NavView User Guide – Anchor Management Module

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1 INTRODUCTION

1.1 OVERVIEW

Anchor Management is one of the modules that can be included with 4D Nav's NavView positioning and navigation package and therefore installed with NavView if it has been purchased. For assistance with the installation of NavView, refer to **S01 – Introduction** in the **NavView User Guide**.

The Anchor Management feature supports anchor management for barge and rig operations using serial radio modems (Telemetry) or IP radio modems (Network Services) for inter-vessel communication. The process utilizes standard NavView features with the addition of the Anchor Management module.

NavView supports operation of the primary systems on the anchor handling vessels, the primary and spare system on the anchor vessel (e.g. rig) and spare anchor tug systems as required.

1.2 LICENSING

Licensing is controlled by the NavView software security, either a KEYLOK USB dongle or a Cloud Controlled Network Floating License. In either case, the license must include the option for the Anchor Management module for the anchor vessel and the Anchor Handling module for the tugs.

If using a KEYLOK USB dongle, plug this into an available USB port on your PC. If using a Cloud Controlled Network Floating License, refer to **S01 – Introduction** in the **NavView User Guide**.

To check if your license supports Anchor Management, from the NavView Home ribbon click on About and confirm that the HasAnchorManagement item is set to true for the Anchor Manager PC and HasAHV is set to true for AHT PCs.

1.3 ANCHOR MANAGER

The Anchor Management module utilizes the concept of an Anchor Manager station. This station is able to access the Anchor Planning and Anchor Management features and thus plan and control anchor operations. Typically this would be the NavView system on the anchor vessel but it could be the NavView system on one of the anchor tugs.

Note: The Anchor Manager must be the Master for the radio modem network.

There can only be one active or online Anchor Manager per project. However, NavView supports a 'hot spare' Anchor Manager. The hot spare is a duplication of the online system except it is set as a Remote in the network. The hot spare can share positioning sensor inputs but must have its own serial radio. The spare stays in sync by listening in on the telemetry traffic but it never transmits and is never polled. If it is required for the spare to go live due

to a failure of the active system, it is only necessary to switch its serial radio telemetry setting from Remote to Master.

1.4 HORIZONTAL CRS AND ANCHOR HANDLING

When NavView works with map projection grid coordinates, they are assumed to be in the current Working Horizontal CRS map projection. When geographic coordinates are entered they are assumed to be on the Working Horizontal CRS geographic datum. This applies to user entries such as waypoint positions and data loaded from supporting files such as AutoCAD dwg files. This can impact the setup and operation of NavView for projects that span multiple Horizontal CRS where the reference geographic datum is the same but the map projections vary, specifically the case of a project starting at an anchor vessel's current location in one zone and finishing at the new target location in a neighbouring zone. This section discusses the ramifications of this scenario.

Note: If the project involves multiple Horizontal CRS that use different geographic datum, the approach detailed here does not apply. In this case, two projects are required, one to handle the work at the initial location and one to handle the work at the target location.

When a position is entered as a geographic coordinate (referred to as Geo in the user interface) by a user, that position is saved as the entered geographic coordinate and converted to its map projection coordinate based on the current map projection. If the map projection is changed, a new map projection coordinate is automatically created by converting the original geographic coordinate to the new map projection. Regardless of the Working Horizontal CRS map projection at the time of the data entry, the geographic position integrity is maintained.

If a position is entered as a map projection grid coordinate (referred to as Grid in the user interface) this coordinate is converted to a geographic coordinate based on the current Working Horizontal CRS and this geographic position is saved. The position is dependent upon the current Working Horizontal CRS at the time of the data entry. This is not a factor when a project takes place in one specific map projection but is must be considered if the project will use multiple map projections.

Therefore, in the case of a project involving multiple map projections when it comes to location data entry such as target locations, waypoints, etc., the user has two choices:

- To enter positions using map projection coordinates, prior to the data entry process, access the Horizontal CRS configuration and change the Working Horizontal CRS to the one applicable to the positions to be entered; or
- Enter all positions as geographic coordinates

In the case of an AutoCAD drawing or ESRI shp file, NavView supports the loading of these drawings and assigning the applicable Horizontal CRS map projection to that file. A background file is only available for display when the current Working Horizontal CRS

matches the one assigned to the drawing. This supports the case of a project using multiple map projections. Refer to **S08 - Windows** in the **NavView User**.

1.5 ANCHOR STATES

In managing anchor operations (see Section 3), NavView uses Anchor States to designate the current location and/or action involving the anchor. The anchor state in combination with the assignment of an anchor to an anchor tug controls how the anchor is displayed in the 2D Map views. The anchor states that are available to be assigned to it and what guidance is provided is shown in Table 1.

The configuration of the Anchor Project involves setting the initial anchor state.

Note: AV = Anchor Vessel, e.g. rig, AHT = Anchor Handling Tug

State	Anchor Location	Anchor Line Visual	Optional States		Guidance
			Assigned to AHT	Not Assigned to AHT	
Racked	At fairlead	None	• Racked • Running • On Bottom • Retrieving • Wet Stored	• Racked • On Bottom • Wet Stored	• AV: Fairlead to anchor • AHT: N/A
On Bottom	On bottom at dropped location	From fairlead to anchor on bottom	• Racked • Running • On Bottom • Chasing Back • Chasing Out • Retrieving • Wet Stored	• Racked • On Bottom • Wet Stored	• AV: Fairlead to anchor • AHT: N/A
Wet Stored	On bottom at assigned location	None	• Racked • Running • On Bottom • Retrieving • Wet Stored	• Racked • On Bottom • Wet Stored	• AV: N/A • AHT: N/A
Running	At assigned AHT offset	Fairlead to anchor on AHT	• Racked • Running • On Bottom • Retrieving • Wet Stored	• N/A	• AV: Fairlead to anchor • AHT: Offset to route from fairlead to target location
Retrieving	At assigned AHT offset	Fairlead to anchor on AHT	• Racked • Running • On Bottom • Retrieving • Wet Stored	• N/A	• AV: Fairlead to anchor • AHT: Offset to route from last On Bottom location to fairlead
Chasing Back	On bottom at dropped location	From fairlead to anchor on bottom	• Running • On Bottom • Chasing Back • Chasing Out	• N/A	• AV: Fairlead to anchor • AHT: Offset to route from On Bottom location to fairlead
Chasing Out	On bottom at dropped location	From fairlead to anchor on bottom	• Running • On Bottom • Chasing Back • Chasing Out	• N/A	• AV: Fairlead to anchor • AHT: Offset to route from fairlead On Bottom location

TABLE 1 ANCHOR STATES

2 CREATE ANCHOR PROJECT

It is recommended the project is setup for all stations on one system and then copied to each of the respective systems. Upon launching NavView on each system, the appropriate station is loaded.

The process involves the following steps:

1. Create the project and the anchor vessel station.
2. Populate the Shared folder as required for the project.

Note: Place files for vehicle outlines in the Project>Shared>SyncFolder.

3. Configure the background files to use.
4. Configure the anchor vessel station.

Note: If the anchor vessel is the Anchor Manager, configure the Anchor Planning.

5. Add a station to the project for each anchor tug to be used.
6. Configure each anchor tug.
7. Repeat steps 5 and 6 for each anchor tug and if required, a spare tug system.
8. Finalize each stations setup.
9. Copy the project to the respective computers.
10. Launch NavView on each computer and load the appropriate station.

The following details the procedure. For the purpose of this description, the anchor vessel is the Anchor Manager.

Note: If Role privileges are enabled, user must be logged in as a Supervisor or Administrator to be able to create a project.

2.1 CREATE THE PROJECT

The first step is to create the project and as part of this process, create the local Anchor Vessel station.

1. Ensure that the NavView used is licensed for Anchor Manager (“HasAnchorManagement”) for the anchor vessel and Anchor Remote (“HasAHV”) for the tugs.
2. Launch and complete the New Project wizard (see **S04 - Project** in the **NavView User Guide**) noting the following:
    a. Ensure that all Horizontal CRS required for the entire project are added either during the execution of the wizard or immediately after completing the wizard, e.g. if the project starts in UTM zone 31 and finishes in UTM zone 32, add the respective CRS for both zones
    b. On the **Station Name** page, if this station is to be the offshore Anchor Manager check the **Is Active Station** box

c. The Anchor module adds a page enabling the user to designate if **This station is the Anchor Manager** or not (see Figure 1), if the station is to be the Anchor Manager check this box

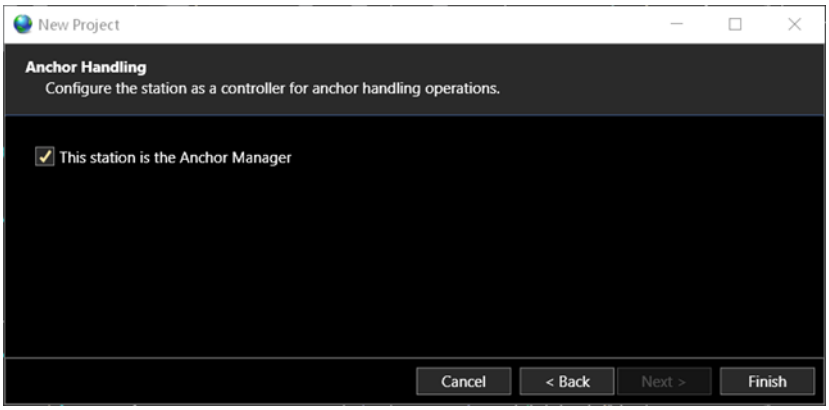


FIGURE 1 NEW PROJECT – ANCHOR HANDLING PAGE

2.2 CONFIGURE BACKGROUNDS

To facilitate normalizing the background drawings that will be used by all NavView systems involved in the project, configure the backgrounds as desired (see **S08 – Windows** in the **NavView User Guide**). This configuration will be used as the base for all 2D Map views opened on all stations after distribution to the respective systems, minimizing repetitive configuration steps.

