



SeeTrack CoPilot User Manual

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Acronyms and Terminology

API	Application Programming Interface
DP	Dynamic Positioning
DVL	Doppler Velocity Log
IB	Interface Box
LED	Light Emitting Diode
ROV	Remotely Operated Vehicle
TMS	Tether Management System

Distribution:

CUSTOMER

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1 Using This Manual

This user manual provides a general product overview and explains how to install and operate the SeeTrack CoPilot unit and its pilot interface.

All the documentation files are in Adobe® Portable Document Format (*.pdf). To view these files you must use Adobe® Reader® 8.0 or above. This program is installed on the SeeTrack CoPilot hardware unit.



Note: This manual should be used in conjunction with the other guides included in the SeeTrack CoPilot hardware unit.

1.1 Scope and Purpose

This manual provides the following:

- an overview of the SeeTrack CoPilot hardware unit configuration and connectivity;
- a general description and specification of SeeTrack CoPilot pilot interface; and
- operating instructions for SeeTrack CoPilot and equipment.

1.2 Targeted Audience

This manual is designed and developed for offshore operators and contractors who are required to operate remotely operated vehicle (ROV) systems using SeeTrack CoPilot.

2 General Overview

SeeTrack CoPilot provides the latest generation of SMART software tools in a simple to use, pilot-friendly form. Training using SeeTrack CoPilot is painless and the intuitive tools help novice users.

SeeTrack CoPilot automates the ROV control process. The ROV can efficiently manoeuvre through a mission, automatically compensating for the effects of currents. The ROV can also take better quality video pictures due to the improved stability when using SeeTrack CoPilot.

SeeTrack CoPilot can be easily retro-fitted to operational units that are fitted with a DVL and a heading reference system.

Pilots using ROVs equipped with SeeTrack CoPilot will be able to:

- hold position and heading at the touch of a button;
- change the position and heading accurately using a simple point-and-click mouse interface;
- use the ROV joystick intuitively, without having to consider currents and tether effects;
- cruise at a constant speed and heading;

- generate accurate waypoint requests by entering specific coordinates;
- plan detailed missions by simply selecting a series of waypoints with the mouse;
- load a vector map of the area; and
- concentrate on the operations and not the action of piloting.

2.1 Requirements

SeeTrack CoPilot requires that the ROV is equipped with a Doppler Velocity Log (DVL).

The addition of dead-reckoning sensors such as gyro, depth and altimeter will improve the overall stability and control of the ROV.

2.2 Dynamic Positioning System

A dynamic positioning (DP) system allows an ROV to automatically hold a requested position. A DP system mimics automatically what a pilot would do in adjusting the thrusters to keep the desired position.

The pilot can easily control the ROV using the DP system. For example, if the pilot manoeuvres the joystick to the forwards position, the ROV will move forwards whilst automatically compensating for cross-currents and tether effects.



Note: Please refer to section 8 – for a more detailed explanation of the DP system.

2.3 SeeTrack CoPilot Core Features

The core features of SeeTrack CoPilot are:

- **Pilot Interface:** The SeeTrack CoPilot pilot interface offers the visual aid of real-time monitoring. Its non-intrusive, dark background enhances the display on screen and allows the user to extract vital real-time information for piloting.
- **Hover Command:** This command provides station-keeping at the touch of a button.
- **Auto-hover Flight Mode:** In this mode the ROV switches automatically between MANUAL mode (when the joystick is in use) and HOVER (when the joystick is not in use).
- **Auto-fly Flight Mode:** In this mode the ROV can be controlled through the enhanced joystick velocity controller or through the Click & Go interface. This mode also enables the alternative navigation tools of the Survey and tracking Module.
- **Cruise Flight Mode:** In this mode the ROV can be made to move at a constant speed, depth/altitude and heading. The pilot can adjust position and heading without interrupting the flight.
- **Easy to Use Application Programming Interface (API):** SeeTrack CoPilot API allows simple integration of new sensors.

- **Survey Module:** This core module comprises the additional navigation tools of Survey Plan and Waypoint, which allow the user to plan specific missions for the ROV with ease and precision.
- **MBI Sonar Track:** This tool works by using sonar input, analysing the images produced by the sonar and identifying targets within the sonar field of view. If a target has been selected, the user is able to reliably and safely move the vehicle relative to the target, provided it remains within the field of view of the sonar. The tracking module has applications in sub-sea operations, such as riser tracking, that allow the vehicle to easily maintain a constant visual of the selected target.
- **Markers:** This tool allows to quickly mark a position and to fly back to it when required. (GPS input is recommended)

3 Operation

The following section **must** be read carefully before installing and operating SeeTrack CoPilot.

3.1 Installation

The SeeTrack CoPilot hardware unit should be removed carefully from its transit case and be checked for any damaged or missing parts. It should be placed in a rack mount cabinet or any other rack mount system.

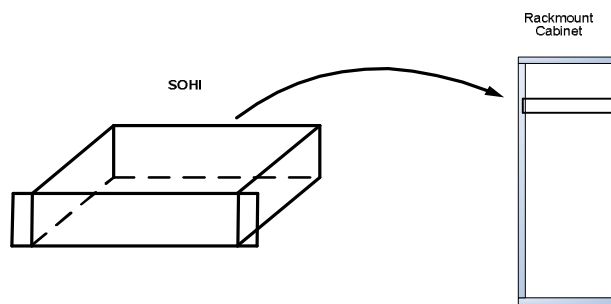


FIGURE 1 – UNIT INSTALLATION ONTO CABINET



Note: In addition to the SeeTrack CoPilot unit, an interface box (IB) may be required, but only when using an analogue joystick interface. Refer to section 10.1 – for further details.

3.2 First-time Installation

SeeByte personnel will complete the initial unit installation on-site as it involves a technical tuning phase.

The installation includes:

- ROV-specific hardware interface design;
- liaison with customer's engineers;

- development of software interface; and
- on-site testing at customer's base.

3.3 Checking and Running SeeTrack CoPilot

The following steps are to ensure that the unit is working properly, and should be followed in order to start using the SeeTrack CoPilot unit.

The SeeTrack CoPilot unit should be firmly mounted onto a rack mount cabinet. The software is pre-installed, ensuring that the SeeTrack CoPilot unit is ready to run.

1. Unpack the SeeTrack CoPilot unit from its transit case.
2. Check the unit carefully for any damage.
3. Check and verify that all fixing screws are present and all parts are well screwed together.
4. Make sure that the **main switches (J1 and J2)** are set to **position 0** before completing the rest of the installation.
5. Plug in the monitor(s).
6. Connect **AC mains power supply** to the SeeTrack CoPilot unit using the power cables provided.
7. Power up. (Refer to section 3.6 – Power Up/Down Procedures for further details.)
8. The pilot interface is automatically started upon powering the unit on. There is also a **SeeTrack CoPilot** icon on the desktop as shown below:



FIGURE 2 –SEETRACK COPILOT INTERFACE ICON



Note: Do right-button mouse click and then select Open to run the interface if it does not auto-start.

