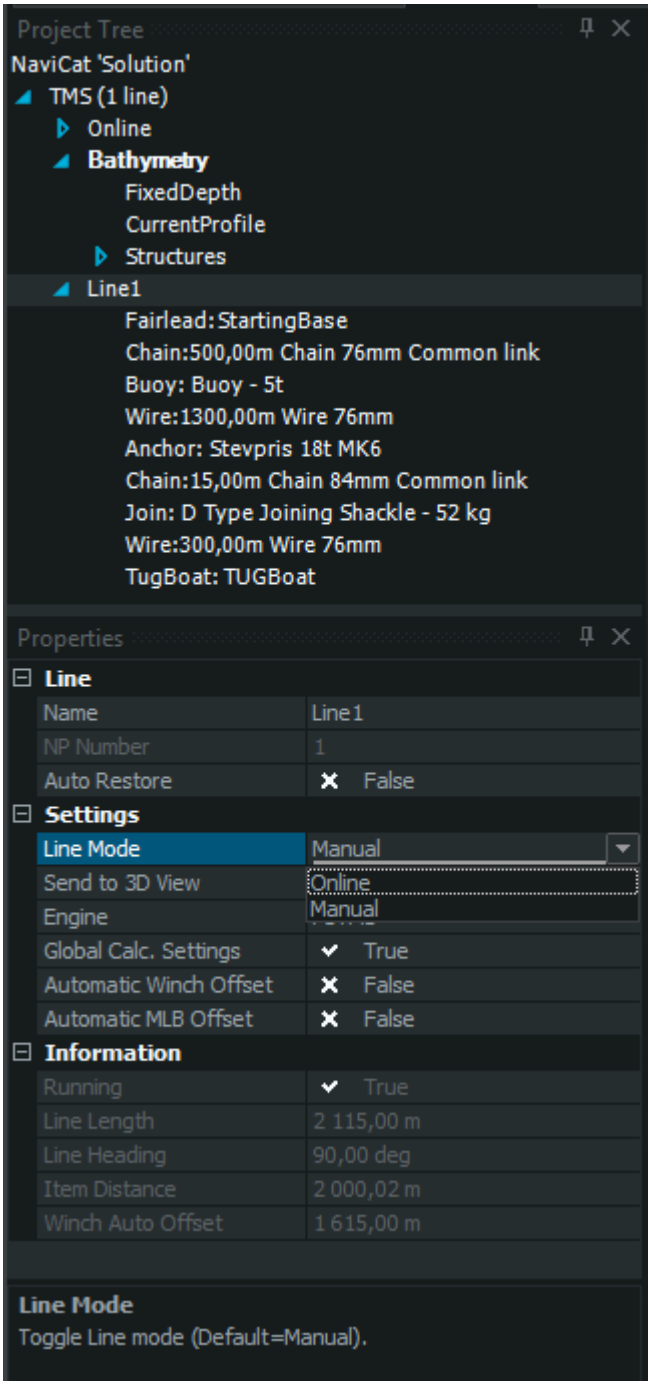


Figure 159 Line modes

Manual Mode (default)
When a Catenary Line is set in Manual Mode, all Catenary objects can be moved and changed during calculation. This includes dynamic change of wires, buoys etc. Also, cable length for the individual segments can be changed dynamically. The resulting change calculated parameters such as TDP, tension etc is updated automatically.

In Manual Mode, the anchor position and catenary lengths can be estimated given the specified setup and a requested true heading, angle or tension value at starting base, see Toolbar Controls for further information about use of the anchor calculator.

Online
In addition to the Manual Mode described above a Catenary line can be in Online mode. When operating in Online Mode NaviCat updates starting base positions and anchor/TUG positions based on position information received from NaviPac or other SceneServers providing relevant information.

Before a Line can enter Online Mode, NaviCat must be connected to a SceneServer, typically this would be the SceneServer launched by NaviPac, when the operator has defined an output for this. Open NaviPac Config, select Data output and add a EIVA NaviCat output.

When NaviPac is started and is sending navigational information to its SceneServer, NaviCat can connect to this SceneSever as described in the Online section. Use the Auto Configuration tool available from the right-click context menu of the Session node found in the project tree. Use this tool to generate at setup matching what has been defined the NaviPac RigMon. Note that additional configuration is required as valid section lengths must be specified for each catenary line define. NaviPac operate in 2D where as NaviCat operate in 3D, consequently valid length for the catenary curves cannot be specified correctly in NaviPac.

The Auto Configuration tool add valid Online Ref IDs to Fairlead objects and Anchors. If additional online updating is required, e.g. when interfacing a winch counter the the proper Online Reference ID must be add to the sections elements manually and properties for controlling the section length must be updated too, e.g. automatic winch offset on the Line node.

For configuration, please refer to TMS Online Configuration

2.6 3D View

Each catenary line can be visualized in 3D either by invoking NaviPac or HMD4. NaviCat facilitate the option for controlling 3D visualization of individual lines. Also, visualization of all Lines can be toggled on/off too.

Catenary Line

For 3D display of a catenary line the line property "Send to 3D View" must be set to the default value true. In addition the "Allow connections" property of the Online node must be set to true in order to allow 3D applications such as HMD4 or NaviModel to connect to NaviCat. When connected, the "Send to 3D View" controls the display of each catenary line being simulated.

TMS Session
Selecting the "Send all Lines to 3D View" from the Session tree node, the "Send to 3D View" can be toggled on and off for all Catenary Lines specified.

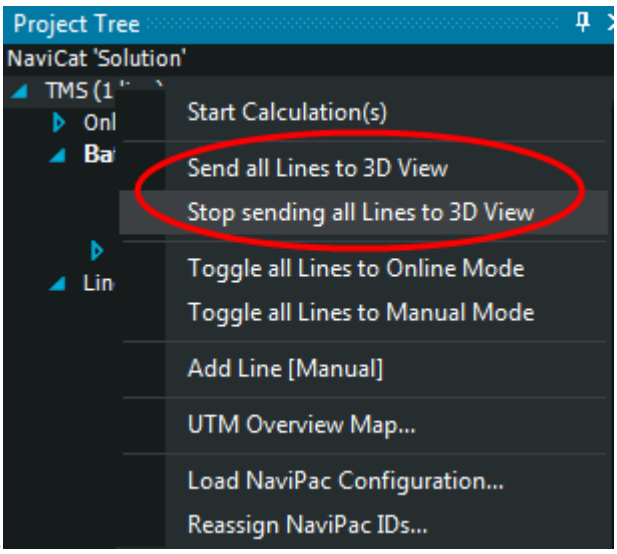


Figure 160 Controlling 3D display

2.7 NaviCat Calculation Engines

NaviCat facilitate catenary calculations using two engines, see Engine property of the Line node located in the project tree. Also, the default calculation engine can be set from the Options dialog available from the main menu Tools\Options.

PSTMS Engine, is an engine used for simulation of anchor chains and cable lay operations. It is fully dynamic in terms of property changes such as length, position, wire and MLB types etc.
CableLay Engine, is a simple engine used for cable lay operations only, where input angle or tension can be used for estimating TDP.

For detailed description refer to the following sections, PSTMS and CableLay.

2.7.1 NaviCat PSTMS Calculation Engine

The NaviCat PSTMS calculation engine, is based on a particle system.

2.7.2 NaviCat CableLay Calculation Engine

The NaviCat CableLay calculation engine, is based on static calculations, where parameters such as water depth, cable weight, angle or tension at fairlead are used to estimate position of TDP, bending radius at TDP.

This engine can be used for CableLay projects only.

3 NaviCat Cable Lay

NaviCat Cable Lay facilitate simulation and display of cable laying operations. When using NaviCat for such application, it must be in cooperation with NaviLay and NaviPac.

3.1 Cable Lay Overview

In order to use NaviCat online for Cable Laying projects the

NaviCat must be configured for online mode. Prerequisites are NaviLay and NaviPac running online.

- NaviPac provide online information such as positions and cable length. NaviPac act as a service provider for NaviLay.
- NaviLay provide online information to NaviCat.

4 NaviCat FAQ and HowTo

The HowTo section contains an number of HowTo documents, each HowTo document can be regarded a recipe on how to do certain things in NaviCat and has the aim of describe specific tasks in NaviCat in a short and easy to access manner.

If you are missing certain HowTo documents, please email your request to support@eiva.com, as described in Documentation and Help.

4.1 NaviCat FAQ

NaviCat TMS FAQ

Q: The simulation seems to have stopped responding properly to Online inputs.
A: This situation can occur in case the computer is not powerful enough or the configuration of NaviCat needs adjustments. One or more of the solutions can be utilized:

Settings:
- Increase the Particle distance, by increasing the value Particles per meter, see Tools/Options/Environment Parameters.
- Decrease the time step value.
- Too many online packages are being received. Try to apply online filtering on the navigational inputs, see Options/Communication Settings.

Catenary Line:
- Right-click the Line node in the project tree and select **Start Calculation**. This will restart the calculation.
- Select the catenary line showing the problem. Try changing the Cable Type (from the property grid listed below the project tree) to a more dense cable. Then wait a few seconds to see the response. When OK set the Cable Type back to the original type.

Q: The time stamp in the property **Last Online Update** is not updated.
A: Click on the property or press F5 to force a refresh. If not updated, verify network connections to the online PC running NaviPac.
- Open the SceneServer on the NaviPac PC, Right Click on the Log listbox and enable logging. Verify that proper strings are sent from NaviPac to the SceneServer. Disable logging. If no packages are sent to the SceneServer, verify NaviPac configuration and ensure proper port configuration of the EIVA 3D Display and Data to EIVA Catenary outputs (Default: udp://127.0.0.1:7913).
- Verify NaviCat connection to the SceneServer running on the NaviPac PC. Select the Connection node from the project tree and verify that counters for packages received and sent are updated. Click on the property to refresh.
- Toggle Lines to manual mode. Disconnect and reconnect to the NaviPac SceneServer. Toggle Lines back to Online Mode.

Q: In **Online Mode** the anchor object position is not updated properly in the 3D view eg HMD4.
A: When operating in **Online Mode** NaviCat typically obtain navigational inputs such as Anchor, Winch and Tug positions from NaviPac. Invalid filter settings can trigger this behavior in case proper Online3D packages are received from NaviPac or other sources via the SceneServer.

Please verify:

- Go to the Windows status bar (lower-right corner of the screen), open the SceneServer. Enable logging (right-click context menu). Verify that proper Online package are received and updated.
- Online Filtering prevent navigational updates. Try to disable the Online filtering (see Options/Communication Settings) by setting all Online Updating properties to zero.
- Anchor position and anchor state are updated properly in NavCat, but not in the 3D view. Depending on the Anchor State (Dropping Anchor to Seabed or Picking up Anchor from Seabed) the **Simulation Stability** parameter may vary. Hence, the **Stability Threshold 3D** (see Options/Environment Parameters) might need to be increased in order to ensure that the **Simulation Stability** is below this threshold during collection and deployment of an Anchor.