1. Add and configure the background files to be used in 2D Map views.
    a. Add required file
    b. Assign the Horizontal CRS that is used by the file
    c. Configure the layers as desired
        I. Change colors if necessary for better visibility of key layers
        II. Toggle those layers that are not required for display
        III. Adjust opacity to optimize viewing
    d. Click Apply
    e. Repeat for each file to use

2.3 CONFIGURE THE ANCHOR VESSEL STATION

The next step is to set up the Anchor Vessel station for normal positioning and navigation operations.

Note: If using IP radios for inter-vessel communication, do not enable Network Services for the Anchor Vessel station during this initial project setup.

1. Add and configure the devices (see **S05 – Devices** in the **NavView User Guide**) to be used for the Anchor Vessel.

a. Add and configure the navigation sensor inputs, i.e GPS, Gyros

b. If using serial radio modems for communications between the Anchor Vessel and the Anchor Handling Tugs, add a **Serial Radio Telemetry** device and configure as follows:

   I. Telemetry Control: Is Master (see Figure 2)

   II. Message Control

   - Append Checksum: Enabled (Default)
   - Command time-out: 500.0ms (Default)

   III. Services

   - Station ID: This is only applicable to a Remote so this can be ignored at this step

   IV. Click OK

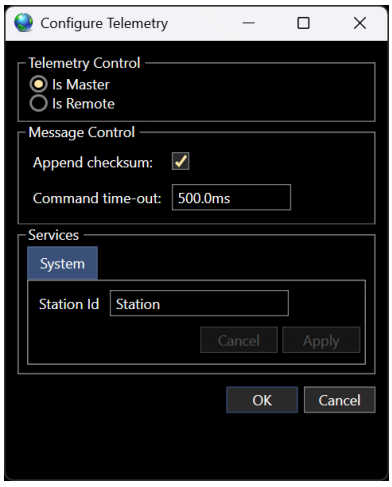


FIGURE 2 SERIAL RADIO TELEMETRY – MASTER

   V. If the Station IDs are known for all of the AHTs, open the Serial Radio Telemetry device configuration again

   VI. In the **Remote Stations**

   - Click  to add a Remote Station for each AHT
   - Click in the ID cell and edit the ID to match exactly the Station ID entered in the respective Serial Radio Telemetry device for each AHT

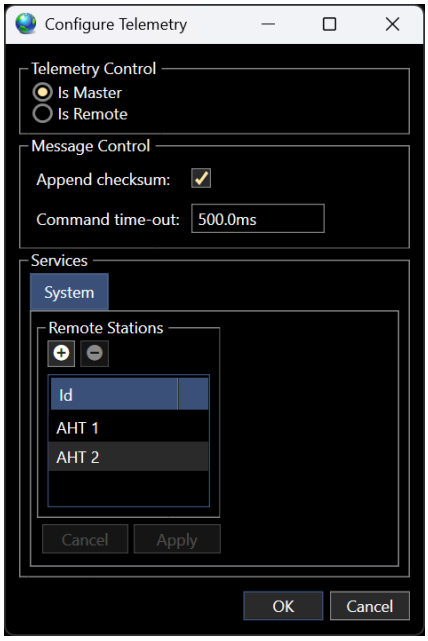


FIGURE 3 SERIAL RADIO TELEMETRY - MASTER – WITH REMOTE IDS

VII. Click Okay

Note: If the project preparation is being done on a PC that does not have the serial and/or Ethernet ports that will be used on the actual field systems, the final configuration of the device communication parameters can be done once the project is loaded on the respective PCs.

Note: Ensure that NavView timing is synchronized to GPS, either using a 1PPS with a ZDA message, a ZDA message alone or as the last option the GGA message (see **S13 – Timing** in the **NavView User**)

2. Add and configure the calculation (see **S06 – Calculations** in the **NavView User Guide**) to be used with the Anchor Vessel.
3. Add and configure the Anchor Vessel vehicle (see **S07 – Vehicles** in the **NavView User Guide**)
    a. Add a Static Offset for the points of interest on the Anchor vessel, i.e. fairleads

Note: at this point only add the local Anchor Vessel vehicle, do not add a vehicle for any of the anchor tugs.

2.4 ANCHOR MANAGEMENT - SETUP

1. From the **Setup** ribbon, click the **Anchor Management** button in the Configure section to open the **Anchor Management** window.

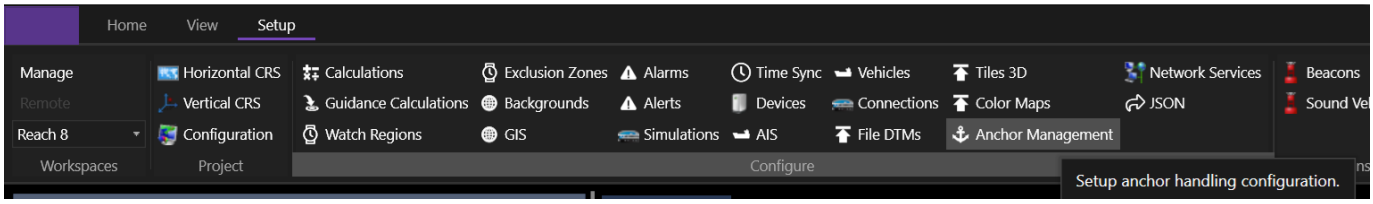


FIGURE 4 SETUP RIBBON - ANCHOR MANAGEMENT BUTTON

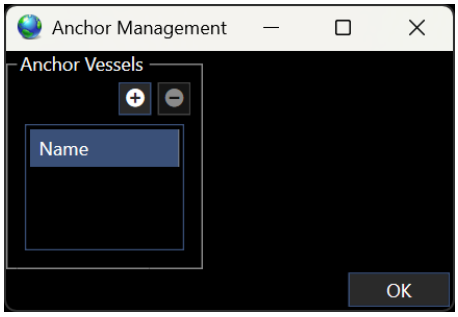


FIGURE 5 ANCHOR MANAGEMENT WINDOW

2. Click the  button to open the **Select the new anchor vessel** dialog.
    a. Select the vehicle from the dropdown list to be set as the Anchor Vessel

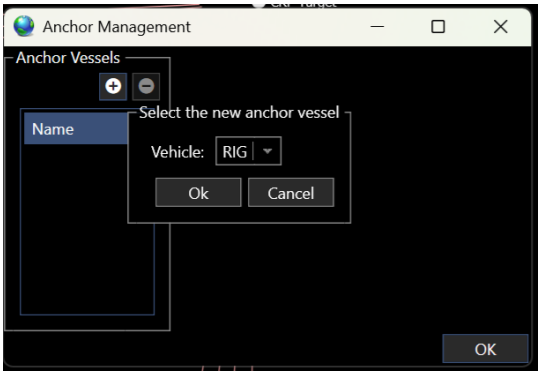


FIGURE 6 ANCHOR MANAGEMENT - ANCHOR VESSEL SELECTION WINDOW

    b. Click Okay
3. Select Anchor Vessel to be configured, see Figure 7.

2.4.1 ANCHORS TAB

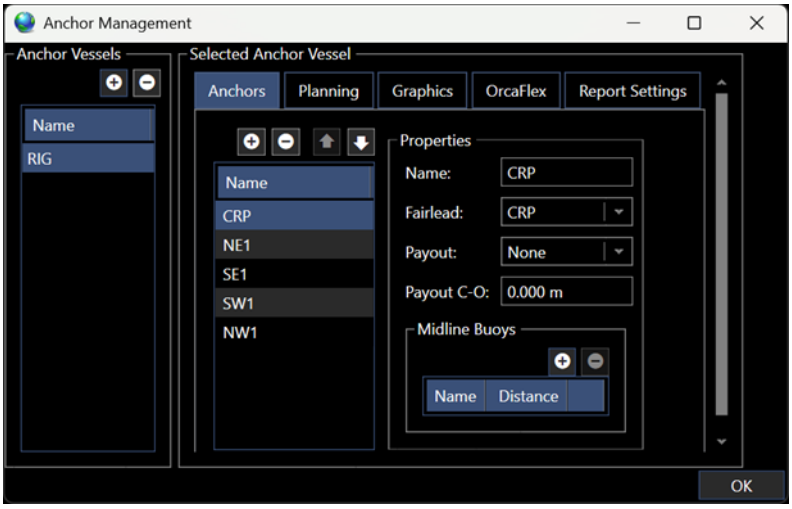


FIGURE 7 ANCHOR MANAGEMENT – ANCHORS

NavView automatically adds an anchor for each static offset present for the Anchor Vessel at the time of configuring the anchors. The default Anchor name is the offset name and the fairlead is the offset. To configure an existing anchor, select it in the list and edit the properties displayed to the right.

To add additional anchors,

1. Click the button to Add an anchor and display the associated **Configure the new anchor** dialog.

Note: When adding anchors, the default name is the name of the previous anchor with an incrementing count appended, see Figure 8.