9. The interface is now running (as shown below in **Error! Reference source not found.**).



FIGURE 3 – SEETRACK COPILOT INTERFACE OVERVIEW

3.4 Interfacing SeeTrack CoPilot

3.4.1 Front Panel

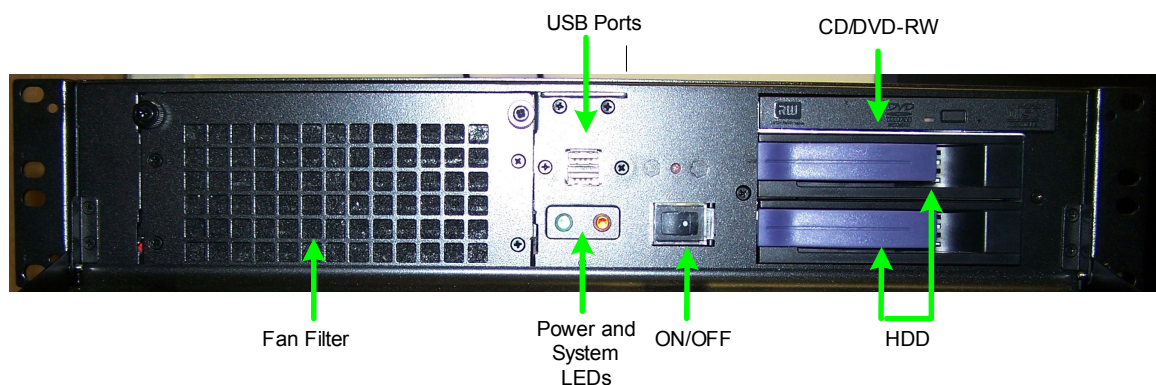


FIGURE 4 – INTERFACING THE SEETRACK COPILOT UNIT FRONT PANEL

The front panel indicates if the unit is running properly. USB connectors are also available for the user to plug in the mouse and other external devices.



Note: The front panel of the SeeTrack CoPilot hardware unit provides the user with critical information.

3.4.2 Rear Panel

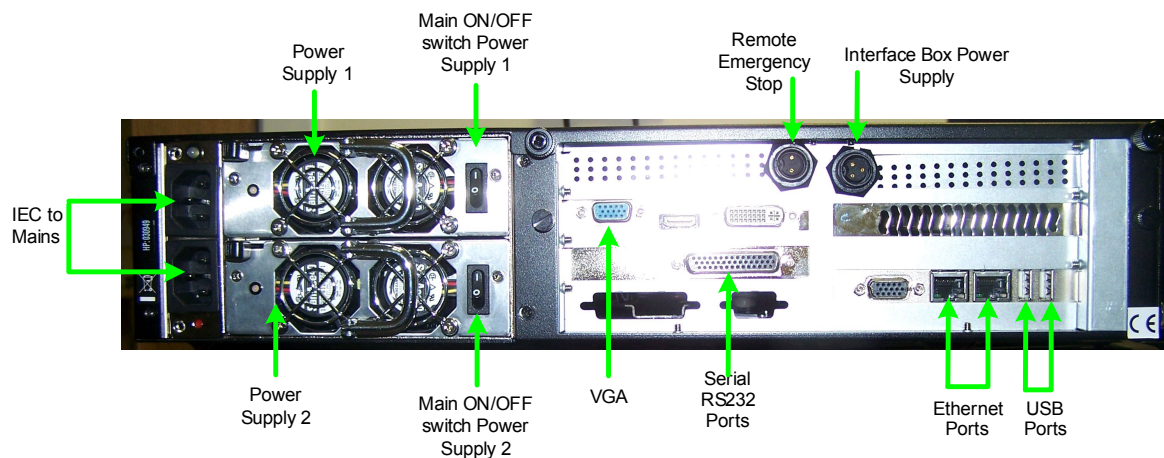


FIGURE 5 – INTERFACING THE SEETRACK COPILOT UNIT REAR PANEL

The rear of the unit is where the power, remote emergency stop button, monitor and navigation sensors should be connected.



Note: The rear panel of the SeeTrack CoPilot hardware unit is where all the data communication occurs.

3.5 Hardware Specification

3.5.1 Front Panel Layout

The position and description of each connector are explained in Figure 6 and Table 1:

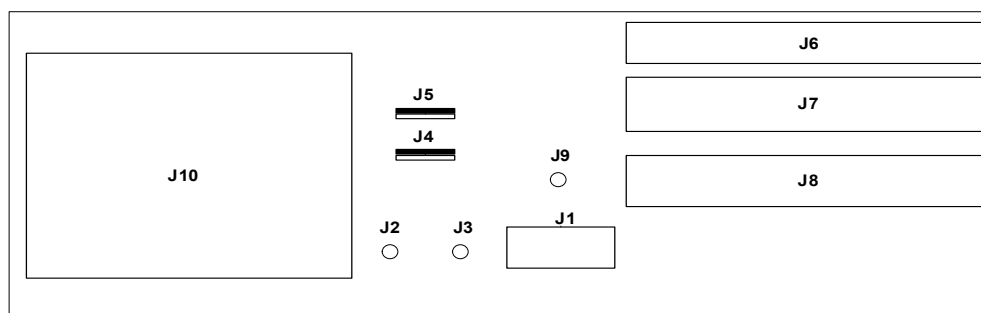


FIGURE 6 – SEETRACK COPILOT HARDWARE UNIT FRONT PANEL LAYOUT

PART	DESCRIPTION	TYPE
J1	On/Off button	Momentary push button

J2	Power Indicator	LED
J3	System Indicator	LED
J4	USB 2.0 port	USB Type A
J5	USB 2.0 port	USB Type A
J6	Drive	DVD-RW/CD-RW
J7	Hard Drive Disk 1	N/A
J8	Hard Drive Disk 2	N/A
J9	Reset button	Momentary push button
J10	Fans and filter	N/A

TABLE 1 – FRONT PANEL CONNECTIONS

3.5.2 Rear Panel Layout

The position and description of each connector are explained in Figure 7 and Table 2:

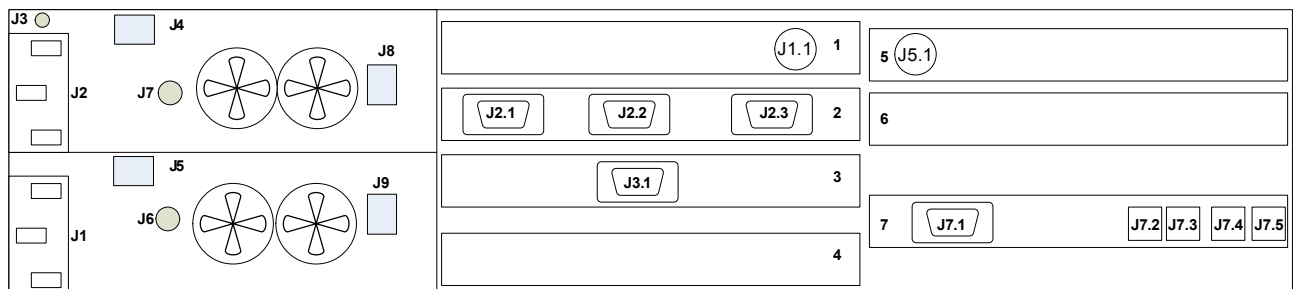


FIGURE 7 – REAR PANEL LAYOUT

PART	DESCRIPTION	TYPE
J1	Mains Input 100-240 VAC 47-63Hz	IEC female
J2	Mains Input 100-240 VAC 47-63Hz	IEC female
J3	Mains indicator	LED

J4	Power supply latch	
J5	Power supply latch	
J6	PSU indicator	LED
J7	PSU indicator	LED
J8	Mains ON/OFF	ON/OFF Rocker Switch
J9	Mains ON/OFF	ON/OFF Rocker Switch
SLOT 1	E-Stop	
J1.1	Remote Emergency stop	2-pin round female
SLOT 2	Display	
J2.1	VGA	15-way D female
J2.2	Not used	
J2.3	DVI	29 pin female
SLOT 3	Serial Communications	
J3.1	Serial ports (up to 4 ports using data cable provided)	25-way D male
SLOT 4	Spare	
SLOT 5	IB power	
J5.1	Interface box power supply	3-pin round female
SLOT 6	Fan	
SLOT 7	IO	

J7.1	Not used	
J7.2	10/100 Base-T Ethernet port (SeeByte use only)	RJ45
J7.3	10/100 Base-T Ethernet port (SeeByte use only)	RJ45
J7.4	USB 2.0 port	USB Type A
J7.5	USB 2.0 port	USB Type A

TABLE 2 – REAR PANEL CONNECTIONS

3.5.3 Power

The SeeTrack CoPilot unit accepts voltages from 100VAC to 240VAC (47-63Hz) from a universal mains AC power supply.