4.2 HowTo - Beka Online Configuration

This guide provides a step by step guide for setting up NaviCat in an online TMS setup known as BEKA. Part of NaviSuite BEKA, NaviPac with the catenary option is configured together with NaviPac 4.5, which include HMD4 used for navigational control and 2D and 3D visualisation. In addition HMD4 or NaviModel is used for 3D displays.

Involved applications:

Licence for EIVA software: EIVA Licence Activator and Wibukey software are installed as part of the EIVA software.
SceneServer: Central network component installed as part of NaviPac. The SceneServer must run on the NaviPac PC. NaviCat and NaviModel must connect to the SceneServer in order to be able to send data between each other.
NaviPac: Navigation software.
HMD4/NaviModel: DTM generation and 3D visualization. HMD4 is a free 3D viewer where as NaviModel requires a licence, see NaviModel Producer Licence Information.
NaviCat: Catenary calculation module.

Installation of EIVA software on to a two PC setup

PC1 (NaviPac and HMD4/NaviModel):

- NaviPac
- HMD4/NaviModel

PC2 (NaviCat):

- NaviCat

Subsequent to software installation, ensure that PC1 can ping PC2 and vice versa.
Ensure that proper dongles are available.
For problems related to software installation contact local software support personnel or EIVA support (support@eiva.com).

Configuration of EIVA software

PC1:

- Restore RigMove setup if available (The NaviPac Project Manager can be used to create a standard setup). Alternatively, a NaviPac Rigmove setup must be configured from scratch.

PC2:

- Update NaviCat Library files and configuration file according to requirements (% ProgramData%\EIVA\NaviCat*.xml). Simply copy and overwrite existing configuration files.
  NOTE: There has to be a match between Library files and NaviCat project files as items from the library is binded to the project file via a unique ID.

PC1:

- NaviPac cold start if needed.
- Modify NaviPac Barge Set up according to clients needs
  - Number of Anchors, MLBs (distance from anchor), proposed/actual positions for all objects
  - Number of TUG boats in use. Including output positions (Add objects to dynamic positioning)
  - Modify HD display for updated configuration
- Do a NaviPac warm start (Manual Start)
- Open SceneServer (Icon located in System tray – double click). From the monitor window (lower part of screen). Verify that UDP packages are received.

PC2:

- Start NaviCat
- Verify that correct configuration and library files have been updated correctly
- Create a new TMS project (press Shift+Ctrl+T)
- Connect to running SceneServer (Right click on the Online node, select Connect; Double click on the correct SceneServer listed in the Server Selection Dialog)
- Click the <Server IP>[Connected] node
- Verify that online data packages are received (Press F5 – see that counters listed in the property view are increasing)

  NOTE: If no packages are received or in case no SceneServer is available, check:
  - Firewall settings
  - Network configuration

- NaviCat Auto configuration
  - While connected to the Sceneserver, right click on the TMS session node and select Auto Configuration.
  - A number of Line objects will be created based on the NaviPac setup
  - For each Line, modify settings according to requirements
    - Change, create or delete items and sections for each Line created

        - Items specified in the Cable, Buoy and Anchor library are available from the combo box list.
    - Save project file (.cat) when all Lines has been modified according to requirements.

    NOTE: NaviCat supports drag-drop loading of .cat project files

- NaviCat Bathymetry
    - NaviCat TMS supports flat seafloor bathymetry or NaviModel DTMs
    - Right click the Bathymetry node and select the type of bathymetry to use.
        - Fixed depth – Enter a value for the depth to use for all Lines part of the simulation
        - NaviModel Bathymetry – Select DTM file (.db); Specify depth value to use outside theDTM
    - When done setting up bathymetry, right click the Bathymetry node and select Apply Bathymetry.

    NOTE: DTMs can be created in NaviModel. Creation of DTM models is outside the topic of this guide.

- NaviCat going online
    - Start Catenary simulations one at a time by selecting the line, right click and select Start Particle System. All particle systems can be started simultaneously from the TMS session node, right click and select Start particle system(s)
    - Verify that all catenary lines looks as expected
    - Toggle catenary lines to Online Mode. Select the line in the tree view and change Line Mode to Online in the property view. All lines can be changed in one operation from the TMS session Node (Right click TMS and select Toggle all lines to online mode)

Online connection between NaviPac and NaviCat has now been setup. Issues related to number of particles, stability threshold values etc. has not been described.

PC1:

- 3D visualization in NaviModel
    - NaviModel DTM
- Create a new NaviModel project
    - Add DTM by dragging drop the DTM database file (.db) onto NaviModel
    - Add overlay (.dis) by drag drop
    - Add 3D objects (.3ds) by drag drop
    - Other configuration....
    - Save NaviModel project file
- NaviModel Going online
    - Right click the Online Node, Right click on the Online node, select Connect; Double click on the correct SceneServer listed in the Server Selection Dialog
    - Online objects are listed in the Online[connected]
    - When connected online Catenaries can be visualized in 3D
    - NaviModel configuration
        - Set time out (Default 10 min -> 1Hour??)
        - Set track length (Default 10 min -> 0 min??)

PC2:

- NaviCat
  - Select Lines and toggle Send To 3D View to true. Catenary lines will be displayed in 3D View.

4.3 HowTo - Beka Demo Project

The **EIVA Demo Data installer** (EIVADemoData_2.0_20200902.exe) gets you started. It includes project files for a NaviPac TMS setup, and project files for NaviCat and HMD4/NaviModel.

Prerequisites:
NaviPac, Navigation and instrument interfacing.
NaviCat, Catenary calculation.
HMD4 or NaviModel, 3D visualisation.

For trial licences contact the EIVA Sales department (eiva@eiva.com).
For technical Support questions contact the EIVA Support team via our EIVA Support portal or by email (support@eiva.com).

Download and installation
The demo project installer for NaviPac 4.5 or newer can be downloaded from the EIVA FTP site. Please send a request for download credentials (default guest account) to EIVA Support support@eiva.com if necessary.

Download and run the **EIVA Demo Data installer** and select the NaviCat project.

Running the Demo Project
To set up the follow these pages:

- Rig Demo NaviPac
- Rig Demo NaviCat
- Rig Demo 3D

The demo project can also be used offline. With NaviCat operating in manual mode, doing catenary simulations and HMD4 or NaviModel is used for 3D visualisation.

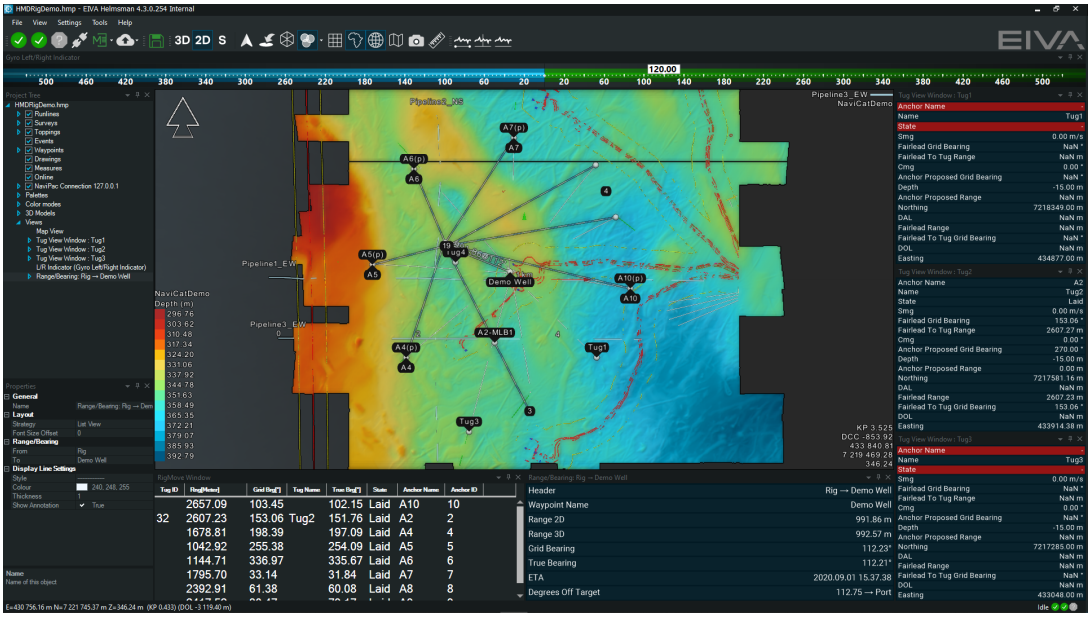
4.3.1 Rig Demo NaviPac

Configuration of NaviPac by defining a TMS project in NaviPac version 4.5 or later. Alternatively load the DemoProject by restoring the project by utilizing the NaviPac Project Manager.

Each vehicle has two Data output's, **EIVA NaviCat** (in the screenshot below renamed to Data to EIVA Catenary) and **EIVA 3D Display**.

In order to run on the local PC, the I/O settings for the Data ouput's are udp://127.0.0.1:7913/
.
Start NaviPac by a **manual start** (use the Reset button before Start), and the SceneServer is launched and is used by NaviCat for data communication.