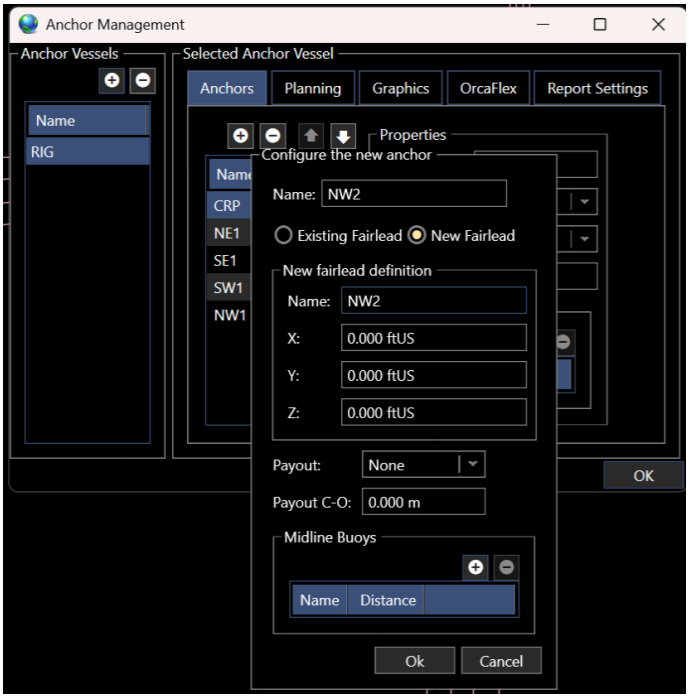


FIGURE 8 CONFIGURE THE NEW ANCHOR DIALOG

2. Edit the **Name** to assign the anchor.
3. Select between...
    I. Using an **Existing Fairlead,** select from the Static Offsets already assigned to the Anchor Vessel; or
    II. Adding a **New Fairlead,** enter a suitable name and enter the offsets from the Anchor Vessel CRP

Note: Once an anchor has been added, the assignment of the fairlead can only be edited by selecting a different one of the associated anchor vessel's Static Offsets. If a new offset for a fairlead is required for an existing anchor, it must be added to the Anchor Vessel from the Configure Vehicle (Static Offsets) dialog. If an existing fairlead's offsets are to be changed, they must be changed in the Configure Vehicle (Static Offsets) dialog.

4. If a Payout device, i.e. winch, is added then this can be selected from the **Payout** drop-down list.
5. If Midline Buoys are required, click the add button then enter a name for the buoy and the distance from the anchor to the buoy.
6. Click OK.
7. Repeat steps 1 through 5 for all anchors to be added.

To remove an anchor, select the anchor to be removed and click the button.

To alter the order of the anchors in the list, select the anchor to move and click the button to move it down in the list or the button to move it up. The order does not impact the operation, it is for visual organization only.

2.4.2 PLANNING TAB

Allows the user to assign a target position and heading for the Anchor Vessel and anchor target positions, see Figure 9.

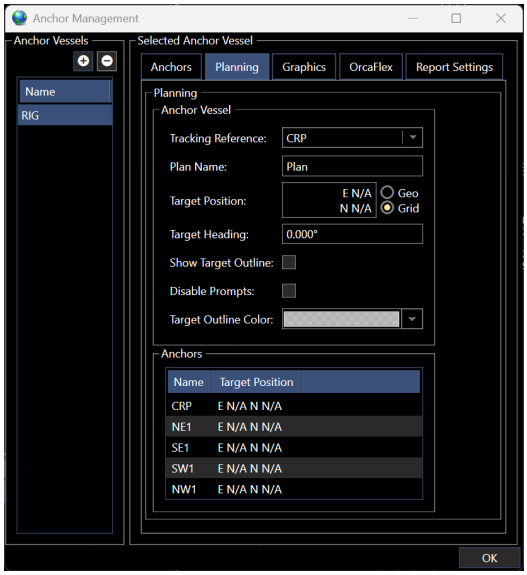


FIGURE 9 ANCHOR MANAGEMENT – PLANNING

Note: Select the Working Horizontal CRS (see section 1.4) that applies to the target locations and set to working.

2.4.2.1 ANCHOR VESSEL

Configure the **Anchor Vessel** target settings.

- **Tracking Reference:** Select from the dropdown list of existing static offsets to be the reference point on the anchor vessel that is to be moved to the target position
- **Plan Name:** Enter name for plan
- **Target Position:** Enter the Target Position coordinates

Note: The anchor vessel Target Position is added as a waypoint to the NavView Waypoints. This waypoint's default name is the anchor vessel name with **Target** appended.

Note: A Point-to-Point guidance calculation is automatically added for the anchor vessel, specifically from the tracking reference location to the target position.

- **Target Heading:** Enter Anchor Vessel target heading
- **Show Target Outline:** Displays the Anchor Vessel outline on the Map view at the target position and heading
- **Disable Prompts:** Check the box to disable anchor operation confirmation prompts
- **Target Outline Color:** Select color for outline as it will appear on Map view

2.4.2.2 ANCHORS

Configure the **Anchor** target positions.

1. Click in the Target Position cell for the respective anchor.
2. Enter the target position.

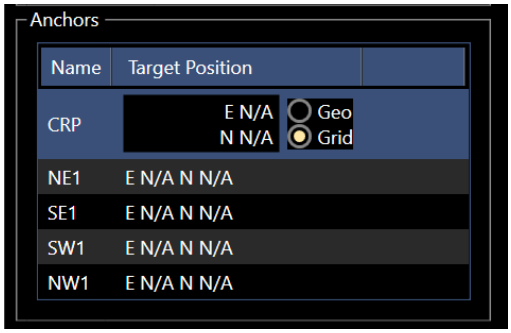


FIGURE 10 PLANNING TAB – ANCHOR TARGET POSITIONS

3. Click elsewhere in the window to accept

Note: The target graphics is automatically set in the waypoint. To edit the graphics, access Waypoints in the Home ribbon. The anchor symbol and color can also be edited in the Anchor Management Graphics tab, see Section 2.4.3.2.

Note: Anchor Target positions can also be added directly from the Map view using the Point Picker and/or Ruler tool and right mouse clicking on the respective Node and selecting Copy To... Anchor Handling > Anchor Vessel > Anchor

Note: If there are multiple Horizontal CRS in use and the Working Horizontal CRS had been changed to apply to the target location, revert the Working Horizontal CRS to apply to the current location.

2.4.3 GRAPHICS TAB

Configure how Anchor Lines, Anchors and Midline Buoys are displayed in Map view, see Figure 11.

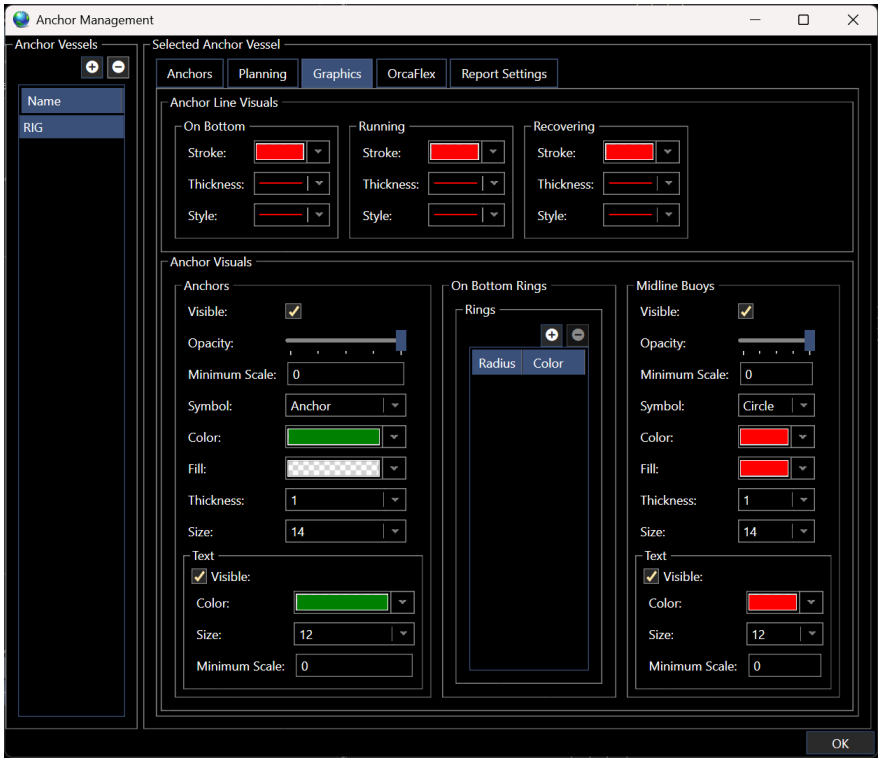


FIGURE 11 ANCHOR MANAGEMENT - GRAPHICS

2.4.3.1 ANCHOR LINE VISUALS

- **On Bottom:** Draws the anchor line from anchor vessel fairlead to anchor set to On Bottom state
- **Running:** Draws the anchor line from anchor vessel fairlead to AHT set to Running state
- **Recovering:** Draws the anchor line from anchor vessel fairlead to AHT set to Recovering state

2.4.3.2 ANCHOR VISUALS

- **Anchors**
  - **Visible:** Check box to make anchors visible
  - **Opacity:** Adjust opacity using slider bar
  - **Minimum Scale:** Sets the limit for visibility base on map scale
  - **Symbol:** Configure the symbol to use for anchors and how it is to be displayed
  - **Text:** Configure the text to annotate the anchor symbol with

- **On Bottom Rings:** Configure rings to draw around anchors that are On Bottom
- **Midline Buoys:** Configure the symbol and text to use for mid-line buoys and how it is to be displayed. This is similar to Anchors