The mains inputs (J2 and J3) of the unit should be connected to an AC mains power supply using the power cables provided.

The unit is powered ON and OFF via two methods:

1. The power supply provides a standard ATX format; the power button on the front (J1) starts the power supply and shuts it down. This is the primary means of powering the unit ON and OFF.
2. On the rear of each power supply module there is a supply ON/OFF switch (J8 and J9). When the power button on the front of the unit (J1) is used, part of the power supply remains live; when the switches on the rear of the unit (J8 and J9) are used, the power supply is completely cut off.

3.5.4 Emergency Stop Button

The SeeTrack CoPilot unit is equipped with **one** emergency stop button: it is a remote stop button and it is connected to a 2-pin connector (J1.1).



Caution: The remote emergency stop button should be plugged in at **ALL** times.



Caution: In the event of a DP failure, the pilot **must** cut out the DP system by pressing the remote emergency stop button. The pilot will then have total control of the ROV using their own joystick.



Caution: If the ROV stops responding, cut the DP system off immediately by pressing the emergency stop button.

3.5.5 Communications

USB ports

Four USB ports are also provided for user-specific peripherals to be connected, a joystick, a keyboard, a mouse or storage devices. Two USB ports are located at the rear of the unit (J7.4/J7.5) and two are located at the front of the unit (J4/J5).

Each port is able to provide up to 500mA of current maximum. Each port is compliant with the USB 2.0 standard, and will support:

- **Hi-Speed** Mode (480Mbps)
- **Full-Speed** Mode (12Mbps)
- **Low-Speed** Mode (1.5Mbps)

Ethernet RJ45 connectors

Two Ethernet RJ45 connectors are located on the rear panel



Caution: The connectors should **NOT** be used except by SeeByte and when the ROV is controlled by an analogue or digital joystick. Please refer to section 10.1 – for further details.

DB9 Serial RS32 ports

Four ports are available to the user and are primarily used to plug in navigation sensors. These ports will read serial data from devices connected to the ports on the rear of the unit that use the RS232 hardware protocol. All ports are electrically protected.

The pin-out details for each DB9 connector are as follows:

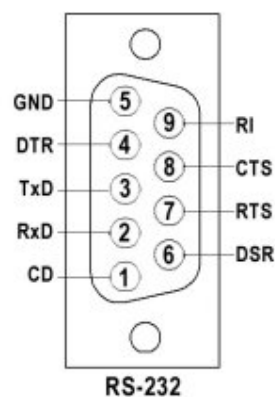


FIGURE 8 – PIN-OUT DETAILS

PIN NUMBER	DESCRIPTION
1	DC – Data Carrier
2	RxD – Receive Data
3	TxD – Transmit Data
4	DTR – Data Terminal Ready
5	GND – Ground
6	DSR – Data Set Ready
7	RTS – Request To Send
8	CTS – Clear To Send
9	RI – Ringing Indicator

TABLE 3 – PIN-OUT DESCRIPTIONS

3.5.6 Display - Connection

VGA/DVI video outputs: these outputs (**J2.1** and **J2.3**) allow the unit's pilot interface to be displayed.

3.6 Power Up/Down Procedures

3.6.1 Switching the SeeTrack CoPilot Hardware Unit On

- Ensure that the **main power sockets (J1 and J2)** are plugged into AC mains.
- Press the **power buttons (J2 and J3)** on the power supply unit to **position 1**. The three indicators **J3, J6** and **J7** should be on.
- Now switch the unit on by pressing the **power On/Off button (J1)** situated at the front of the unit.
- The **power indicator (J2)** is now on.
- The unit is now on.

3.6.2 Switching the SeeTrack CoPilot Hardware Unit Off



Important Note: Ensure that the emergency stop button is pressed before switching off the unit.

- **Shutdown Procedure**

From the taskbar:

1. Ensure that the emergency stop button is pressed.
2. Select the following icon  located on the top taskbar.
3. Select Shut Down...
4. Select Shutdown

- **Emergency Procedure**

1. Ensure that the emergency stop button is pressed.
2. Push and maintain the **On/Off** button (**J1**) for a few seconds until the system stops.
3. Press the **main power** buttons to position 0 (**J2** and **J3**) at the rear of the unit.



Important Note: The emergency procedure is **NOT** recommended and should only ever be used as a final option.

4 Pilot Interface Overview

The SeeTrack CoPilot pilot interface presents the user with an overview of the ROV's status and its position in the navigation chart. The overall look of the pilot interface is designed for use primarily in low light conditions and has also been designed to be easy to read and intuitive to use.

The SeeTrack CoPilot pilot interface comprises of four main elements:

- **Pilot Information Display**

The pilot information display is the column on the left side of the interface. It provides the pilot with vital information on the current status and operation of the ROV.

- **Navigation Chart Display**

The navigation chart display is the main panel in the pilot interface. It allows the user to monitor the position of the ROV in real-time. It is also possible to use the navigation chart display to generate commands for the ROV by selecting coordinates with a mouse. A left-button mouse click in this display generates a new position request for the ROV, and a right-button mouse click generates a new heading request.

- **Water Column Display**

The water column display is positioned on the right side of the interface, next to the navigation chart display. It allows the pilot to monitor and alter the depth/altitude of the ROV. A left-button mouse click in this display generates a new depth/altitude request for the ROV. A right-button mouse click has no effect in this display.

- **Pilot Interface Toolbar**

The pilot interface toolbar allows the user to access the additional functionalities of the interface.