If the demo project is loaded the following EIVA Helmsman display will be launched:

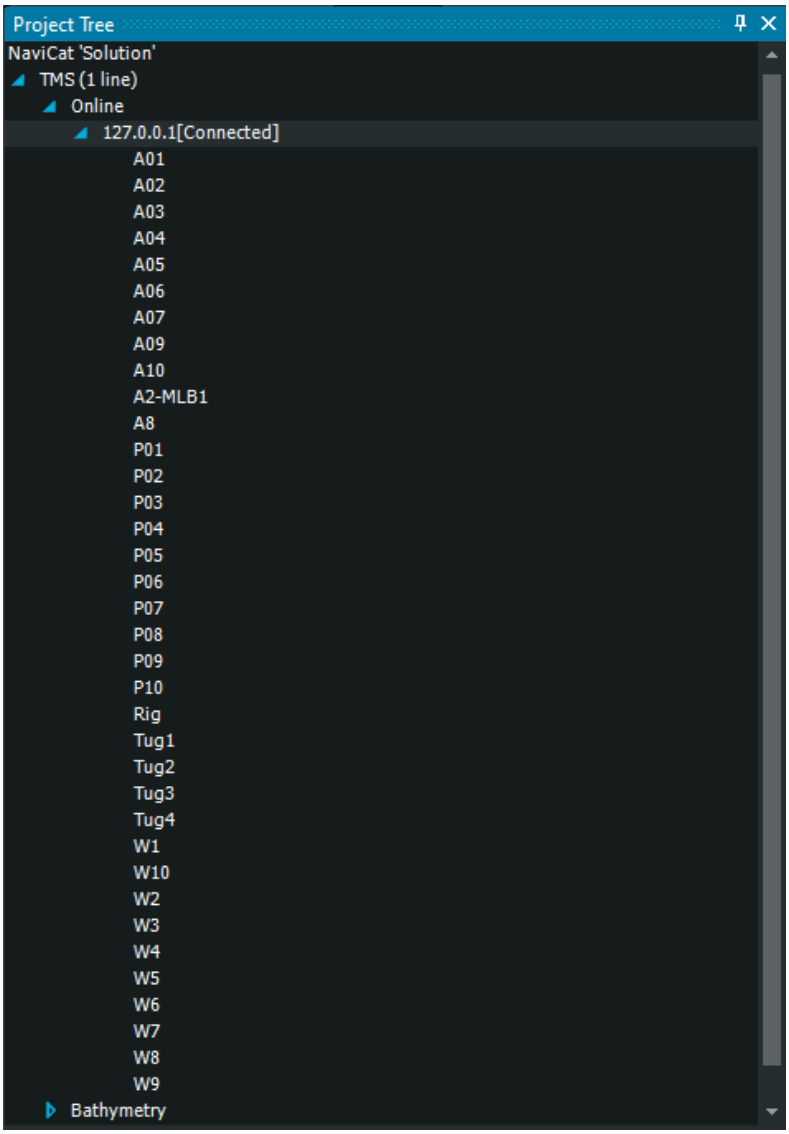


4.3.2 Rig Demo NaviCat

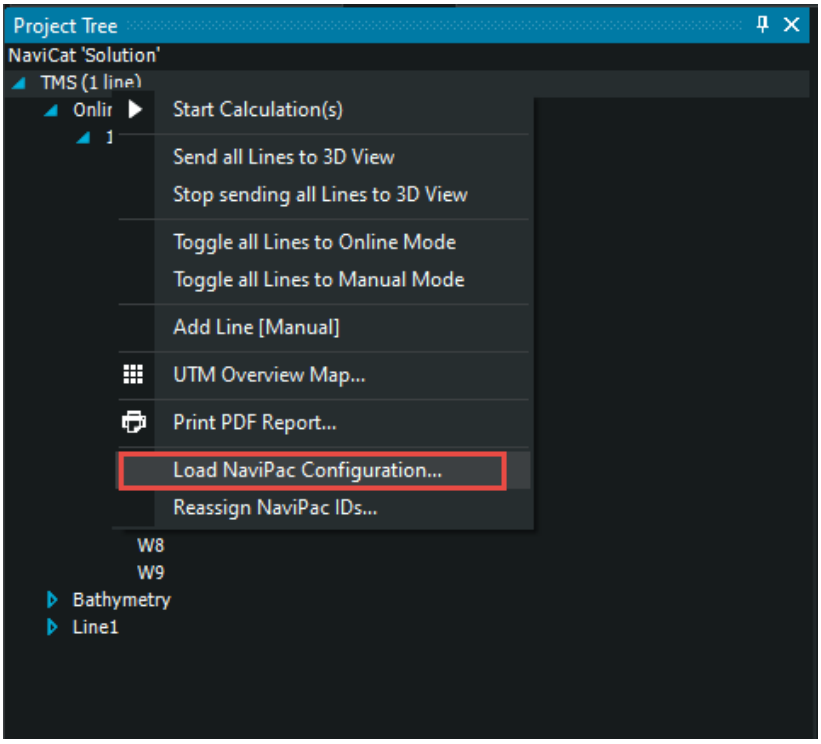
When NaviPac is running, launch NaviCat.

Connect to the running SceneServer, right-click the Online node in NaviCat project tree and select **Connect**.

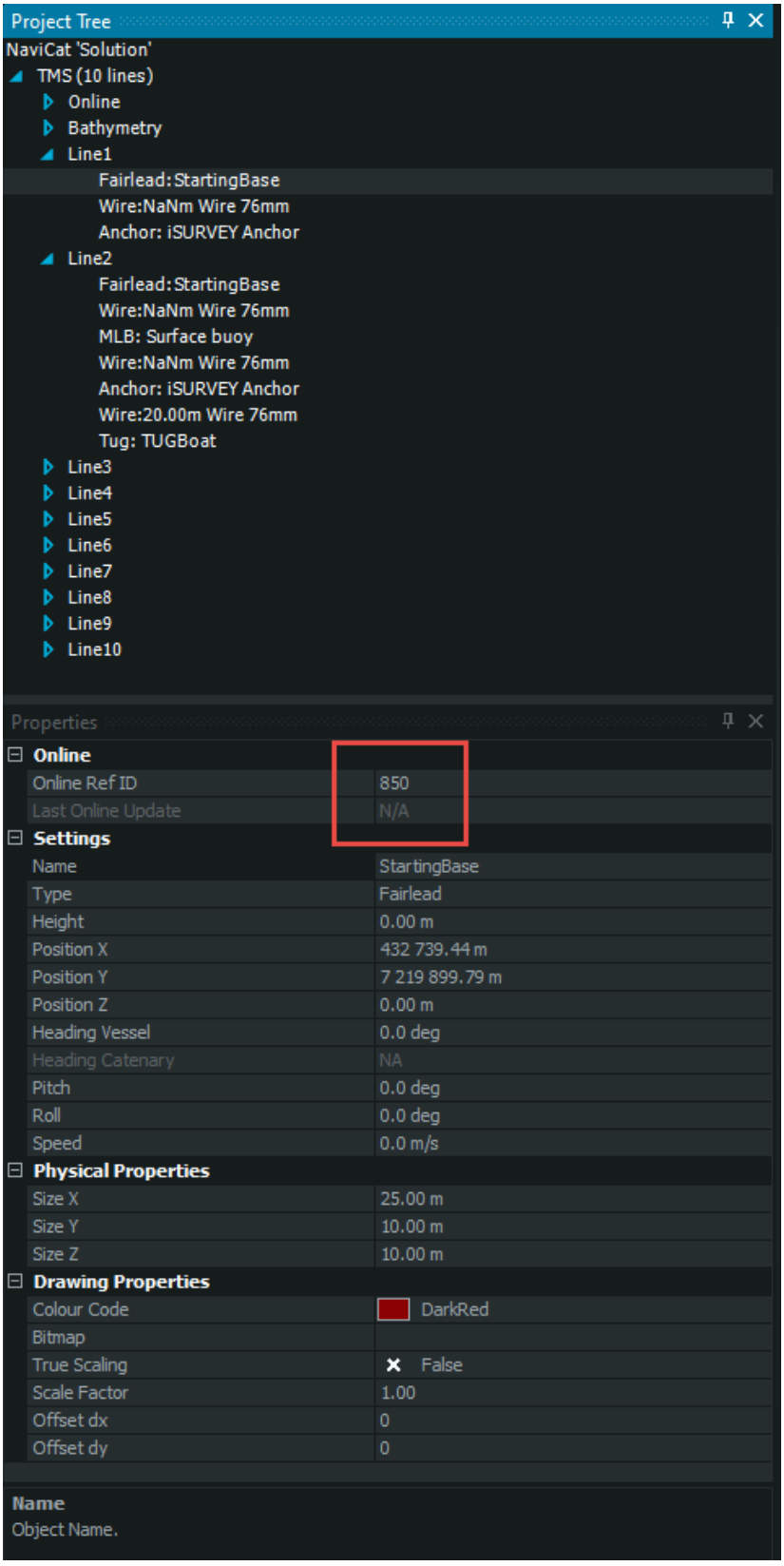
After a couple of seconds all NaviPac objects will be listed under the Online node. See and select the individual object information such as ID, Name and position is listed. The ID number is used by NaviCat to update online information such as position.



Right-click TMS Line and select Load NaviPac Auto Configuration. This will generate a default project based on available NaviPac objects. Save the NaviPac project.
Alternatively, load the NaviCat demo project and connect to the SceneServer as described above.

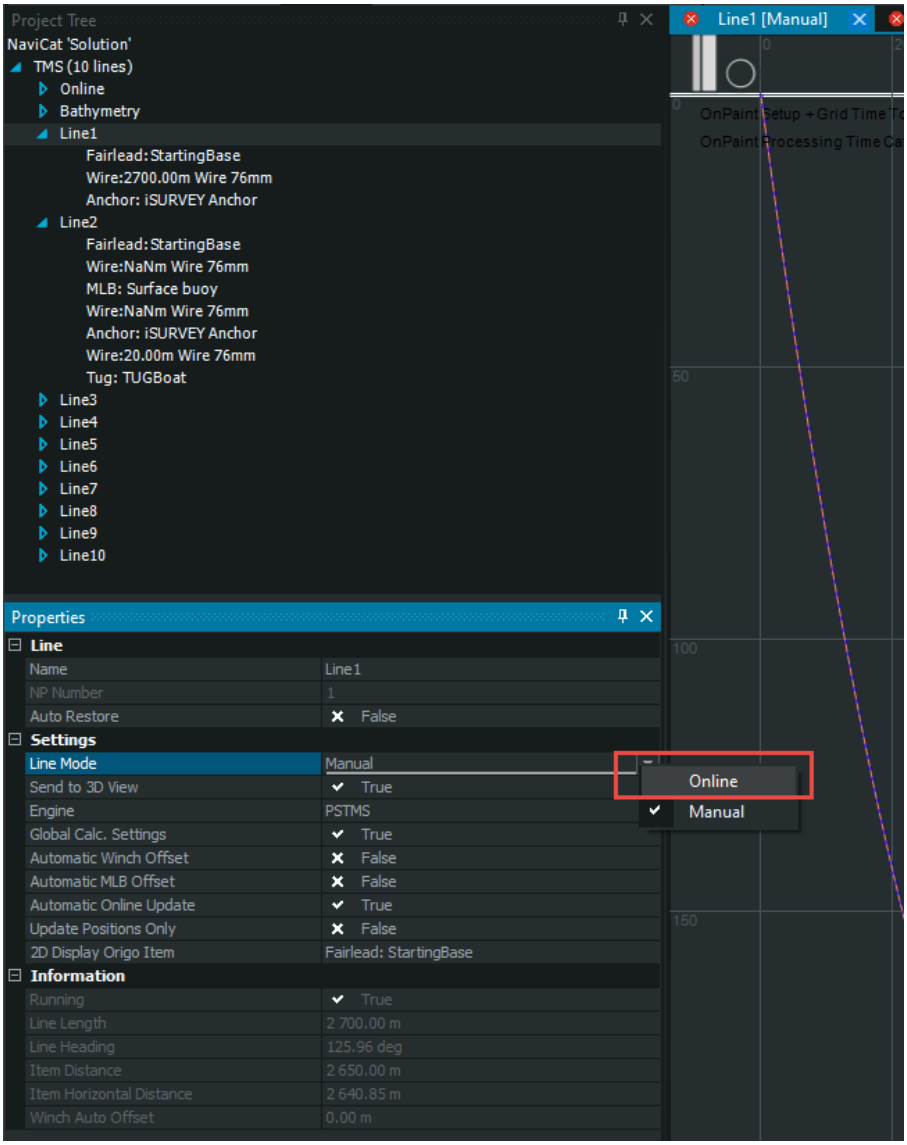


For each line verify ID number, e.g. W1=850 and the ID of the fairlead of line 1 is set to 850 illustrated by:

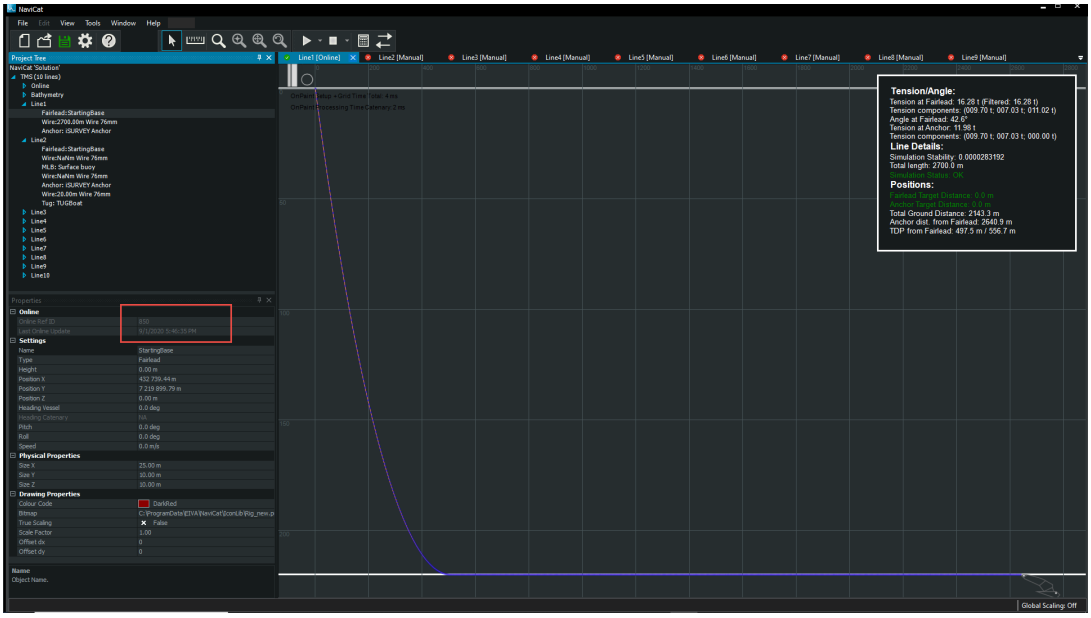

Project Tree
NaviCat 'Solution'
TMS (10 lines)
Online
Bathymetry
Line1
Fairlead: StartingBase
Wire:NaNm Wire 76mm
Anchor: iSURVEY Anchor
Line2
Fairlead: StartingBase
Wire:NaNm Wire 76mm
MLB: Surface buoy
Wire:NaNm Wire 76mm
Anchor: iSURVEY Anchor
Wire:20.00m Wire 76mm
Tug: TUGBoat
Line3
Line4
Line5
Line6
Line7
Line8
Line9
Line10
Properties
Online
Online Ref ID
850
Last Online Update
N/A
Settings
Name
StartingBase
Type
Fairlead
Height
0.00 m
Position X
432 739.44 m
Position Y
7 219 899.79 m
Position Z
0.00 m
Heading Vessel
0.0 deg
Heading Catenary
NA
Pitch
0.0 deg
Roll
0.0 deg
Speed
0.0 m/s
Physical Properties
Size X
25.00 m
Size Y
10.00 m
Size Z
10.00 m
Drawing Properties
Colour Code
DarkRed
Bitmap
True Scaling
False
Scale Factor
1.00
Offset dx
0
Offset dy
0
Name
Object Name.

Modify each line in order to match proper catenary configuration such as section type and length, buoy type and anchor type. For dynamic length assign the Online Winch Object ID to the Section.

When all catenary lines have been configured, the line can be toggled online by changing Line Mode from Manual to Online as illustrated by:



Subsequently all position objects will be updated based on online values received from NaviPac. Each time the position is updated for an online object the timestamp Last Online Update property is updated too.



4.3.3 Rig Demo 3D

When connected to a SceneServer the Catenary lines can be exported for 3D visualisation in NaviPac Helmsman Display, HMD4 or NaviModel.

By default, from the Online node in the project tree you can connect HMD4 or NaviModel to the running instance of NaviCat.

From NaviCat ensure that the Online property Allow Connections has been set to True and that the Line property Send to 3D View is set to true too. Both are by default toggled to true.

Launch HMD4 or NaviModel and connect to the NaviCat applications.

4.4 HowTo - Shallow Water Configuration

There are special settings used for catenary simulation in shallow waters, eg with water depth below 20 meter.

As the catenary simulation quickly reaches the default Stability Threshold, go to the NaviCat menu bar / Tools / Options and adjust the following settings:

- Stability Threshold = 0.0000001 (Default value is 0.00005)

- Time Step = 0.001 s (Default value is 0.003000 s)
- Subdivision Stability Threshold = 0.00005 (Default value is 0.005)

Figure 161 Environment Parameters controlling the simulation engine.

For general information about parameters, refer to Options dialogue box

Estimating Anchor Positions

In order to use the Anchor position calculator special configuration settings are required too. This is exemplified for a single line setup at 20 meter of water. Total wire length is 1791.3 meter.

The Anchor Calculator should be used in planning mode only, i.e. Line Mode must be set to Manual. In case online simulations are required, i.e. Line Mode is set to Online, it is

recommended that the Anchor Calculator is used on a separate PC. Also, it is important that the Line sections has set the Length from Tension to false and that Auto Calculation properties are adjusted accordingly, as discussed below.

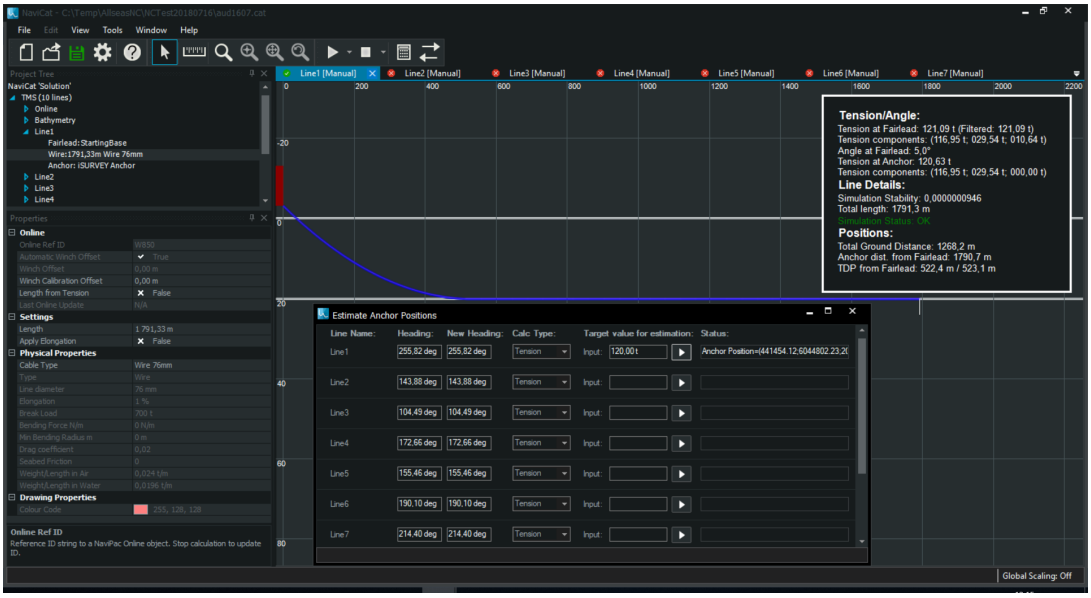


Figure 162 Anchor position estimation given required tension at 120 ton at 20 meter water depth.

IMPORTANT:
In order for the Anchor Estimator to work properly, each catenary Line must have the Length from Tension property set to false as illustrated below:

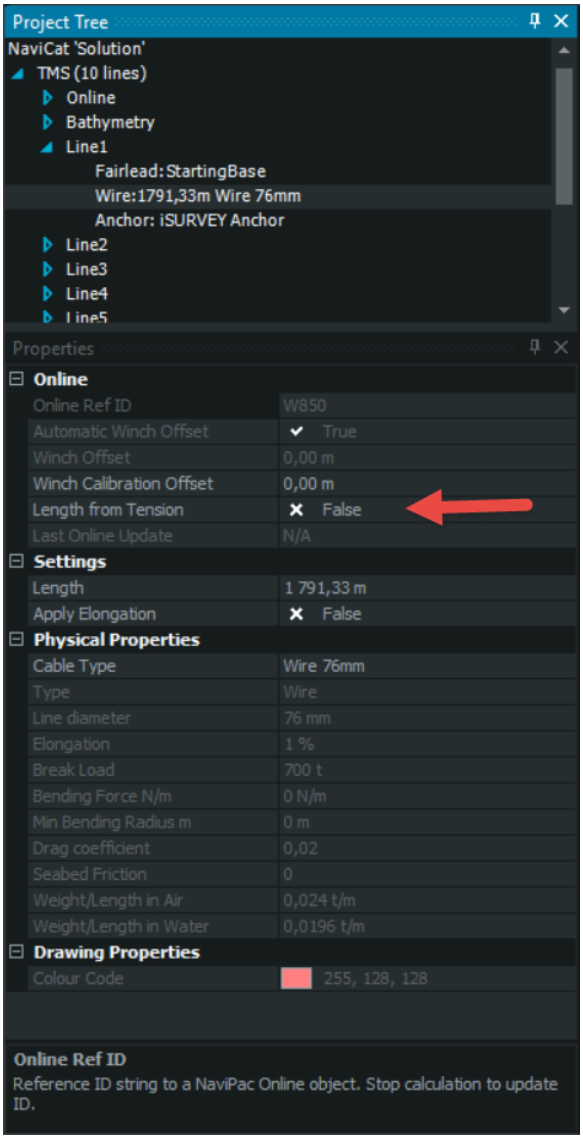


Figure 163 Length from Tension set to False.