2.4.4 ORCAFLEX TAB

Configure **OrcaFlex** (only applicable if modelling anchor catenary)

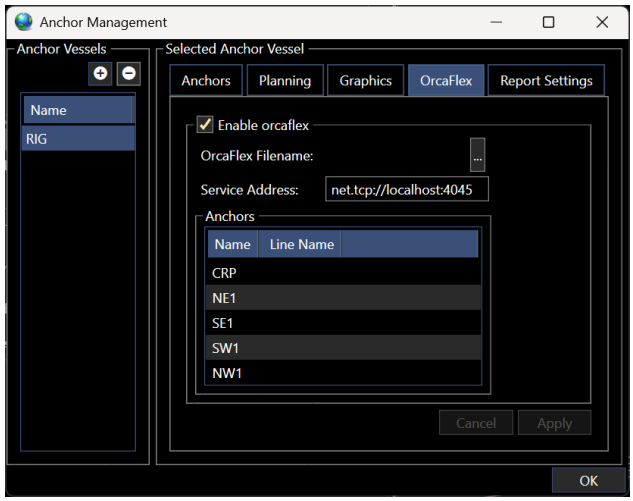


FIGURE 12 ANCHOR MANAGEMENT – ORCAFLEX

2.4.5 REPORT SETTINGS TAB

Configure **Report Settings.**

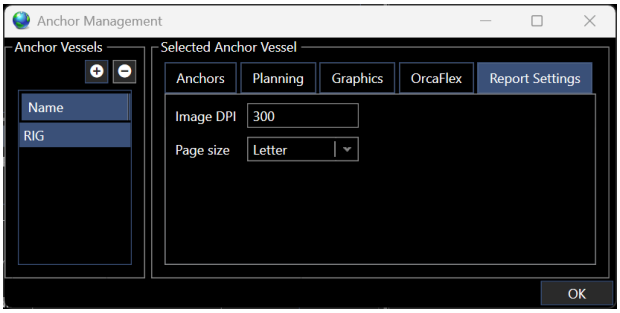


FIGURE 13 ANCHOR MANAGEMENT – REPORT SETTINGS

- **Image DPI:** Enter the DPI to use when printing the report
- **Page size:** Select the page size

2.5 ADDING/CONFIGURE ANCHOR HANDLING TUGS (AHT)

The next step is to add a NavView station for each AHT in the project.

In addition, it is possible to create ‘spare’ AHT stations. These support the case of a NavView system being required for an AHT that was not originally planned to be part of the project but has been added. Once installed on this AHT, the configuration can be modified accordingly to

address the respective vessel, i.e. vehicle name, outline and devices, as long as the vehicle itself is not removed and re-added.

1. Select Open Project from the Main Menu.

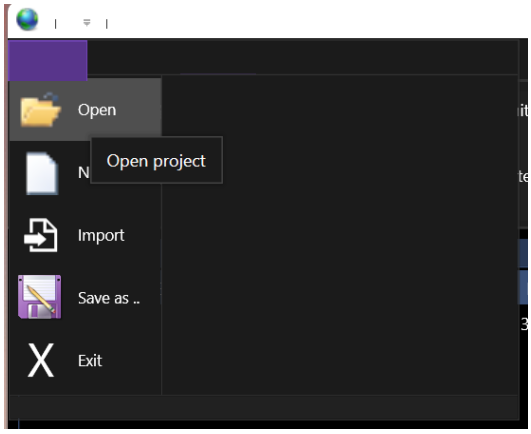


FIGURE 14 OPEN PROJECT

2. In the **Select Project** page, select the anchor project the AHTs are to be added to, i.e. the project just created.
3. In **Select Station** page,
    a. Check **New Station**
    b. Enter the name for the new station, e.g. AHT1
    c. Check **Is Active Station**
4. If the NavView license supports **Anchor Manager** this page will display, do not check **Is master anchor handling station.**
5. Add and configure the devices to be used for the AHT.
    a. Add and configure the navigation sensor inputs, i.e. GPS, Gyro
    b. If the communications between the Anchor Vessel and the AHTs is to be serial radio modems, add a **Serial Radio Telemetry** device and configure it for telemetry network Remote (default setting), see Figure 15
        I. **Telemetry Control:** Is Remote
        II. **Message Control**
            - **Append Checksum:** Enabled (Default)
            - **Command time-out:** 500.0ms (Default)
            - **Station ID:** Enter ID for this station, recommend short, descriptive term (Default is NavView Local Station name)

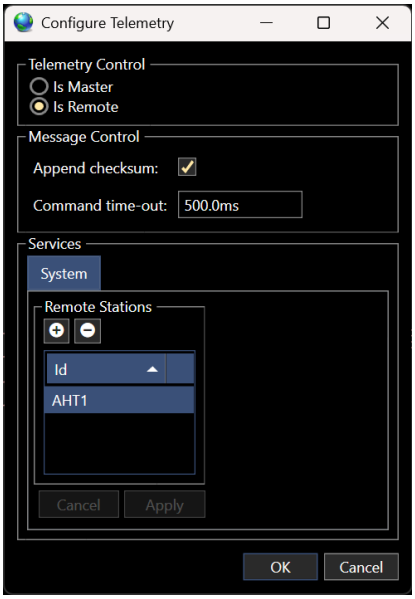


FIGURE 15 SERIAL RADIO TELEMETRY DEVICE – AHT

Note: If the project preparation is being done on a PC that does not have the serial and/or Ethernet ports that will be used on the actual field systems, the final configuration of the device communication parameters can be done once the project is loaded on the respective PCs.

Note: Ensure that NavView timing is synchronized to GPS, either using a 1PPS with a ZDA message, a ZDA message alone or as the last option the GGA message.

6. Add and configure the calculation to be used with the AHT.
7. Add and configure the AHT vehicle.
    a. Edit the default Static Offset for the point of interest on the AHT, e.g. stern roller

Note: Only add the local vehicle, do not add a vehicle for the Anchor Manager or any of the other AHT stations.

Note: A Point to Route guidance calculation is automatically added to each AHT. This is updated whenever an anchor is assigned to the AHT according to the operation executed.

8. Repeat steps 1 through 7 for each AHT, and spare AHT systems as required.

2.5.1 FINALIZE THE VEHICLE CONFIGURATIONS (SERIAL RADIO ONLY)

Each station needs to be updated so each is aware of the existence of the others.

1. Open the Project and select the first station/vehicle added to the project.
2. Open the Configure Vehicles dialog (or select Setup > Vehicles in the Explorer window)

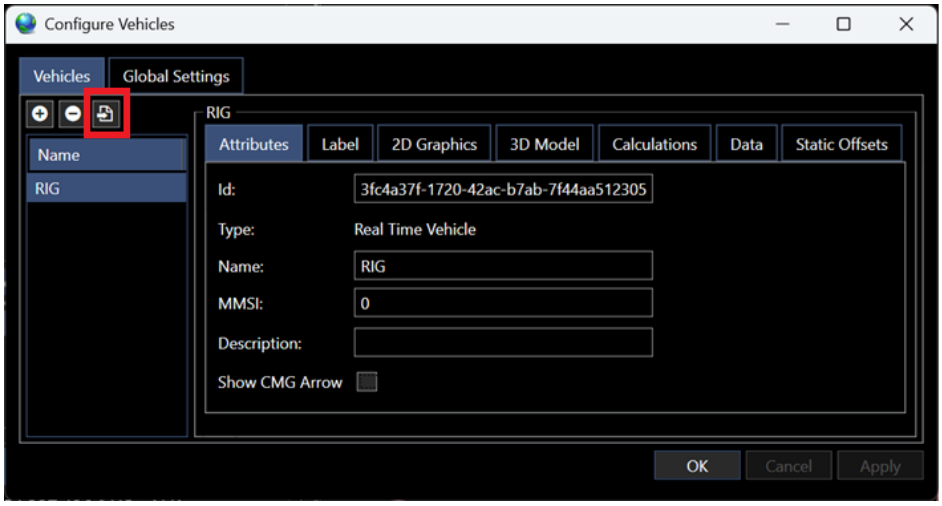


FIGURE 16 CONFIGURE VEHICLES DIALOG – IMPORT VEHICLES

3. Click the **Import vehicles from config file** button ( ) and navigate to the Local station for the next vehicle/station created for this project, i.e AHTs. In the **Config** folder, select the **vehicles.xml** file and click **Open**.

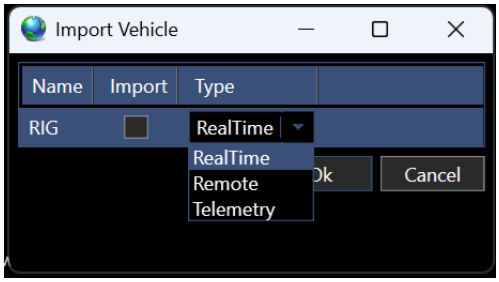


FIGURE 17 IMPORT VEHICLESS DIALOG

4. Check the **Import** box for the vehicles listed that are to be anchor handling vessels (AHT).
5. Select the appropriate **Type** for the selected vehicle then click **OK**.
    a. **Telemetry:** The station will be communicated with using the Serial Radio Telemetry device
    b. **Remote:** The station will be communicated with using an IP network (Network Services)
6. Repeat steps 3 to 5 until all vehicles created for this project have been added to the first station.
7. Open the Project again and select the next station that was created.
8. Repeat steps 3 to 5 until all vehicles created for this project have been added to this station.
9. Repeat steps 7 to 8 until all stations have all vehicles added.