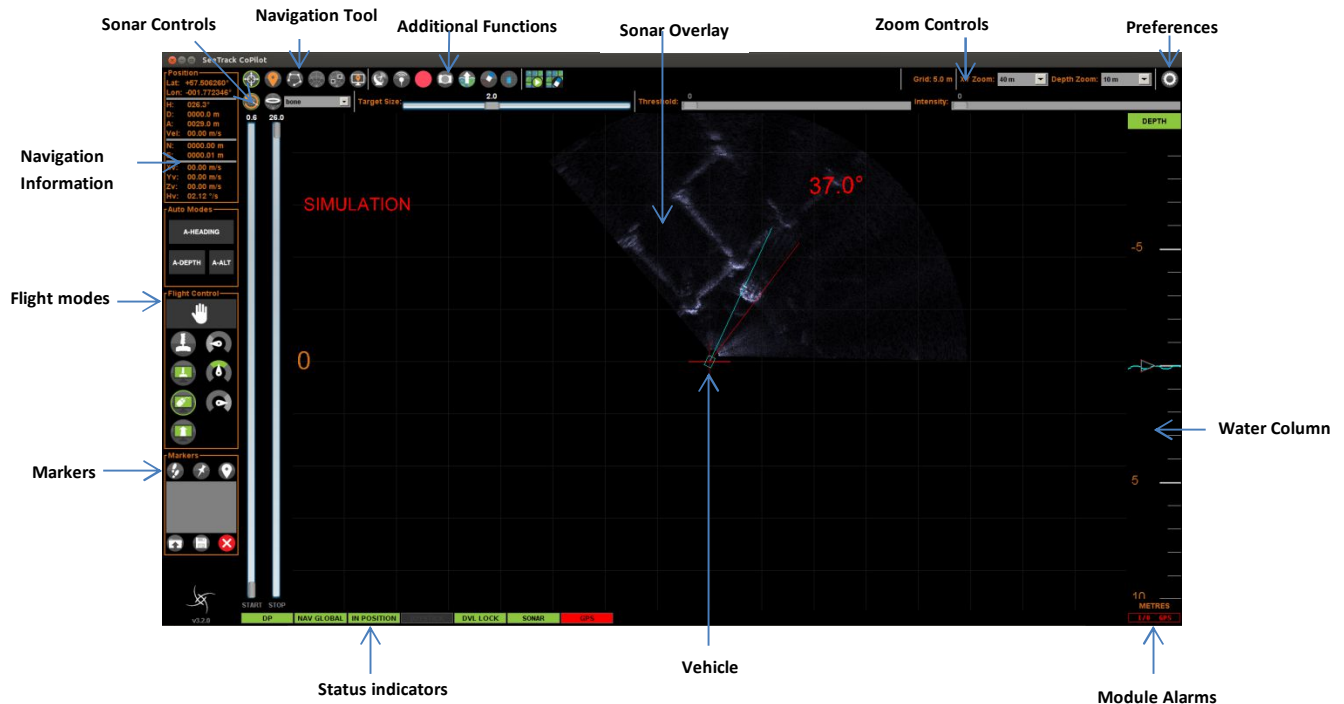


FIGURE 9 – PILOT INTERFACE OVERVIEW

5 Navigation Chart Display

The **navigation chart display** is centred on the ROV. It displays a plain view of the ROV and the surrounding area. The navigation chart is capable of displaying various objects – such as other ROVs, the TMS and the vessel – but can only control the main ROV in the centre of the view.

The ROV position is estimated by SeeTrack CoPilot's navigation system – the accuracy of which depends on the frequency and quality of the absolute navigation fixes.

The view is always pointing to magnetic north; however the ROV will rotate in the centre of the screen to reflect the current ROV heading.

When in AUTOFLY mode, the main ROV is controlled in X (Surge), Y (Sway) and Yaw (Heading) in the navigation chart display using the mouse. A left-button mouse click changes the current target position to the new screen coordinates where the click occurred. The target waypoint is represented by a cross and a trajectory line is drawn between the current ROV position and the target waypoint. A right-button mouse click changes heading. The target heading is displayed by a line of fixed length from the current ROV position at the requested target heading. The target heading is also displayed as a number at the end of the target heading line.

The number of turns the ROV makes over its own axis is displayed on the left side of the navigation chart display. A clockwise turn is represented by a positive figure, and an anti-clockwise turn is represented by a negative figure.

The navigation chart also displays a grid as a form of reference. The grid square scale is specified by the grid size label. This scale changes with the zoom scale to improve its usability.

In addition to a grid, the navigation chart is also capable of displaying a user-defined water current direction and user-defined water current velocity. The navigation chart display is also responsible for displaying the head-up display messages indicating various system states.

5.1 Navigation Chart Display Zoom Scale Control

The navigation chart display zoom scale allows the user to change the displayed size of objects in the viewable area. The scale of the viewable area is measured from the centre of view to the right or left edge of the viewable area. The scales are set to pre-defined values of 2m, 5m, 10m, 20m, 50m, 100m and 200m (or their equivalent values in feet).

6 Water Column Display

The **water column display** allows the user to view the area above and below the ROV in the water column. The ROV remains in the centre of the display at all times. If the seabed is within range of the DVL or Altimeter, and is within the current field of view, it is also displayed.

The water column display can be operated in either depth or altitude mode. This option allows the ROV to remain at a constant user-defined value. In depth mode, the ROV will maintain the specified depth of the ROV relative to the sea surface; in altitude mode, the ROV will maintain the specified altitude of the ROV relative to the sea bed.

The depth/altitude mode can be changed by clicking on the button at the top of the water column display. For example, if the button indicates that the display is in 'Depth' mode, it will change to 'Altitude' when selected.

While in AUTOFLY or CRUISE mode, the user can control the ROV's Z (Heave) axis by clicking above or below the centre of the water column display. The ROV will then ascend or descend to the specified depth or altitude, depending on the selected display mode.

The seabed icon is displayed in yellow and the sea surface in cyan. The **current** depth/altitude is represented by a cyan arrow and the **target** depth/altitude selected by the user is represented by a red arrow.

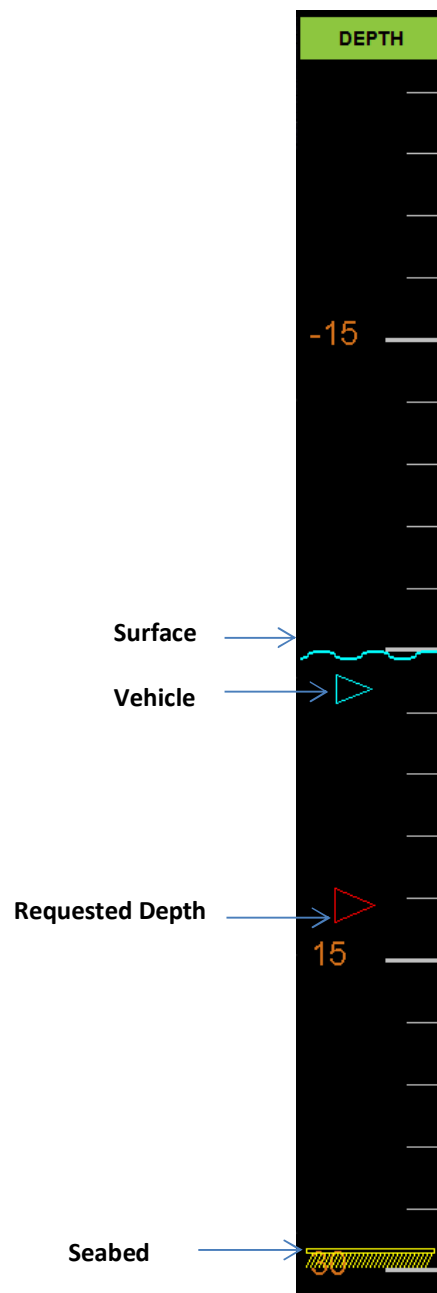


FIGURE 10 – ROV MOVING IN WATER COLUMN DISPLAY

6.1 Water Column Display Zoom Scale Control

The water column zoom scale allows the user to change the displayed size of the area of interest around the ROV. Zooming out in this control allows the user to send requests further above or below the ROV. The ROV is always at the centre of the water column display; the seabed is also displayed but moves according to the current ROV altitude. The zoom scale of the viewable area is measured from the centre of view to the top or bottom of the viewable area. The scales are set to pre-defined values of 2m, 5m, 10m, 20m, 50m, 100m, 200m, 500m and 1000m (or their equivalent values in feet).

7 Pilot Information Display

The **pilot information display** contains the essential navigation information required to operate the ROV with confidence and precision. This display provides the user with the current navigation data for the ROV and a visible indication of the selected flight control method.

The pilot information display comprises many user-friendly elements, including the current navigation information; status indicators; and flight mode and velocity selection.