Auto Calculation

Auto Calculation settings controls how the **Anchor Calculator** estimates the anchor positions according to its input parameters such as Tension, Angle or Bollard Pull.
For further information about the **Anchor Calculator** please refer to Toolbar Controls.

Shallow water settings for Auto Calculation are illustrated below. The initial and final particle distances have been lowered compared to the default settings. Minimum Iteration number has been increased, where as the Delta Range threshold has been lowered.

Particle Distance Initial = 10.0 m

Particle Distance Final = 5.0 m
Minimum Iteration Number = 1000
Delta Range Threshold = 0.25

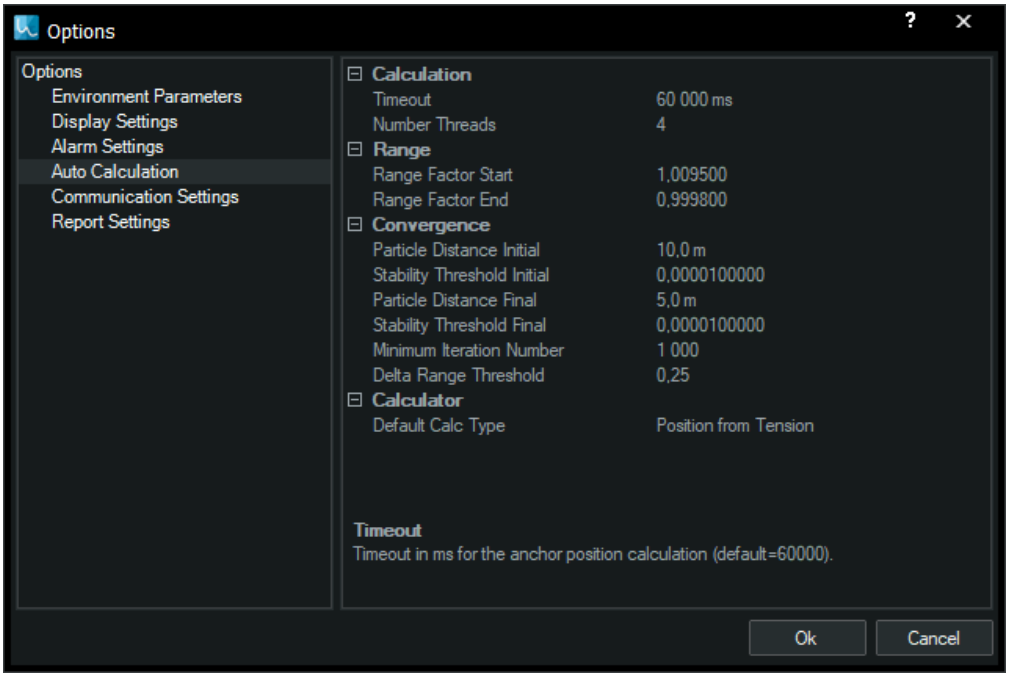


Figure 164 Auto Calculation settings.

By lowering the Particle Distance Initial and Final parameters a closer result to the final particle distance of typically 1.0 meter are used providing better intermediate results when the calculator iterate through the anchor positions.

Minimum Iteration Number: 1000. Minimum number of time steps applied before new particles are inserted. Ensure that simulation results such as tension has time to reach a more correct result. Normally when the stability value drops below the specified stability threshold, the engine steps to an idle mode in order to reduce CPU load. If the stability threshold is too high, incorrect tension values might be used causing erroneous estimates of the anchor position.

Data Range Threshold. Default = 1.0. Smaller number result in increased accuracy of the Anchor Position. For shallow water setups try to use values of [0.05..0.25] as even small anchor displacements may result in large change in tension. When decreasing Data Range Threshold, note that simulation time used to estimate the anchor position increases too. Consequently, even small changes in the catenary length 10-20cm at a tension of 50 or more ton has a huge impact on the tension at the starting base.

4.5 HowTo - Length from Tension Regulation

The Length from Tension is used in Online Mode only and provides an option for adjusting the length of the near starting base section dynamically to reach a specified tension Z-point. Normally, the NaviCat engine requires length input to dynamically change the length of specified catenary section. The change in length can be done in Manual mode by manually entering a required length for a section.

In order to enable the Length from Tension regulation the inner most section of a catenary line must have a Online Ref ID specified, e.g. W850. This enables a number of online properties such as the Length from Tension property. As illustrate below, toggle Length from Tension to true in order to initiate the usage of Length from Tension regulation.

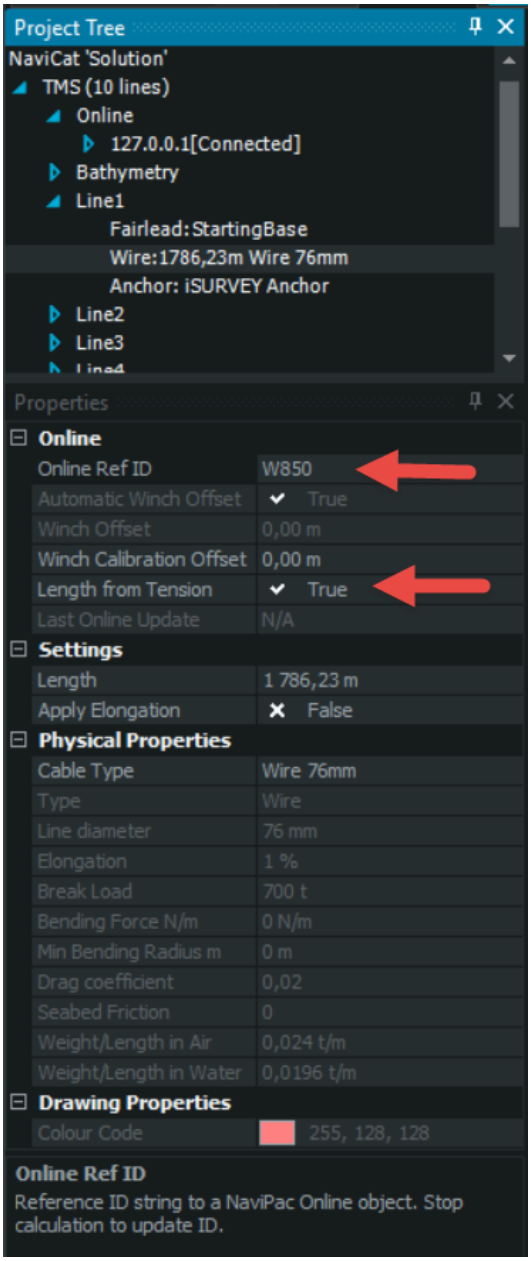


Figure 165 Enabling Length from Tension regulation.

Start the catenary simulation and toggle the Line Mode to Online in order to start receiving updates online. Line Mode is controlled from the Line node in the project tree.

This HowTo focus on dynamic length adjustments where tension inputs are used dynamically to adjust the Catenary length.

Online Updates

In online Mode the length is changed by providing a C13 CABLE package, see Online3DProtocol.pdf located in the <NaviCat installation folder>\Documentation, e.g.

$EIVA3D,C,13,CABLE,O=W850 L=1637.2 LC=1637.2 T=58 TMAX=999.00 V=0.00*FF

O=W850 - Online Ref ID that need to referenced by the catenary section in order to recieve online updates.
L=1637.2 - Length in meters received from an online source such as a winch controller or cable counter.
T=58 - Tension in ton received from an online source such as a winch controller with weight cells.
V=0.0 - Winch speed is 0.0, i.e. the winch is not in operation, i.e. fixed length.

NOTE:
For test and integration purposes not that IODesigner (distributed with NaviCat) can be used to generate C13 CABLE packages and send those to a specified SceneServer.

When Length from Tension is enabled and the Line Mode is Online, the Tension Z Point parameter is listed in the parameter display in the 2D profile view as listed below. This property display the latest online tension Z-Point received.

Figure 166 Length from Tension regulation. Tension Z-Point and filtered fairlead tension.

According to the Environment parameters, discussed below the inner segment length is adjusted continuously until the fairlead tension reach the tension z-point within the tension resolution.

During pay-in and pay-out tension fluctuations will be noticed, due to the behavior of the NaviCat engine. The Filtered fairlead tension, average filter of size 3 recorded over 15 time

steps per sample, provide a more stable tension value which reflect a more correct fairlead tension used for the regulator.

Environment Parameters
A number of properties listed in the Environment Parameters dialogue control the Length from Tension regulation. Below is listed settings for a shallow water setup where small changes in length has a large impact on tension. The higher tension the more sensitive.

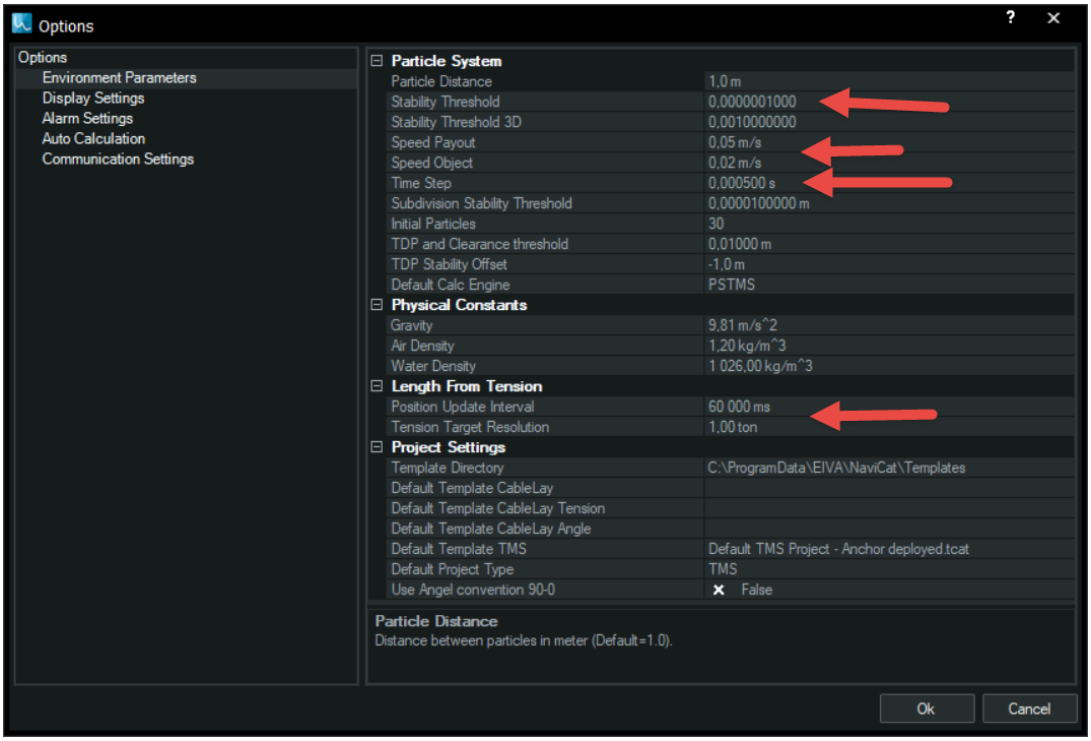


Figure 167 Environment Parameters for Length from Tension regulation.