Note: After importing all of the vehicles to the first station, all of the vehicles will be present in its vehicle.xml file. Therefore, selecting the first station's vehicle.xml file when adding vehicles to the remaining stations will enable the importing of all vehicles from this file in one step.

2.6 ENABLE NETWORK SERVICES

Anchor Management supports inter-vessel communications using an IP network. If an IP network is to be used, MongoDB and Redis services are required for Network Services to support inter-vessel communications and Anchor Management. In this case, it is important to note that the PC used to setup up the project does not require the MongoDB and Redis services to be installed and if they are installed, not to enable the Network Services for any station until the project setup is completed.

When project setup is completed Network Services can be enabled for all the stations before distribution of the project.

1. Launch NavView.
2. Open the project and select the first Station added to the project.
3. Enable Network Services pointing them to the localhost (this will be updated accordingly after distributing the project). After distribution, the Remote stations (AHTs) Network Services will need to be configured to point to the anchor vessel by substituting "localhost" with the IP address of the anchor vessel PC. See **S23 – Network Services** in the **NavView User Guide.**
4. Repeat step 3 for each Station.
5. Exit NavView.

2.7 DISTRIBUTE ANCHOR PROJECT

When a project is created, a folder with the project name is created in **Public Documents\4D Nav\NavView**. This project is to be distributed to all of the PCs to be used with NavView for the anchor project. The process of creating the project complete with a station configured for each vehicle and then distributing it enables each system to 'know' about all the vessels involved in the project. Spare AHT station provides the option to mobilize a NavView system to a vessel that may not have originally been part of the project.

1. Exit NavView to close the project and enable distribution of the project created.
2. Copy the project folder created to the **Public Documents\4D Nav\NavView** on all of the NavView PCs.
3. Ensure the correct security dongle is connected to the respective PCs (see section 1.2).
4. On each PC, launch NavView.
5. Open Project wizard selecting the anchor project and the appropriate station for the PC.
6. Complete any device communication setup required for each NavView.

7. If Network Services are to be used and have been enabled already, edit the target IP address accordingly. If the serial radios are operating, confirm communications between systems.

3 MANAGING THE ANCHORS

The management of the anchors is done from the Anchor Management window on the Anchor vessel. The window is opened by clicking on the Anchor Management button in the ribbon's View tab.

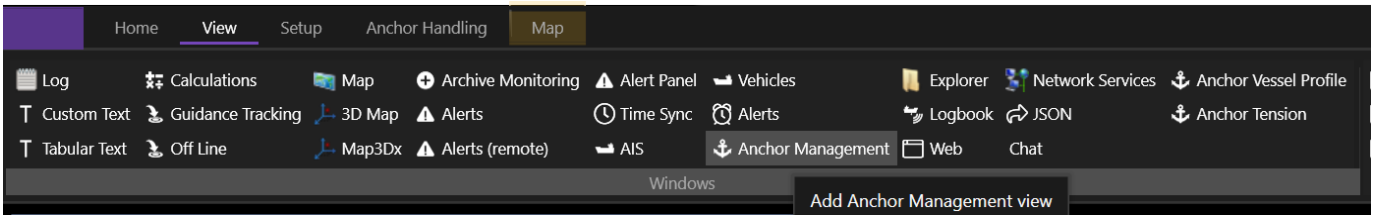


FIGURE 18 ADD ANCHOR MANAGEMENT VIEW – RIBBON VIEW TAB

FIGURE 19 ANCHOR MANAGEMENT WINDOW

All remote vehicles that have an Anchor Handling Vehicle (AHV) license will be considered as anchor handlers and will be listed in the Anchor Handlers section of the Anchor Management window.

3.1 CONFIGURE ONLINE/OFFLINE STATE

At the top of the window is a button indicating if this station is the **Active Online** station or is **Offline.**

If the station is online, its status is displayed in green as ACTIVE ONLINE, if the station is offline, its status is displayed in red as OFFLINE.

To toggle from one state to the other, click this button.

Note: In systems with multiple Stations set as Anchor Managers, e.g. one offshore on the Anchor Vessel and another onshore in the **Network Operations Center (NOC)**, the offshore Anchor Vessel system must always be set to ACTIVE ONLINE. All others must only be set to ACTIVE ONLINE when they are being used to control the anchor assignments.

Management of the anchor operation involves managing the anchors' state and the assigning of the anchor to the respective AHT. These are correlated, the state of one affects the state options of the other (see Table 1 Anchor States).

3.2 SETTING ANCHOR STATE

Management of the anchor operation involves managing the anchors' state and the assigning of the anchor to the respective AHT. These are correlated, the state of one affects the state options of the other (see Table 1 Anchor States).

To change the anchor state, in the Anchors data grid click in the State cell for the respective anchor to display a dropdown list of available options, select the desired state see Figure 19.

- **Racked:** Anchor location is set to associated fairlead, position updates as the fairlead position updates, no further action is required
- **On Bottom:** Anchor location requires definition
  - Click in the **Current Position** cell and enter the current On Bottom location
  - Click in the **Depth** cell and enter the depth, or if a DTM is present, click the **Query DB** button
- **Wet Stored:** Anchor location requires definition
  - Click in the **Current Position** cell and enter the current On Bottom location
  - Click in the **Depth** cell and enter the depth, or if a DTM is present, click the **Query DB** button

Upon selecting a new state, a prompt requiring the operator confirm the state change is displayed. The options supported with these prompts vary depending upon the case.

Note: Assign the anchor to the AHT before changing the anchor state.

3.3 ASSIGNING ANCHORS

To assign an anchor to an AHT, in the Anchor Handlers data grid click in the Anchor Assignment cell for the respective AHT and select the anchor from those listed as available to assign, i.e. you cannot assign an anchor to an AHT if it has already been assigned to another AHT. Upon selecting the anchor, a prompt requiring the operator confirm the assignment is displayed.

Note: The prompt can be disabled, see Figure 9.

Once an anchor operation has been completed, the anchor assignment for an AHT is to be reverted to **None**, i.e. On Bottom (deployed).

When an anchor is assigned to an AHT a command is sent to that AHT informing it that it has been assigned the anchor and a reply confirming receipt of the assignment from the AHT is looked for. This process can be monitored in the Anchor Handlers data grid under **Acknowledged**, see Figure 22.

-  Status is unknown
-  No reply to command has been received
-  Reply to command has been received

3.3.1 RACKING AN ANCHOR

1. In the Anchors data grid, set the respective anchor state to **Racked.**
2. Answer confirmation of state change prompt accordingly.

Racked state selection is available regardless of the current anchor state or whether or not the anchor is assigned to an AHT.

Guidance in Racked state:

- **Anchor Vessel:** Fairlead to anchor
- **AHT:** N/A

3.3.2 RUNNING/RETRIEVING AN ANCHOR

1. In the Anchor Handlers data grid, assign the anchor to be run or retrieved to the respective AHT. Accept the Confirmation prompt.
2. In the Anchors data grid, set the respective anchor state to **Running** or **Retrieving.**
3. Answer confirmation of state change prompt accordingly.
    a. If the previous state was Racked and the change in state is to **Running**, the confirmation of state change prompt includes a display of the target location and the option to edit the target location via an Edit button

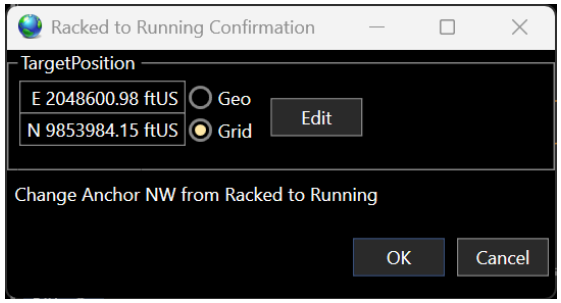


FIGURE 20 RACKED TO RUNNING CONFIRMATION PROMPT

b. If the target location is to be changed, click the **Edit** button to open the **Anchor Planning** dialog, edit target location as desired and click **OK**

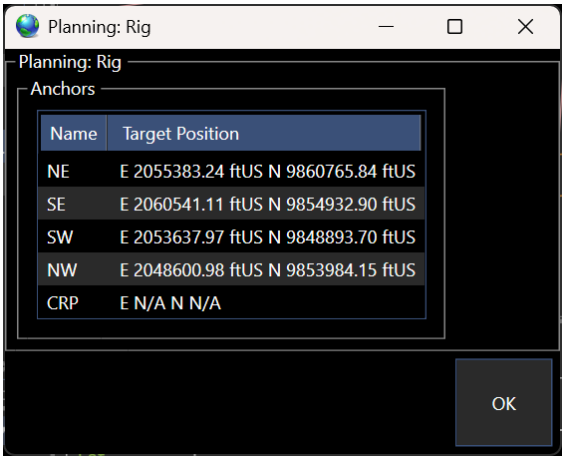


FIGURE 21 ANCHOR PLANNING DIALOG

c. If target location change is not required, simple confirmation of state change prompt is displayed, click OK

4. In the Anchor Handlers data grid, when the command sent to the AHT has been confirmed,  will display in the **Acknowledge** column for that tug, if an acknowledgment is not received  will display.