7.1 Navigation Information

This pilot interface feedback panel provides the user with the following ROV information: Latitude (**Lat**), Longitude (**Lon**), Heading (**H**), Depth (**D**), Altitude (**A**), Vehicle Velocity (**Vel**), North (**N**), East (**E**), Surge Velocity (**Xv**), Sway Velocity (**Yv**), Heave Velocity (**Zv**) and Yaw Velocity (**Hv**). This information is normally updated from the navigation system, but if the DP is in standby only the raw ROV information is displayed. No value is displayed if no ROV information is detected.

Position	
Lat:	+57.505894°
Lon:	-001.772732°
H:	092.9°
D:	0007.1 m
A:	0000.7 m
Vel:	00.28 m/s
N:	0004.43 m
E:	0015.07 m
Xv:	00.28 m/s
Yv:	00.00 m/s
Zv:	00.00 m/s
Hv:	00.00 °/s

FIGURE 11 – NAVIGATION INFORMATION

7.2 Status Indicators

The status indicators on the pilot interface display allow the user to monitor the status of the system.



FIGURE 12 - STATUS INDICATORS

7.2.1 The DP Status Indicator

This indicator displays the status of the DP system:

- The indicator is **green** when the DP system is running.

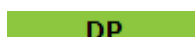


FIGURE 13 - DP RUNNING INDICATOR

- The indicator is **red** when the DP system is in standby.

STANDBY

FIGURE 14 - DP STANDBY INDICATOR

The DP can go into standby if the ROV is not in working range (i.e. the DVL has no bottom-lock) or some critical error was detected. In this situation SeeTrack CoPilot changes into MANUAL mode and the pilot has full control.

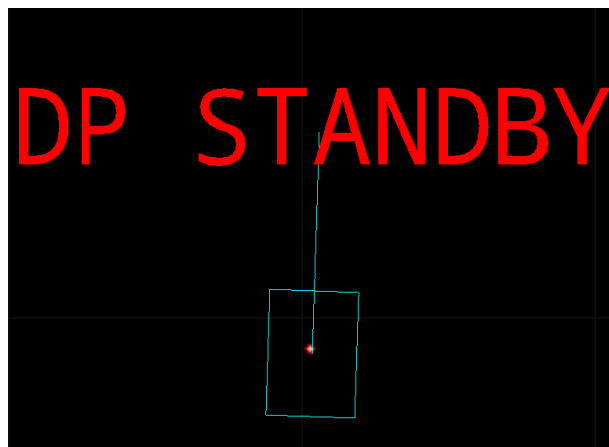


FIGURE 15 - DP STANDBY DISPLAY

7.2.2 The Position Status Indicator

This indicator is illuminated **green** when the ROV is within the tolerance range of its target position. The indicator is not displayed when the ROV is not in position.

IN POSITION

FIGURE 16 - IN POSITION INDICATOR

7.2.3 The Joystick Indicator

This indicator is displayed **green** when the system receives a command from the joystick. The indicator is not displayed when the joystick is not considered to be in use.

If the joystick movement is within the specified deadband range, the system will not detect the command. For example, a joystick movement of 20% will not be detected by the system if the deadband setting is 30%.

JOYSTICK

FIGURE 17 - JOYSTICK INDICATOR

7.2.4 The Navigation Status Indicator

This indicator can have four different displays, depending on the accuracy of the navigation system and the ROV's global reference:

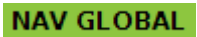
INDICATOR APPEARANCE	STATUS
 Figure 18 – Nav Global Indicator	The navigation system is operating correctly (green), and the global position is accurate.
 FIGURE 19 - NAV LOCAL INDICATOR	The global position may have a degree of imprecision – but it is still compatible with effective ROV operation (yellow).
 FIGURE 20 – NAV FAULT INDICATOR	The navigation system has failed (red). Only the MANUAL flight mode is accessible.

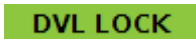
TABLE 4 – NAVIGATION STATUS INDICATORS

7.2.5 The DVL Lock Indicator

This indicator informs the user of the failure of the DVL sensor to get an adequate fix on the seabed. When this indicator is illuminated **red** the DP system will lose precision after a short amount of time. The ROV can be flown in MANUAL mode under these circumstances.



FIGURE 21 - DVL LOCK (LOCK LOST) INDICATOR

When the DVL gets a fix on the seabed, the indicator is **green** displaying DVL  and the system will return to normal operation.

7.2.6 The External Position Fix Indicator



Note: An external interface might be required. The external position data could come from USBL, LBL, GPS or other available devices. The indicator will be labelled with the device category name (USBL, LBL or GPS).

This indicator informs the user if a position fix (Latitude and Longitude) is being received in a continuous manner to SeeTrack CoPilot. The indicator will turn **red** when no device is connected or if no data is being received. The indicator will turn **green** when data is received.

GPS

FIGURE 22 – EXTERNAL POSITION FIX INDICATOR

7.2.7 The Sonar Indicator

This indicator is displayed **green** when the sonar is connected to SeeTrack CoPilot. The indicator is displayed **red** when the sonar communications have failed or if the sonar is not connected.

SONAR

FIGURE 23 – SONAR INDICATOR

7.3 Markers

It allows the user to place markers onto the Pilot Interface to denote positions of interest to be returned to. These markers can be placed automatically at the vehicles current position, or manually at a position chosen by the operator. Marked areas can be saved and loaded by the operator for repeat missions.

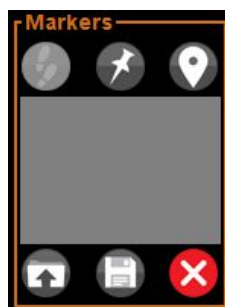


FIGURE 24 - MARKER PANEL INTERFACE

7.3.1 Placing a Marker at the Current Position



FIGURE 25 - MARK CURRENT LOCATION

The user can automatically drop a marker at the vehicles current position, which will be visually denoted by a gold dot on the Pilot Interface, by clicking the Place Marker Icon. The location of this marker will appear within the Markers interface.

7.3.2 Manually Placing a Marker

The user can manually place a marker by selecting the Add Marker icon.



FIGURE 26 - ADD MARKER

The user will then be instructed to enter the coordinates of their chosen location into the window. Once entered, the user should click 'OK' to place the marker. If incorrect coordinates have been entered, a warning message will be displayed. Press Ok to add the marker to the display.

FIGURE 27 - ADDING A MARKER



Note: Hold the control (Ctrl) key and use left-button mouse click to quickly add a marker.

7.3.3 Fly to Marker

Once a marker has been placed, the user can, at any time during their mission, instruct the vehicle to fly to the Marker by clicking on the chosen marker from the marker list and then selecting the Fly to Marker Icon.



FIGURE 28 - FLY TO MARKER



Note: Fly to Marker option is only available in Auto-Fly mode.

7.3.4 Save Marker Positions

The user has the option of saving the position of their current marker(s) for use at a later date. To do this, the Save icon should be selected. Once clicked, the file will automatically be saved to the data directory. See section 7.11 **Error! Reference source not found.** for more information regarding the data directory.



FIGURE 29 - SAVE MARKER LIST

7.3.5 Load a Marker File

To load a previously saved Marker File, the user must select the Load icon.



FIGURE 30 - LOAD MARKER LIST

By selecting the appropriate file from its location and selecting 'open', the saved markers will be loaded onto the current Pilot Interface and added to the marker's list.