Particle System
Stability Threshold = 0.0000001 - Must be sufficient small in order to not reach "stability" too early as the catenary must have reached a stable state, eg no change in tension.

Speed Payout = 0.05 m/s and Speed Object = 0.02 m/s - Must be sufficient small in order to maintain "stable conditions" when position or length are changed.
Time Step = 0.0005 - Must be sufficient small in order to maintain "stable conditions" and reduce the forces introduced when position or length are changed.

NOTE:
When time steps and speed of object and payout are lowered, simulation time increases. Hence, adjusting those parameters has a consequence in terms of simulation speed versus instability.

Length From Tension

Position Update Interval = 60000ms - Specify the update rate of online packaged that controls position of fairlead and anchor/tug and wire length. The update rate should be adjusted to a value that ensure that the Length from Tension regulation has reached or is close to the online Tension Z-point.

Target Tension Resolution = 1.0 ton - Specify how close the Tension Z-Point should be matched when performing the Length from Tension regulation.

Tension Regulation
The Length from tension regulation follows a three step check and length adjustment illustrated below.

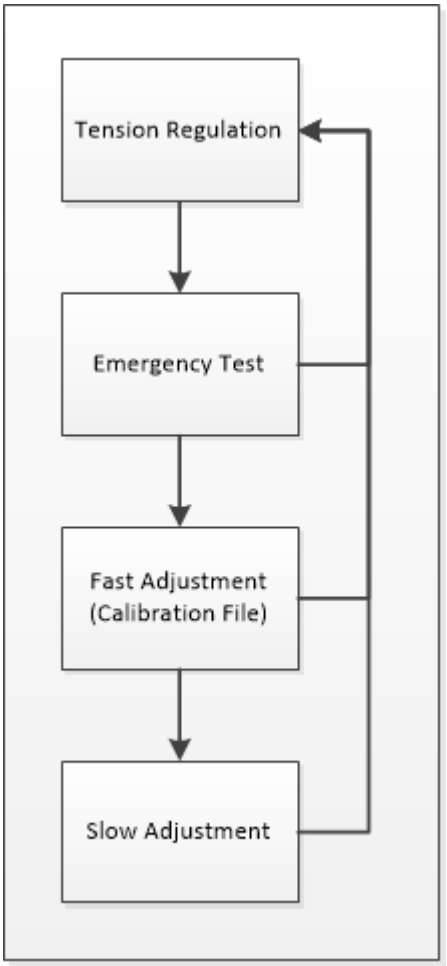


Figure 168 Length adjustment steps for the Length for Tension regulation.

First step in the regulation is an Emergency adjustment in case tension raises above a threshold of 500 ton. In this case and emergency payout of 0.5 meter is performed in order to reach a stable scenario as fast as possible. This situation will occur if the catenary get over

stretched, eg if the fairlead or anchor/tug moves faster apart than the payout can handle. Hence, it is important that the Object Speed and Pay-out Speed are similar value vise.

Second step is a Fast adjustment using Calibration file in case the Tension Resolution * 10 is exceeded by the difference of the current tension and target tension, i.e. for a tension resolution of 1.0 ton the fast adjustment is invoked if the difference between the Target tension and current tension at fairlead is larger than 10.0 ton. The change in length is calculated from the calibration file. The fast adjustment is also used in case the winch is in operation, i.e. pay in/out and the V= property in the C13 online package is different from 0.0.

Slow Adjustment adjust the catenary by a length calculated from the calibration function and the tension resolution. The change in length = (tension resolution / change in tension at fairlead tension) * 0.5
In that way the change in length decreases as tension at fairlead increases.

Generally, due to the behavior of the NaviCat engine dynamic changes has to take place in small steps in order not to introduce too large forces to the particle system and there by cause large oscillations and unstable scenarios.

Calibration Files
Calibration files can be updated for the individual Lines using the Length from Tension regulation. In order to update the existing (and default) calibration file is done from the context menu of the catenary section where Length from Tension is enabled as illustrated below:

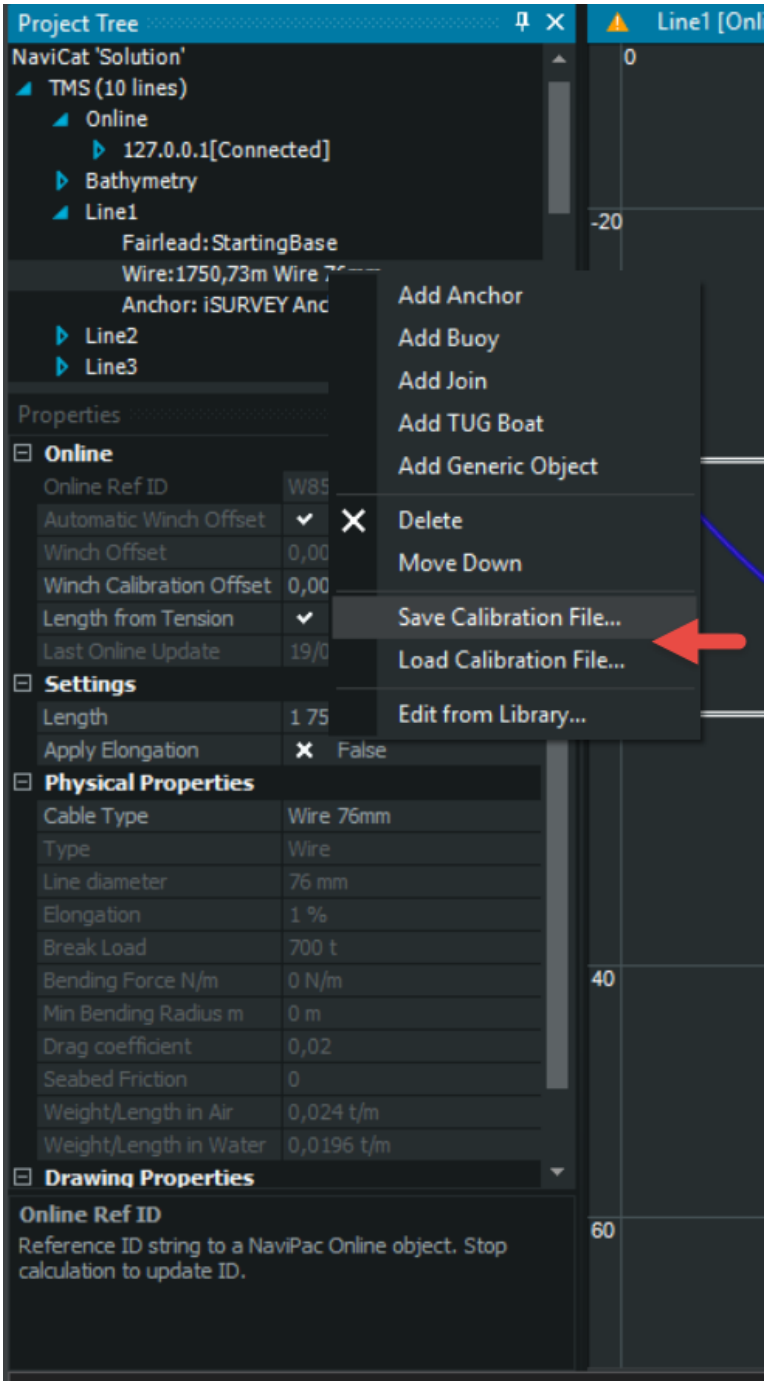


Figure 169 Adding or saving calibration file for the Length from Tension regulation.

Default calibration file created for a shallow water scenario with water depth of 20 meter:

<Target Tension [ton]>, <Change in Tension at Target Tension [ton/m]>

0.55, 0.00
0.67, 0.20
0.87, 0.40
1.23, 0.40
1.54, 0.80
2.02, 1.20
2.81, 2.00
4.27, 4.00
5.22, 5.40
6.54, 7.40
8.48, 11.20
11.46, 17.60
16.41, 30.20
20.21, 41.80
25.51, 57.80
33.25, 85.00
45.18, 133.00
64.95, 224.60
101.34, 424.20
179.88, 952.20
403.52, 2895.40

The file are generated manually for a setup of a single catenary line of length 1800.0 meters. For different target tensions [ton], the length is changed by 5 cm in order to calculate the change in tension [ton/m]

Depending on the setup new calibration files must be created in order for the fast Tension to Length regulation to work properly.

IMPORTANT:
The calibration file loaded is not persisted as part of the NaviCat project file (.cat) or the zcat export archive. To be added in a future version of NaviCat.

Restart
When operating in Online Mode having Length from Tension enabled, as described above, the initial Catenary length is adjusted prior to simulation start.

Position for fairlead and anchor is adjusted according to the latest position online objects.

The Length of the inner section is adjusted to match a total catenary length of |Fairlead..Anchor| + 0.1 * water depth at fairlead.

Due to the length adjustment, it might take some time for the tension regulation to reach the tension Z-Point.

From the Line node the online updating can be disabled by changing the Automatic Online Update property.

4.6 HowTo - Usage of Item Bitmaps

Each Catenary Item, such as Starting Base, MLB's and Anchors has the option to be displayed in the Profile View as a colored box or a bitmap. The purpose of this document is to describe how this is done and how the display can be customized to meet most requirements.

NaviCat is distributed with a bitmap library. When installing NaviCat the library is located in: <NaviCat Install Directory>\IconLib. When launching NaviCat all bitmap files are copied to % ProgramData%\EIVA\NaviCat\IconLib from where all running instances of NaviCat (version 4.3.2 and newer) are fetching bitmaps for display in the 2D profile window. Templates and bitmap settings accessible for the Options Dialogue should reference to this folder too when bitmaps are applied.

In general each Item display can be modified according to the following settings:

Item Size
Item size, typically specified in height, width and depth. Height specify the vertical size in the Profile View, width specify the horizontal size in the Profile View whereas depth is the dimension into the plane of the Profile View. The latter is only relevant for 3D representation. Item size is typically specified in [m] or [mm].

Drawing properties
The drawing properties contains of the following 6 properties.