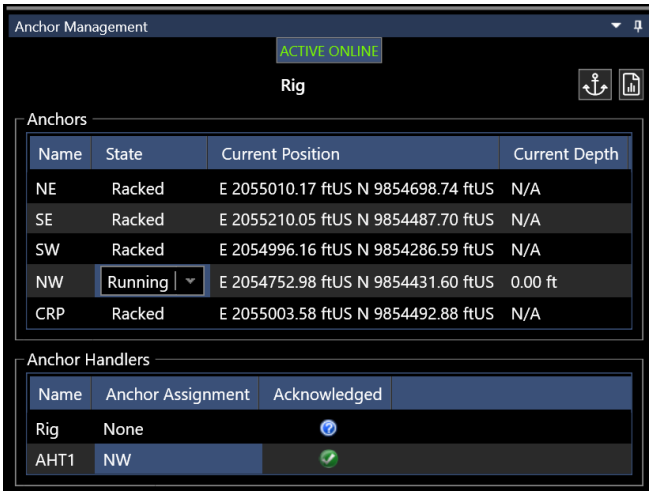


FIGURE 22 ANCHOR ASSIGNMENT ACKNOWLEDGED

Running and Retrieving state selections are available if the anchor has been assigned to an Anchor Handler.

When an anchor has been assigned to a AHT and anchor state selected is Running or Retrieving, the following occurs.

a. Sets the anchor location to the assigned AHTs Static Offset
b. Draws the anchor line from the associated fairlead to the anchor based on the Anchor Visuals for Running or Retrieving accordingly, see section 2.4.3
c. Guidance results in
   - **Anchor Vessel:** Fairlead to anchor
   - **AHT:**
     - **Running:** Track Route guidance from fairlead to target and To Target guidance, distance and direction to anchor target
     - **Retrieving:** Track Route guidance from fairlead to On Bottom location and To Target guidance, distance and direction to fairlead

3.3.3 CHASING OUT/CHASING BACK AN ANCHOR

1. In the Anchor Handlers data grid, assign the anchor to be chased to the respective AHT.
2. In the Anchors data grid, set the respective anchor state to **Chasing Out** (anchor is on bottom and to be retrieved, AHT is using the pendant from the rig to run down the anchor line to the anchor) or **Chasing Back** (anchor has just been put on bottom, AHT is returning the pendant to the rig).
3. Answer confirmation of state change prompt accordingly.
4. In the Anchor Handlers data grid, when the command sent to the AHT has been confirmed,  will display in the **Acknowledge** column for that tug, if an acknowledgment is not received  will display.

Chasing Out and Chasing Back state selections are available if the anchor has been assigned to an Anchor Handler and the anchor current state is On Bottom.

When an anchor has been assigned to a AHT and anchor state selected is Chasing Out or Chasing Back, the following occurs.

a. The anchor location remains at the On Bottom location
b. Draws the anchor line from the associated fairlead to the anchor based on the Anchor Visuals for On Bottom
c. Guidance results in
   - **Anchor Vessel:** Fairlead to anchor
   - **AHT:**
     - **Chasing Back:** AHT offset to line from on bottom location to fairlead
     - **Chasing Out:** AHT offset to line from fairlead to on bottom location

3.4 DEPLOYING AN ANCHOR

1. In the Anchors data grid, set the respective anchor state to **On Bottom.**
2. The state change confirmation prompt and anchor location assigned depend upon the previous anchor state:
   a. If the previous state was **Running**, the **Anchor Drop Layback** dialog will display allowing the entry of the necessary data to calculate the anchor location astern of the AHT

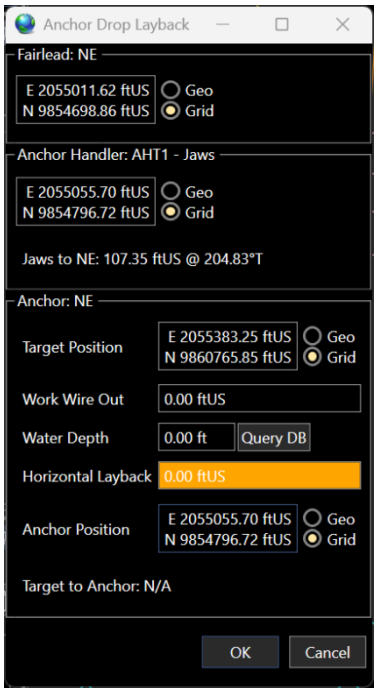


FIGURE 23 ANCHOR DROP LAYBACK DIALOG

- **Fairlead**: Displays the position of the fairlead at the time the On Bottom state was set (read only)
- **Anchor Handler**: Displays the position of the anchor handler's offset and the range and bearing from the fairlead to the anchor handler's offset at the time the On Bottom state was set (read only)
- **Anchor**
  - **Target Position**: Displays the target location (read only)
  - **Work Wire Out**: Enter the length of wire out from the anchor handler's stern roller offset to the anchor
  - **Water Depth**: Enter the water depth at the anchor location or if a DTM is present, click the **Query DB** button
  - **Horizontal Layback**: Displays the calculated horizontal layback from the anchor handler's offset to the anchor location, calculated using Pythagoras' theorem from the work wire out and water depth (read only)
  - **Anchor Position**: Displays the calculated anchor location, calculated using the horizontal layback and azimuth from the anchor handler's offset to the fairlead at the time the On Bottom state was set
  - **Target to Anchor**: Displays the range and bearing from the target location to the calculated anchor location

Note: Target to Anchor will be N/A if Horizontal Layback is 0.

- Click **OK** when completed to apply and assign the On Bottom anchor position

b. If the previous state was **Racked**, the simple state change confirmation prompt will display and the position assigned to the anchor will be that of the respective fairlead at the time it is set On Bottom

c. If the previous state was **Retrieving**, the simple state change confirmation prompt will display and the position assigned to the anchor will be that of the respective AHT offset at the time it is set On Bottom

d. If the previous state was **Wet Stored**, the simple state change confirmation prompt will display and the position assigned to the anchor will be the wet store location

e. If the previous state was **Chasing Out or Chasing Back**, the simple state change confirmation prompt will display and the position assigned to the anchor is unchanged, i.e. it remains the On Bottom location since assigning Chasing Out or Back does not change the anchor location

3. If required, the **On Bottom** position can be edited.
   a. On Bottom state selection is always available
   b. Sets the anchor location as noted above

c. Draws the anchor line from the associated fairlead to the anchor based on the Anchor Visuals for On Bottom

d. Guidance results in

- **Anchor Vessel:** Fairlead to anchor
- **AHT:** N/A

4 SERIAL RADIO TELEMETRY CONTROL

The Device Window view displays a Services tab and Data tab. The device on the Anchor Vessel will display as the Master Telemetry (see Figure 24) and the on the Remotes (AHT) will display as the Remote Telemetry.

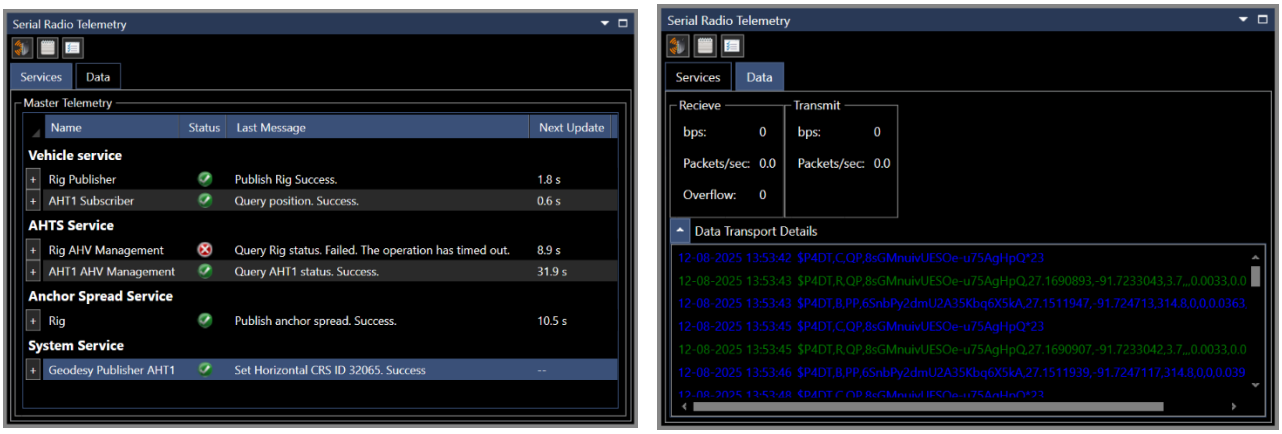


FIGURE 24 SERIAL RADIO TELEMETRY DEVICE - STATUS VIEW – ANCHOR VESSEL

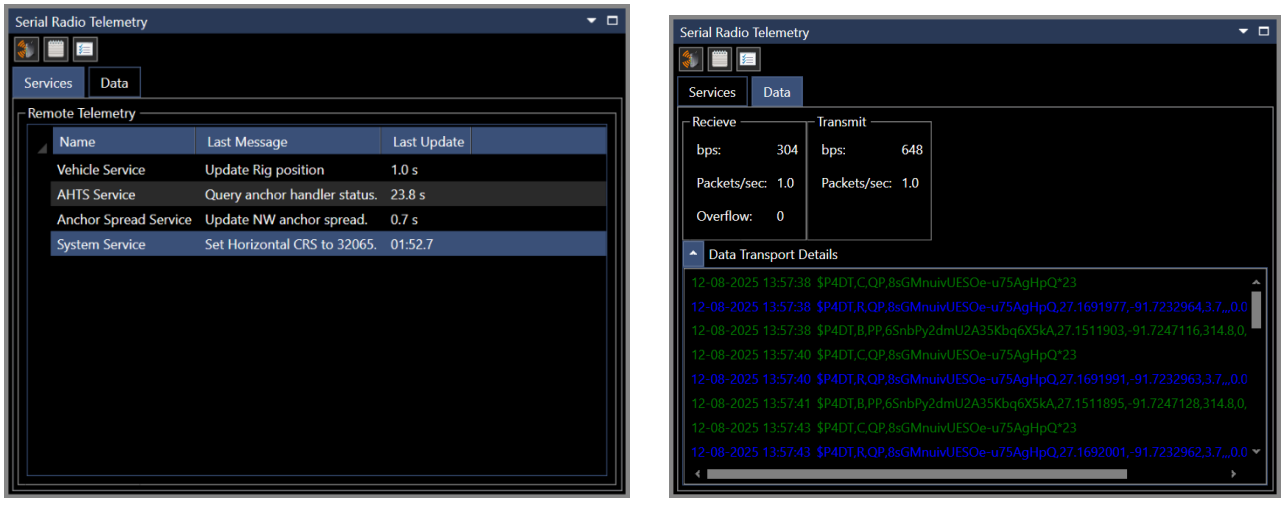


FIGURE 25 SERIAL RADIO TELEMETRY DEVICE - STATUS VIEW – REMOTES (AHT)

4.1 SERVICES

The Services tab displays the communication services in use and their status.