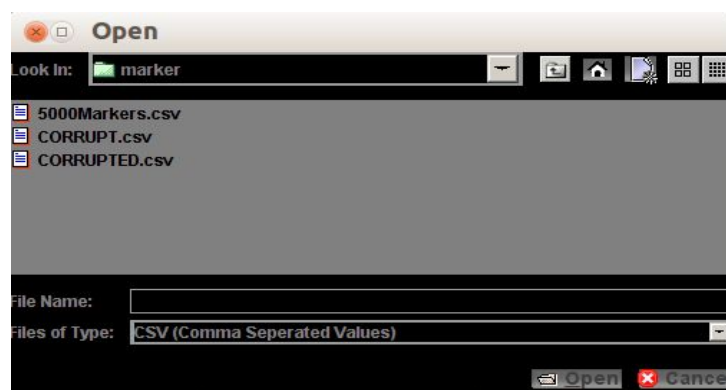


FIGURE 31 - LOAD MARKER WINDOW

7.3.6 Editing Markers

The user can edit the position and name (alias) of a specific marker:

- Right-button mouse click on the marker to be edited within the Markers Interface list of markers
- Select 'Edit' from the options provided
- Edit the details as shown in section 7.3.2 and save. The marker position and name will now be changed.

7.3.7 Deleting a Marker

To delete a marker, there are two possible actions that can be undertaken:

1. Using the Delete icon
 - Select the Marker you wish to delete from the Markers Interface list of Markers
 - Left-button mouse click on the Delete icon



FIGURE 32 - DELETE MARKER

2. Using the Markers Interface

- Right-button mouse click on the marker you wish to delete from the Markers Interface list of Markers
- Select Delete from the available options

Your chosen marker will now be deleted.

7.3.8 Selecting Multiple Markers for Deletion

To select multiple markers from the Markers Interface list of Markers, the user should, whilst holding the control (Ctrl) key on their keyboard, select the markers they wish to delete by clicking on each marker.

All of the markers can also be selected by clicking on one of the markers in the list and then pressing Ctrl + A to select all of them.

7.4 Flight Modes

Selecting the flight mode buttons on the pilot information display changes the flight mode

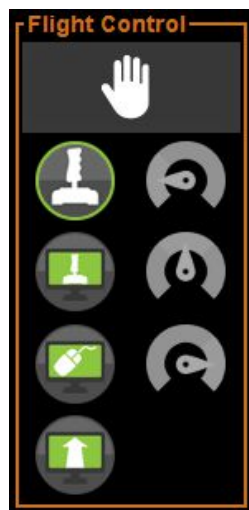


FIGURE 33 – FLIGHT MODE BUTTONS



Note: When the DP is in standby, the only mode enabled is MANUAL and the rest of the buttons are disabled in the pilot interface.

7.4.1 HOVER Command

The ROV maintains position when the 'HOVER' button  is selected. The HOVER command can be used at any time to interrupt the vehicle's motion and hold the position of the ROV.

The HOVER command provides station-keeping at the touch of a button and is useful for monitoring missions when the ROV must remain in a fixed position for long periods of time.



Note: The selected flight mode defaults to AUTOFLY whenever the 'HOVER' button is pressed – except when the AUTOHOVER flight mode is in use.

7.4.2 Flying in MANUAL Mode

In MANUAL mode the pilot has full control as if the joystick is directly connected to the ROV, and the DP system is in standby. The pilot interface displays navigation data and monitors the position of the ROV.



Note: Selecting the 'HOVER' button will change the ROV into AUTOFLY mode.

Example

1. Select the 'MANUAL'  button.
2. Fly the ROV manually with the joystick.
3. The ROV is moving on the navigation chart according to your requests via the joystick movements.



Note: Clicking in the navigation chart or water column display has no effect; the ROV responds to joystick commands only.

7.4.3 Flying in AUTOHOVER Mode

In AUTOHOVER mode the pilot has full control as if the joystick were directly connected to the ROV. This mode provides station-keeping when no control inputs from the joystick are detected.

If the pilot releases the joystick, the DP system takes control and maintains the vehicle's position. The pilot can use the joystick again to regain full control of the ROV.

Example

- Select the 'AUTOHOVER'  button.
- Fly the ROV with the joystick.
- Release the joystick.
- The ROV holds position automatically.
- Fly the ROV around again via the joystick.



Note: Clicking in the navigation chart or water column display has no effect; the ROV responds to joystick commands only.

7.4.4 Flying in AUTOFLY Mode

In AUTOFLY mode the DP system is in total control. The ROV can be controlled with both mouse and joystick commands, and when there are no commands the DP system provides station-keeping.

AUTOFLY mode also offers the user a range of additional **navigation tools** to assist in controlling the ROV. These navigation tools allow the user to plan detailed missions for the ROV with ease and precision.



FIGURE 34 – NAVIGATION TOOL BUTTONS

7.4.4.1 Click & Go Navigation Tool

Click & Go  is the default navigation tool in AUTOFLY mode. The pilot can select a set of coordinates by clicking on the screen using the mouse and the ROV will then fly to those coordinates and go into a stable hover. Alternatively, the ROV can be moved using a joystick input and will **decelerate** to a stable hover when the joystick is released. This method of station-keeping provides a smoother halting manoeuvre for the ROV, and is only available in the AUTOFLY flight mode.

Example

1. Select the 'AUTOFLY'  button.
2. Choose a speed (SLOW, MEDIUM or FAST); the ROV will aim to move at the chosen speed.
3. The depth/altitude of the ROV can be altered at any time using the water column display.

- **Mouse Commands**

- A right-button mouse click on the navigation chart display will change the heading of the ROV (a new line at the chosen heading will appear).
- A left-button mouse click on the navigation chart will select a target destination.
- The requested waypoint will appear on the screen represented by a cross.
- The ROV will move towards the chosen position.
- Once the target has been reached the 'IN POSITION' indicator will illuminate and the ROV will maintain position until a new destination is chosen.

- **Joystick Commands**

- A command from the joystick controls the ROV at a velocity proportional to the chosen speed (SLOW, MEDIUM or FAST).
- The green arrow indicates the direction of the pilot's velocity request.
- When the joystick is released the ROV will decelerate as quickly as possible until it reaches a resting point, and will then maintain position until the system receives another command.



Note: If the ROV takes too long to decelerate to a resting point, the DP system will activate a HOVER command.

7.4.4.2 *Specific Waypoint Navigation Tool*



The **Specific Waypoint** navigation tool allows the user to manually send the ROV to a specific position using absolute or relative coordinates.

There are four methods of identifying the specific waypoint:

1. **Global**

This option allows the user to specify the waypoint by entering the latitude, longitude, depth/altitude and heading coordinates. The user can choose whether to enter depth or altitude coordinates by selecting the appropriate format in the drop-down box. The user also has a choice of formats for entering latitude and longitude: decimal degrees; degrees and decimal minutes; and degrees, minutes and seconds.



Note: Latitude and longitude coordinates are always on WGS84 reference datum.

The screenshot shows a software interface for setting a global position. At the top, there are four buttons: 'Local Position', 'Relative Position', 'Fine Position', and 'Global Position'. The 'Global Position' button is highlighted. Below these buttons, there are two 'Format' labels. The first 'Format' label has a dropdown menu showing 'Decimal Deg.' and another dropdown showing 'Depth'. The second 'Format' label has four input fields: 'Latitude:' with the value '+00.000000°', 'Longitude:' with the value '+000.000000°', 'Depth: (m)' with the value '0.0', and 'Heading: (°)' with the value '0'. A 'Send' button is located at the bottom of the interface.