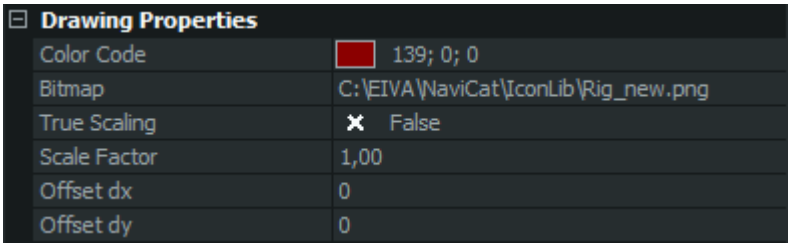


Figure 170 Drawing properties

Color Code
Color code for symbol. The color is only applied in case no bitmap symbol is specified.

Bitmap
Bitmap to symbolize the item, e.g. Fairlead or MLB. A fully qualified path must be specified. Formats supported are bmp and png files.

True Scaling
Only valid for bitmaps. Set to true for setting bitmap size to item size in meters. False use bitmap size in pixel (Default = true). True Scaling can be overwritten by the Global Scaling Property, Global True Scaling, see Options/Display Settings.

Scale Factor

Scale factor is an isotropic factor used for scaling the symbol bitmap according to its true scaling of bitmap size (Default=2). Scale Factor can be overwritten by the matching Global Scaling Property, Global Scale Factor, see Options/Display Settings.

Offset dx
Offset in cm/pixels depending on True Scaling (Default=0).

Offset dy
Offset in cm/pixels depending on True Scaling (Default=0).

The Offset properties depend on the True Scaling property.
If True Scaling is enabled the bitmap is scaled according to the physical size of the object item as described above in section Item Size. In this case the dx and dy are offsets in cm. Note that dx and dy has to be specified as integral numbers. Example: If we have an item object with a width of 100m and an offset of 50 meter has to be applied, then the value of dx must be set to 50m * 100 cm/m equivalent to 5000.
If True Scaling is disabled the offsets can be applied directly in raw pixels. Bitmap size and offsets will then depend on the screen resolution.

IMPORTANT:
An additional set of Global Scaling properties are controlled from the Options/Display Settings The Global Scaling Properties overwrite matching scaling properties for the individual Items.

For all catenary items with reference to a library, i.e. Anchor, Buoy and Joins the drawing properties are maintained within the Library.
Default properties for the Fairlead object is defined in the Options dialog under Display Settings. Note that settings can be modified on the Fairlead Item object directly too in case Global Scaling is disabled. Also, this is the case for TUG and Generic Item Objects.

4.7 HowTo - Usage and Configuration of Anchor Calculator

This page describes how use and configure the **Anchor Calculator**. With reference to the help section Options/Auto Calculation where a short description of the configuration properties are presented in brief, this HowTo present a more thorough description on how to configure and use the Anchor Calculator.

Configuration range factors
For most scenarios the default settings for Start Range Factor, SRF and End Range Factor, ERF should cover the interval for valid tension range. In some situations the user might have to adjust the two factors to match requirements. This HowTo describe the procedure for estimating those values.

Step 1)
Specify the water depth for the operation, eg 200 m and enter the depth value in the bathymetry **FixedDepth**.

Step 2)
Configure your catenary setup in terms of wire segment types and lengths, including MLBs and anchor. Place the starting base (winch position) at position (0.0m, 0.0m, 0.0m) and the anchor on the seafloor at distance x where proper stretched catenary curve is generated, e.g. for a catenary setup of 1000 meter, at a water depth of 200 meter, a good starting position for the anchor (placed on the seafloor) would be (950.0m, 0.0m, 200.0m).

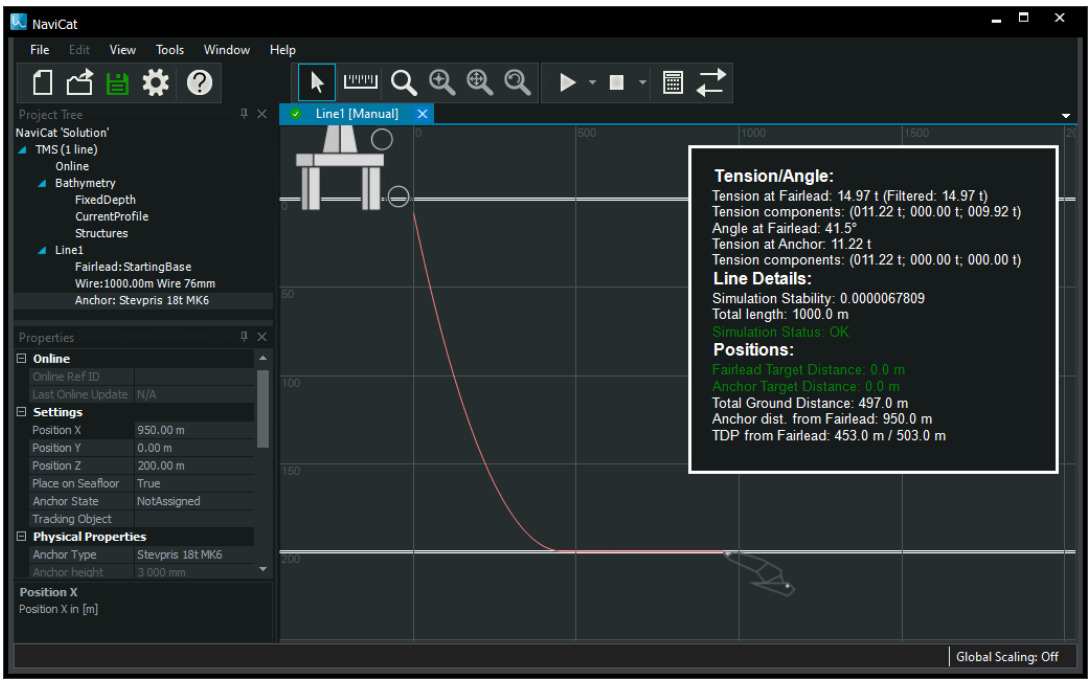


Figure 171 Initial anchor position at (950,0m, 0.0m, 200.0m).

NOTE:
It is advisable to vary x only (keeping starting base at origo and anchor on the seafloor) in order to simply the computational steps involved when estimating the Start and End Range Factors, SRF and ERF.

Step 3)
To estimate the **Start Range Factor**, SRF move the anchor toward the fairlead to reach the minimum tension for the test interval. The slack point, where the catenary curve draws a vertical line from the fairlead to the seafloor, must not be exceeded as tension no longer change with anchor position.

Also please not that convergence is reached faster for higher tension values compared to lower tension values. Hence, it is advisable that the minimum tension value is higher than the tension at slack.

The slack position, using x only calculated from the example above: x_slack = 1000m - 200m = 800m. Hence, x must be larger than 800m when estimating SRF.

Moving the anchor manually by changing the x position and evaluation the resulting tension at fairlead being calculated result in a start position x=830.0 meter if a required minimum tension at fairlead is around 3.9 ton as illustrated below. If a lower minimum tension is required move the anchor closer toward the fairlead (NOTE: not below 800.0 meter as x must be > 800.0 meter).

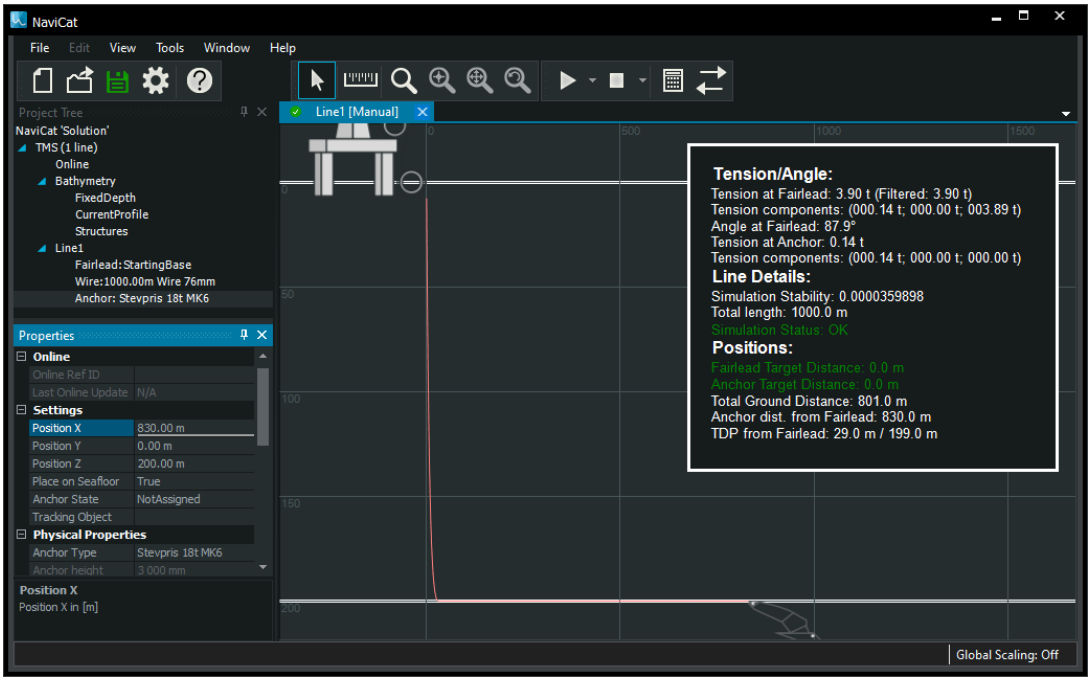


Figure 172 Start anchor position at (830,0m, 0.0m, 200.0m) at minimum tension range of 3.9 ton.

Using the formula from Options/Auto Calculation for SOF = (TotalLength - WaterDepth) * C_start, we can calculate C_start.

Using the above example we get:
SOF = 830.0m
TotalLength = 1000.0m
WaterDepth = 200.0m

C_start = 830.0 / (1000.0 - 200.0) = 1.0375

The **Start Range Factor**, SRF = 1.0375.

NOTE: Applying this SRF value implies that the minimum tension entered when using the Anchor Calculator must be **above** 3.9 ton.

Step 4)

To estimate the **End Range Factor**, ERF move the anchor away from the fairlead to reach the maximum tension for the test interval. As the anchor is moved away from the fairlead, tension increases and the catenary curve gets closer and closer to a straight line between the fairlead and the anchor. At some point, when moving the anchor away from the fairlead, the catanary setup will start to oscillate and become unstable due to massive forces introduced by the stretched catenary, see illustration below. When an unstable simulation is reached the **Simulation Stability** will not drop toward 0.0, but remain high. Also, other parameters will be unrealistic, e.g. **Tension at Fairlead**, **Total Length** etc.