There are two types of service, broadcast and two way. All communications are controlled by the Master. All transmissions by the Master and the Remotes are queued and executed in the order they are queued.

Note: Remotes (AHTs) must be present in the configuration in order for the associated communications to display and be available for configuration.

Note: Communications of any one type with a Remote are independently configurable, i.e. the retry settings for AHTS Services for one Remote do not affect those of another Remote.

4.1.1 BROADCAST SERVICE

a. Used by the Master to provide the remotes with periodic updates of data at a specified interval

b. Does not require an acknowledgment from the Remotes

c. Click the + button associated with the specific service to expand the display to show and edit the configuration settings

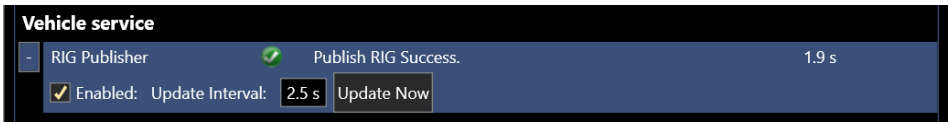


FIGURE 26 BROADCAST SERVICE CONFIGURATION

- **Enabled**: Check to enable broadcast, clear box to disable broadcast
- **Update Interval**: Enter the broadcast interval, default is 2.5 seconds
- **Update Now**: Click to add a broadcast as the next transmission in the queue

4.1.2 TWO WAY SERVICE

a. Used by the master to poll remotes at a specified interval

b. Requires an acknowledgement by the intended recipient remote

c. Click the + button associated with the specific service to expand the display to show and edit the configuration settings

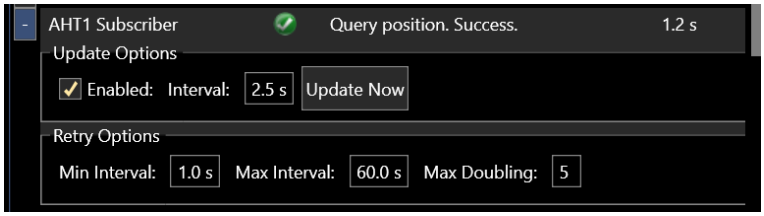


FIGURE 27 TWO WAY SERVICE CONFIGURATION

- **Enabled**: Check to enable communications, clear box to disable communications
- **Interval**: Enter the communication cycle (command/query and reply) interval, default is 2.5 seconds
- **Update Now**: Click to initiate a communication cycle as the next transmission in the queue
- **Retry Options**
  - Retries are based on an algorithm using a minimum interval and maximum interval and a doubling factor to balance the need for retries based on corrupted communications against the possibility the respective remote is no longer available
  - The interval between retries increases exponentially based on the minimum interval until the number of failed attempts equals the maximum doubling factor
  - After the number of failed attempts equals the doubling factor, the interval increases linearly by a factor of the minimum interval
  - The maximum interval between retries is capped by the maximum interval
  - **Min Interval**: Enter the minimum interval for the communication cycle
  - **Max Interval**: Enter the maximum interval for the communication cycle
  - **Doubling Factor**: Enter the doubling factor to apply to the retry algorithm

Note: All Remotes listen to responses made by other Remotes to queries and commands from the Master. In doing so they are able to both stay synchronized with respect to all anchor operations and monitor the positions of the Remotes.

Monitoring Services

Monitoring of both service types is done via the data grid on the Services tab.

- **Name:** Vehicle name of the broadcast originator
- **Status:** Status of the communications
  -  Communications are successful, note that in the case of a broadcast message where no response is required, this will always display
  -  Communications have failed, applies to query and command communications where a response is required, indicates a response has not been received
- **Last Message:** The type of message transmitted and its status, Success or Failed, and in the case of the latter the reason for the failure, e.g. The operation has timed out
- **Next Update:** Time to the next broadcast

4.1.3 VEHICLE SERVICE

The **Vehicle Service** supports the exchange of vehicle position data. The Master system uses a broadcast service to transmit the position data for its local vehicle and a two way service to query the Remote (AHT) systems for their position.

The position data exchanged includes position, heading, velocities and pitch and roll.

4.1.4 AHTS SERVICE

The **AHTS Service** supports anchor assignments using a two way service. The anchor assignments for each AHT are transmitted at the specified interval enabling any Remote to synchronize with the project with respect to anchor assignments as part of the normal communications.

When an anchor is assigned to an AHT from the Anchor Management window, the command to the respective AHT is added to the queue as the next transmission. The periodic transmission cycle then resets based on the time of this transmission.

The data transmitted includes the anchor state and the anchor location.

4.1.5 ANCHOR SPREAD SERVICE

The **Anchor Spread Service** supports the broadcast of the anchor spread information including the anchor target position, anchor position and anchor state.

4.1.6 SYSTEM SERVICE

The **System Service** supports the transmission of select system configurations. Specifically it supports the synchronizing of the Remotes Horizontal CRS setting with the Master's within the transmission of a **Geodesy** message. This is of particular importance for those projects that span multiple map projection zones. The specifics of this service are as follows:

- Two way communications
- Upon the launch of the Master system (in the case of Anchor projects this is generally also the Anchor Manager), a Geodesy message containing the EPSG ID for Working Horizontal CRS is transmitted to each Remote
- Upon changes to the Master's Working Horizontal CRS, a Geodesy message with the EPSG ID for new Working Horizontal CRS is transmitted to each Remote
- Upon receipt of a Geodesy message, the Remote initiates the automatic reconfiguration of its system to use the new Working Horizontal CRS and sends an acknowledgement to the Master
- The Master displays the status of the communications with each Remote, including any errors encountered by the remote in attempting to change its geodetic settings

Note: The System Service requires the Anchor Management be set to **Active Online.**

Note: The updating of the remotes is currently limited to the Horizontal CRS EPSG code.

Note: The Update Options Interval setting is not applicable or used for this message, it is only transmitted on a change to the Master's Working Horizontal CRS. The Retry Options are applicable as this message once initiated must be received and acknowledged by the Remotes to ensure they are using the correct Working Horizontal CRC.

4.2 DATA

The **Data** tab allows the operator to monitor and view the communications particulars.

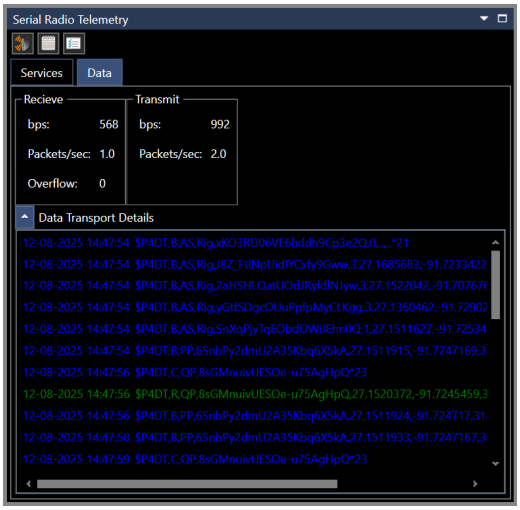


FIGURE 28 SERIAL RADIO TELEMETRY – DATA TAB

4.2.1 RECEIVE

The Receive panel displays the bits per second received, number of packets received per second and the overflow status as the number of bytes in the overflow.

4.2.2 TRANSMIT

The Transmit panel displays the bits per second transmitted and the number of packets transmitted per second.

4.2.3 DATA TRANSPORT DETAILS

The messages transmitted (blue) and received (green) are displayed in a scrolling display with the newest messages at the top.

5 NETWORK SERVICES CONTROL

The Web Network Services window displays communications status between the anchor vessel and all the remote anchor handlers. On the Anchor Vessel this displays as the Master Anchor Handling (see Figure 29).