FIGURE 35 – GLOBAL POSITION OPTION

2. Local

This option allows the user to specify the waypoint by entering the north, east, depth/altitude and heading coordinates. The user can choose whether to enter depth or altitude coordinates by selecting the appropriate format in the drop-down box.

The screenshot shows a software interface for setting a local position. At the top, there are four buttons: 'Fine Position', 'Global Position', 'Local Position', and 'Relative Position'. The 'Local Position' button is highlighted. Below these buttons, there are two 'Format' labels. The first 'Format' label has a dropdown menu showing 'Depth'. The second 'Format' label has four input fields: 'North: (m)' with the value '0.0', 'East: (m)' with the value '0.0', 'Depth: (m)' with the value '0.0', and 'Heading: (°)' with the value '0'. A 'Send' button is located at the bottom of the interface.

FIGURE 36 – LOCAL POSITION OPTION

3. Relative

This option allows the user to specify the waypoint by entering coordinates relative to the ROV's current position. The waypoint request can be specified using any or all of the following four fields:

- **Forward/Backward (m):** A positive figure in this field will make the ROV move forward. A negative figure in this field will make the ROV move backward.
- **Lateral Left/Right (m):** A positive figure in this field will make the ROV move right. A negative figure in this field will make the ROV move left.
- **Up/Down (m):** A positive figure in this field will make the ROV go down. A negative figure in this field will make the ROV go up.
- **Turn Left/Right (degrees):** A positive figure in this field will make the ROV turn right. A negative figure in this field will make the ROV turn left.



Note: Forward is positive, Lateral right is positive, Down is positive and Turn right is clockwise.

Fine Position	Global Position
Local Position	Relative Position
Coordinate	
Fwd/Bkwd: (m)	0.0
Lat Left/Right: (m)	0.0
Up/Down: (m)	0.0
Turn Left/Right: (°)	0
Send	

FIGURE 37 – RELATIVE POSITION OPTION

The user must first select the required method of specifying the waypoint by selecting the appropriate tab at the top of the Waypoint panel.

The user must then enter the precise figures for each field according to the chosen method of determining the waypoint.

By selecting the 'Send' button, the command is activated and the ROV is directed to the specified coordinates.



Note: If the user attempts to send the ROV to an invalid coordinate, a dialogue box will appear to advise that the waypoint request is impossible to achieve.

4. Pre-defined Relative

It is similar to method 3 but without the need to enter figures. Pre-defined motions are available to select.

Local Position	Relative Position
Fine Position	Global Position
↶ ↴ ↷ ↵ 0.2 m ↶ ↴ ↷ ↵ 1.0 ° ↶ ↴ ↷ ↵	

FIGURE 38 – FINE POSITION OPTION

7.4.4.3 Survey Plan Navigation Tool



The **Survey Plan** navigation tool is used to prepare a mission for the ROV by either planning a path on - screen or uploading a saved path.

The user can specify the coordinates, depth/altitude, heading and wait time for each of the waypoints in the path before the ROV begins its mission. When activated, the ROV will automatically follow the designated path with no further input from the pilot, unless interruption is deemed necessary.

The Survey Plan navigation tool allows the pilot to observe and monitor the ROV instead of negotiating its path manually.

The user can employ two methods to plan a path for the ROV:

1. Planning a Path Using the Mouse

The user should indicate the position and heading for each of the waypoints using the mouse.

- The **position** must be determined first, with a left-button mouse click; and
- the **heading** determined second, using a right-button mouse click.

The waypoints are assigned an ID number as they are registered on the navigation chart, to remind the user of the order of sequence.



Note: Holding control key (Ctrl) and pressing Z key will delete the last waypoint entered.



Note: It is possible to only use left-button mouse clicks to plan a mission. In that case the heading will be automatically calculated based on the direction of the line.



Note: Holding shift key and using left-button mouse clicks will automatically create a waypoint with the previous heading.



It is also possible to plan a path by selecting the 'Edit' button and entering the required data manually for the series of waypoints.

FIGURE 40 – SURVEY PLAN EDITOR

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Additional waypoints can then be added by repeating this process.

The user can enter the coordinates for the waypoint in two formats:

1. **latitude/longitude** (in decimal degrees); or
2. **north/east**.



Note: Latitude and longitude coordinates are always on WGS84 reference datum. The user also has the option of selecting either depth or altitude mode when specifying the waypoint. The path will be loaded and displayed on the navigation chart by selecting the 'OK' button.



Note: Pressing the Depth/Altitude button allows to change the mode and values of either depth or altitude for all the waypoints.

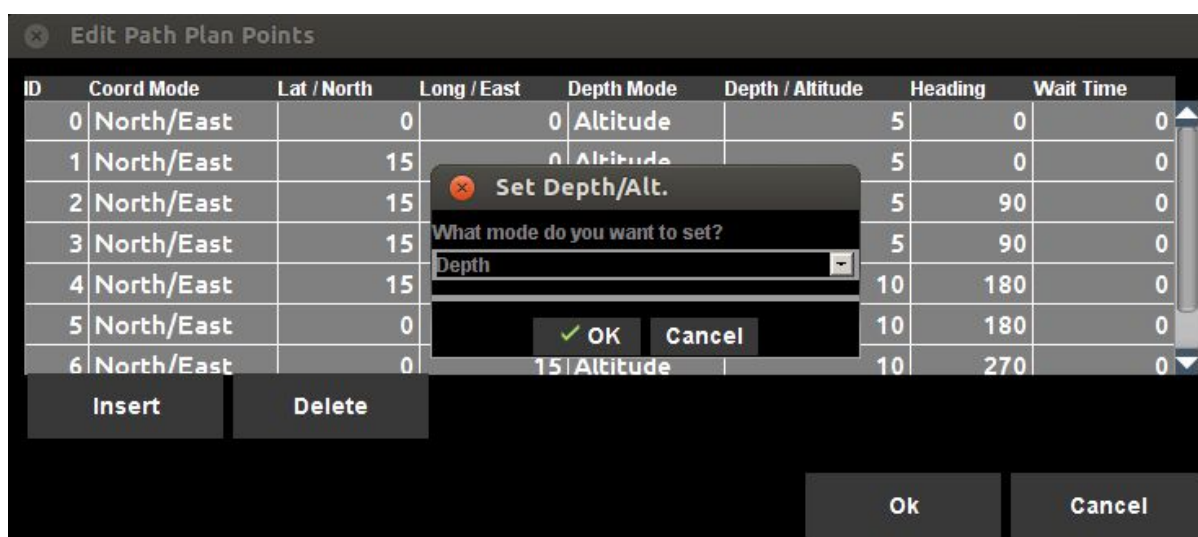


FIGURE 41 – SURVEY PLAN EDITOR SETTING DEPTH OR ALTITUDE VALUES

▪ Editing a Path

Whether it was created using the mouse or editor, the user can edit the details of a path by selecting the  (**Edit**) button to display the Edit window.

The coordinates, depth/altitude, heading and wait time (in seconds) for a waypoint can all be altered by selecting the appropriate field and entering the required data.

It is possible to insert new waypoints within the path by selecting the entry in the table directly after the desired position of the new waypoint, then pressing the 'Insert' button. For example, if the user wishes to insert a new waypoint between positions 2 and 3, they should select the entry in the path table with the ID

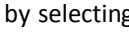
number 3, then select 'Insert'. This will produce a new entry with coordinates exactly half-way between the waypoints 2 and 3. This data can then be amended according to the particular values of the new waypoint.

It is also possible to delete waypoints by first selecting the appropriate entry in the editor table, and then pressing the 'Delete' button.