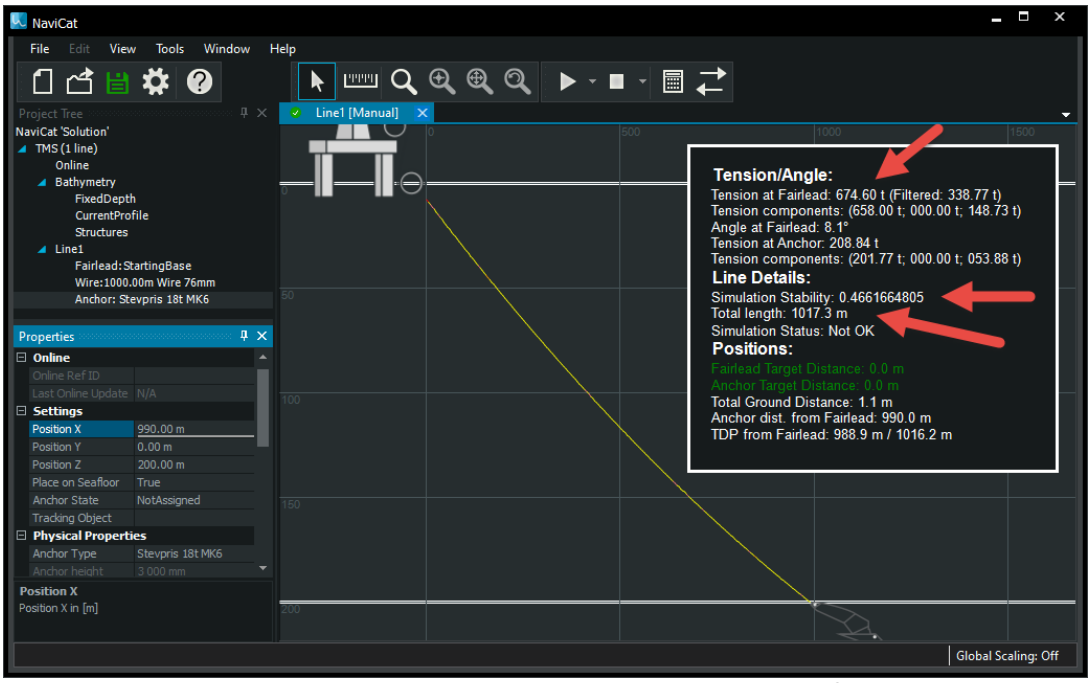


Figure 173 Anchor position at (990,0m, 0.0m, 200.0m) introducing instability. Convergence cannot be reached.

When an unstable simulation occur, move the anchor toward the fairlead by lowering x until stability is regained.

NOTE: The Time Step value has an influence too. By making the Time Step smaller the simulation become more stable, but on the cost of performance.

For the example above a stable but high tension configuration is reached when when the anchor is located 980.0 meters away from the fairlead as illustrated below. Also, we notice the **Tension at Fairlead** of 108.23 ton.

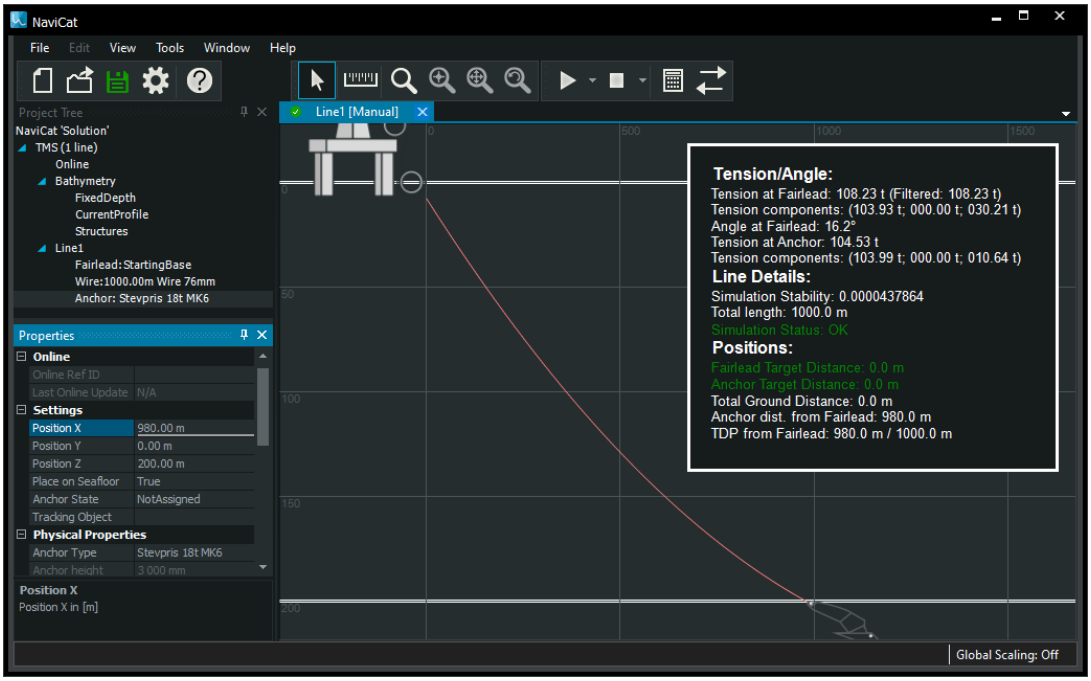


Figure 174 Stable, high tension configuration at anchor position at (980,0m, 0.0m, 200.0m). Convergence is reached.

Using the formula from Options/Auto Calculation for EOF * C_end = Sqrt(TotalLength^2 - WaterDepth^2)

Using the above example we get:
EOF = 980.0m
TotalLength = 1000.0m
WaterDepth = 200.0m

C_end = Sqrt(1000.0^2 - 200.0^2) / 980.0 = 0.99979173

The **End Range Factor**, ERF = 0.99979173.

NOTE: Applying this ERF value implies that the minimum tension entered when using the Anchor Calculator must be **below** 108 ton.

NOTE2: When using the Anchor Calculator and Length from Tension or Length from Angle the configuration of the test range properties follow the same principle, except that the anchor position is kept fixed and the length of the near fairlead section is adjusted to accomudate the target tension or angle specified in the Anchor Calculator

Convergence settings

The convergence settings for the Anchor Calculator are used to control convergence criteria's for the temporary catenary simulations leading to the final estimate based on an iterative process.

Based on the test range defined by the start- and end positions found above, individual catenary simulations are initiated to cover the test range. The number of simultaneous simulations are controlled by the **Number of Threads** property, see Auto calculation. For a scenario using 4 threads, for anchor positions will be used, one at the start position and one at the end position and two equally spaced in x,y between the two. All using identical setups in terms of wire type and length, MLBs etc.

Individually the simulations are executed in a two step process. First simulation is using the properties defined by **Particle Distance Initial** and **Stability Threshold Initial** when convergence is reached, i.e. the simulation stability drops below **Stability Threshold Initial**, the particle distance is changed to **Particle Distance Final** and **Stability Threshold Final**. Simulation continues until the simulation stability drops below **Stability Threshold Final.** As an extra option for controlling stability the property Minimum Iteration Number specify the number of time steps executed before the **Particle Distance Final** and **Stability Threshold Final** are used.

Based on the simultaneous **Number of Threads** simulations, the test range interval is narrowed to the two anchor positions having a result below and above the target tension. All simulations are stopped and a new iteration set of **Number of Threads** simulations are configured and started. This continue until the range between individual anchor positions drops below the **Delta Range Threshold.**

Hence, when defining the convergence settings it is important to verify that the particle distances and stability thresholds are configured correctly in order to ensure proper convergence and consequently calculation of a valid result, e.g. tension at fairlead as this result have an impact on future results until convergence is reached.

When operating in shallow waters, see HowTo - Shallow Water Configuration as special configuration is required, due to setups where very small displacement in anchor position result in high changes in tension.

Using the Anchor Calculator
See section Anchor Calculator. Alternatively, launch the Anchor Calculator and press F1 for online help.

4.8 HowTo - Quick Reference Guide

The purpose of this guide is to provide the reader with shot guide lines on how to operate NaviCat in TMS mode. The prerequisite for using this quick guide is a fully configured TMS setup within NaviPac and knowledge on how NaviPac and HMD4/Navimodel.

Configuration

For NaviPac to communicate with NaviCat, NaviPac must be configured with the Data Output Instrument, Data to EIVA Catenary and EIVA 3D Display. The port settings of this instrument must be set to UDP for the local PC, i.e. 127.0.0.1 using address 7913 (udp://127.0.0.1:7913). When started NaviPac will subsequently starte a local instance of the EIVA SceneServer, located in the system tray, and send out positions for anchors, fairleads and MLBs.

Start NaviCat. Ensure Option settings are defined as required. From the Online node in the Project tree, right-click and select "Connect". From the dialog displayed, select the SceneServer just started by NaviPac. When connected a list of object being received will be shown. When all relevant object has been updated, typically within a few seconds, the configured TMS Lines has to be configured.

Select the TMS node, right-click and select "Load NaviPac Configuration...". This action populate the project tree with catenary lines defined in NaviPac.

Go through each line and ensure that the type of Cable, including its Length are set properly. Also, type of Anchors and MLB's used must be configured. New types can be added to the relevant repositories.

When all configuration have been verified. Save setting to a NaviCat project file from File/Save as. This project file can the be loaded subsequently from the File/Open or File / Recent Files menu points.

NOTE:
In case changes to the NaviPac installation occur. NaviPac IDs can be reassigned by selecting the TMS node, right click and click "Reassign NaviPac IDs"

Starting Calculations
When the NaviCat project has been configured properly. Catenary simulations must be started. All Lines defined can be started individually or all simultaneously.

Right click the TMS node and select "Start Calculations(s)". This will start simulations for all lines configured. Right click a Line node and select "Start calculation".

Going Online
In order for NaviCat to reflect online updated from NaviPac, the catenary lines must be in Online Mode. In order for an objects, such as an anchor, to be updated online it must be associated with a proper "Online Ref ID". Using the "Automatic Configuration" assure that proper IDs are assigned for fairleads, anchors and MLBs. IDs for cable sections must be defined too according to the exchange format used.
When IDs has been updated, remember to save the project.

Toggle between Manual Mode and Online Mode are done individually on each Line by selecting Line, change the Line Mode property from Manual to Online or vise verse. Toggling on Line Mode for all Lines configured is done by right click the TMS node and select "Toggle all lines to Online Mode" or "Toggle all lines to Manual Mode".

The item property "Last Online Update" display the time of last online update. Click on property for live update.

3D View
NaviCat can export Catenary lines to HMD4 or NaviModel for 3D display. Ensure that the Online property "Allow connection" is set to true. Also, the "Send to 3D View" property must be set to true. The property can be set for each line individually or for all lines simultaneously by right click on the TMS node and select "Send Lines to 3D View" or "Stop sending all lines to 3D view".

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