Note: The service requires the Anchor Management be set to **Active Online.**

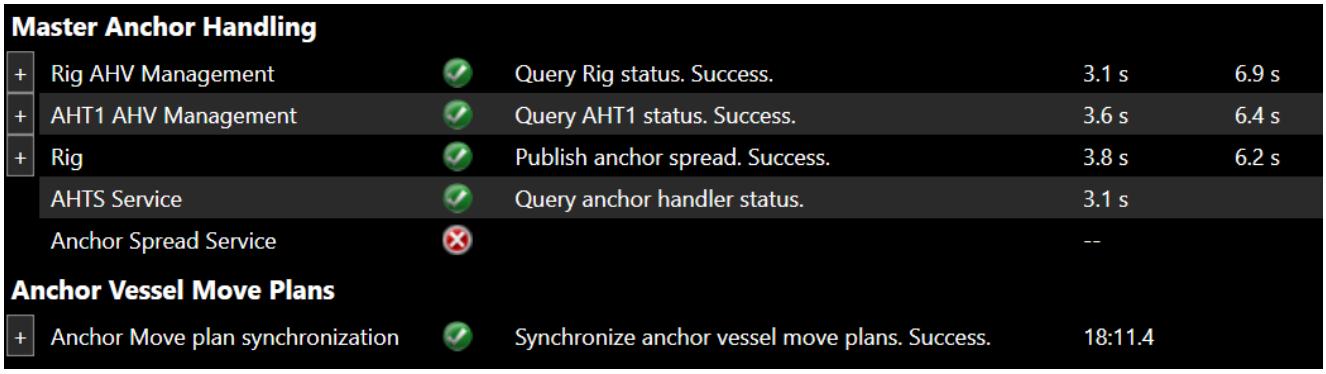


FIGURE 29 NETWORK SERVICES – ANCHOR VESSEL

On the Remotes (AHT) will display as the Remote Anchor Handling (see Figure 30).

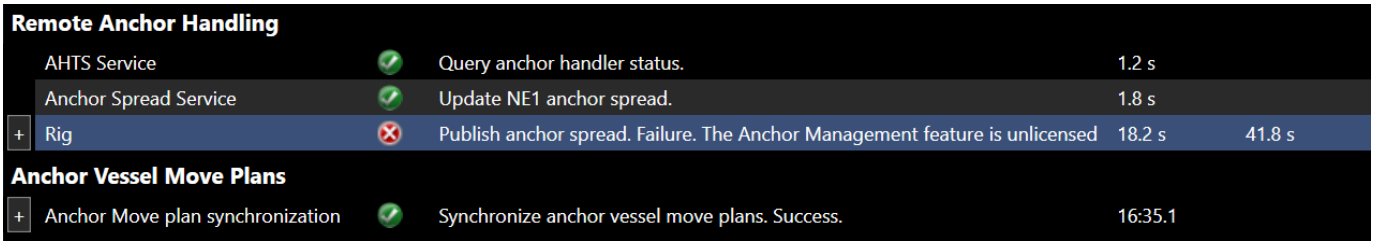


FIGURE 30 NETWORK SERVICES – REMOTE ANCHOR HANDLERS

6 ANCHOR HANDLING TAB

The Anchor Handling tab is part of the Anchor Management module.

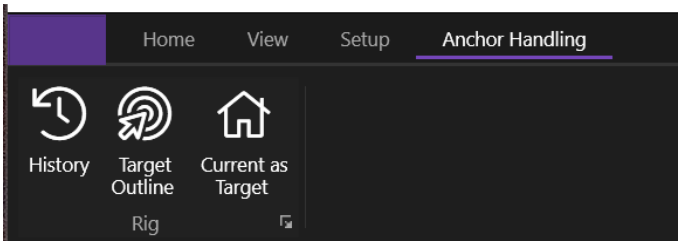
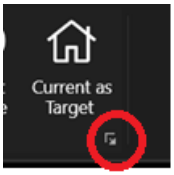


FIGURE 31 ANCHOR HANDLING TAB

- **History:** Toggles on/off history trail of the anchor vessel
- **Target Outline:** Toggles on/off anchor vessel target outline
- **Current as Target:** Sets the current position of the anchor vessel as target position

- 

Clicking on the access button opens the Anchor Management setup dialog

7 ANCHOR MOVE PLANS

The Anchor Move Plans feature is used to create move plans that can be assigned to the anchor vessel. Anchor Move Plans can be created on the local Anchor Vessel station or on a remote station. Anchor Move Plans are also distributed to all stations on Network Services.

Note: Anchor Move Plans are not distributed using Serial Radio Telemetry

Anchor Move Plans is found in the Home ribbon in the Files section.

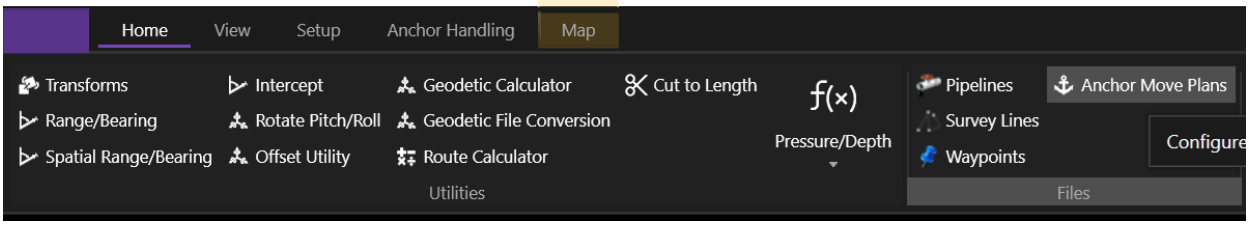


FIGURE 32 ANCHOR MOVE PLANS – HOME RIBBON

1. Open Anchor Move Plans.

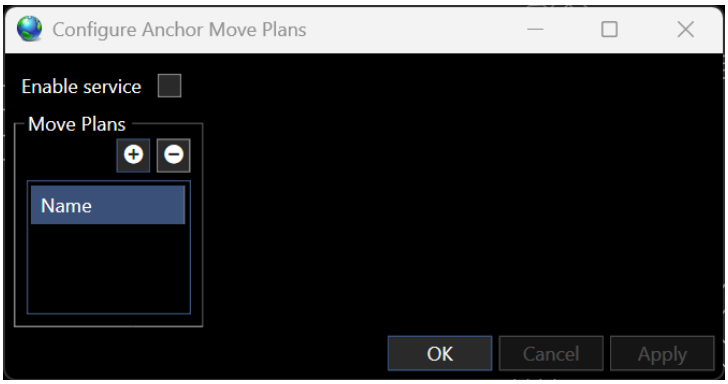


FIGURE 33 CONFIGURE ANCHOR MOVE PLANS DIALOG

Note: TBD

2. Click the add button  to add an anchor plan.

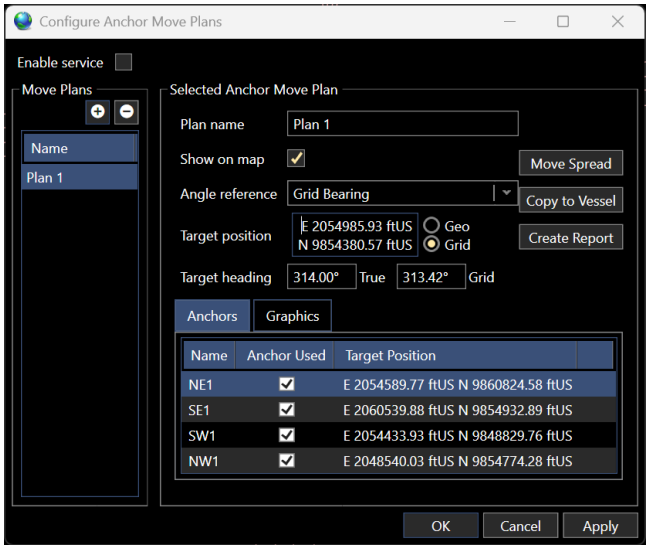


FIGURE 34 SELECTED ANCHOR MOVE PLAN

- **Plan name:** Enter name for anchor plan
- **Show on map:** Toggle the anchor plan display in Map view on/off

Note: The anchor plan can also be toggled off/on in the Map view Layers

- **Angle reference:** Direction from fairlead to anchor target, select either grid or true
- **Target position:** Enter anchor vessel target position
- **Target heading:** Enter anchor vessel target heading, grid/true

3. The Anchors tab displays the anchors created in the Anchor Management setup. Anchors to be used can be selected or deselected. Target Position can be edited by clicking on the cell.

Note: Anchors are required to be added using the Anchor Management setup, see section 2.4. Anchors cannot be added in the Anchor Move Plans dialog.

4. In the Graphics tab, select how the anchor plan items will be displayed in Map view.

7.1 MOVE SPREAD BUTTON

The anchor spread can be shifted by entering an anchor vessel target position and orientation. The anchor lines maintain distance and direction.

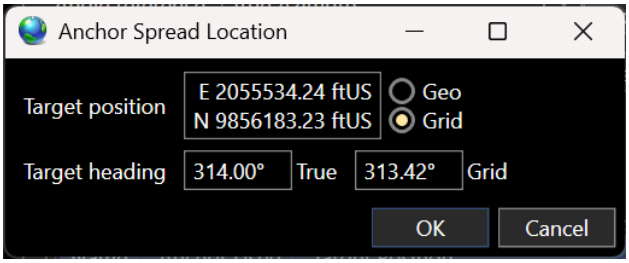


FIGURE 35 MOVE SPREAD DIALOG

7.2 COPY TO VESSEL BUTTON

To make a Move Plan active on the anchor vessel, from the anchor vessel station select the move plan from the list and click the Copy to Vessel button. This will update Anchor Management window with the anchor target positions, see section 3.

7.3 CREATE REPORT BUTTON

An anchor move plan report can be created by clicking on the Create Report button. This opens the Map view window which can be configured, i.e. Layers. The report is stored as PDF format.