Note: Holding control key (Ctrl) and pressing Z key will delete the last waypoint entered.

▪ Running a Path

To run the mapped path, the user must select the  (play) button. The ROV will then fly each line, before moving on to the next. The  (pause) button can be used to suspend the journey, and the  (stop) button can be used to stop the journey completely. The path can be removed at any time by selecting the  (clear) button.

The  (skip forward) button when pressed skips the current waypoint.

The  (skip backward) button when pressed will start reversing the path to the beginning of the path.

The  (jump to end) button when pressed will select the last waypoint of the mission.

The  (jump to start) button when pressed will select the first waypoint if the mission.

When the ROV has completed the Survey Plan sequence, the user can select the  (play reverse) button again to repeat the journey.



FIGURE 42 – SURVEY PLAN BUTTONS

▪ Saving a Path

A path can be saved at any point by selecting the  (Save) button and entering an appropriate file name and location.

▪ Loading a Path

Saved paths can be loaded by selecting the  (Load) button and opening the appropriate file.

▪ Deleting a Path

Selecting the  (Clear) button will remove the path and the path data will not be saved.



Note: Although a path may remain visible if the user selects another cursor tool, the ROV will only follow the path when the Survey Plan tool is selected.

7.4.4.4 MBI-Track Navigation Tool



When the MBI-Track button  is pressed the target tracking dialog is opened on screen which allows the user to perform tracking commands on potential targets.

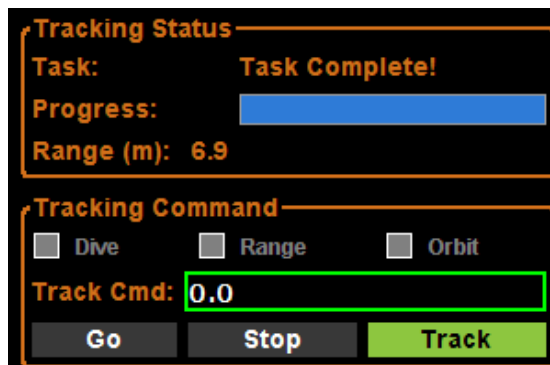


FIGURE 43 – TRACKING DISPLAY

The colour of the target box indicates the status of the tracking system:

- **A Solid green** indicates a currently tracked target selected by the user.
- **A Dashed yellow** box indicate a detected target

The user must press the TRACK button to enable the tracking. The user can press a left-button mouse click to select a visible target in the sonar image. If the tracking module successfully locks on, a green box will appear. The ROV will adjust automatically its heading to face the target.

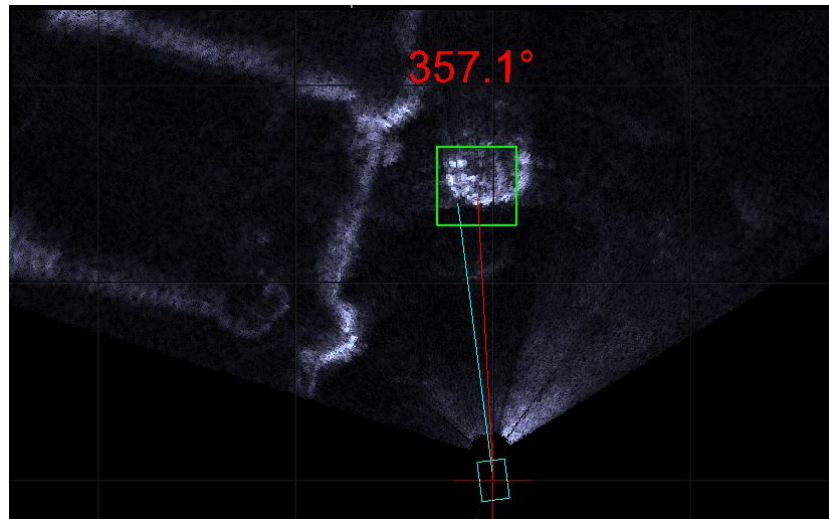


FIGURE 44 – TRACKING A TARGET

A right-button mouse click performs the same behaviour as a left-button mouse click – but in this instance a point is tracked.

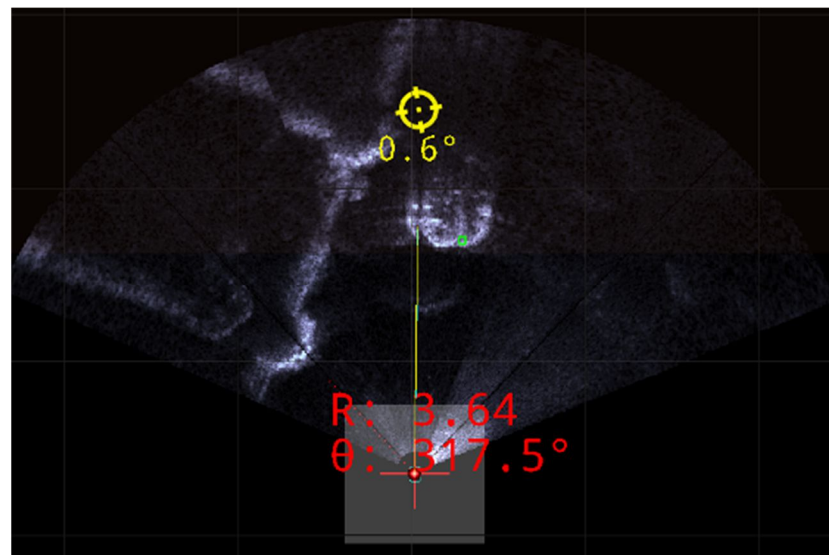


FIGURE 45 – TRACKING A POINT

When the TRACK button is pressed the tracking status and command controls are displayed.

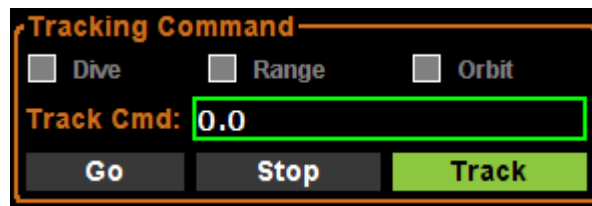


FIGURE 46 – TRACKING COMMAND PANEL

There are two ways to control the vehicle once the target is acquired.

1. Tracking Panel Commands

The user can select three different tasks such as dive, orbit and surge. All the motions are relative to the target.

The Orbit task commands the vehicle to orbit around the target either in a clockwise or counter clockwise direction. For example if 180 degrees is selected, the vehicle will move around the target by 180 degrees (clockwise) from its present position.

The Dive task commands the vehicle to either dive (when a positive request is entered) or rise (when a negative request is entered).

The Surge task commands the vehicle to either move forwards (when a positive request is entered) or move backwards (when a negative request is entered). No requests within a radius of 2 m of the target are allowed.

By pressing the GO button the selected task will start. The task progress is constantly updated along with the range to the target. Once the task is accomplished the vehicle will hover.

The user is able to stop the tracking command at any time by pressing the STOP button.



Note: Clicking the 'HOVER' button will result in the target lock being released. The system will continue holding position.

2. Joystick Commands

The joystick commands the vehicle to move relative to the target. For mid-water objects, such as a riser, the vehicle will orbit the target in a clockwise or counter clockwise direction when the joystick is pushed laterally. Pushing forward or backwards on the joystick increases or decreases the range to the target. The vertical control commands the vehicle to dive or rise.



Note: Clicking the 'HOVER' button will result in the target lock being released. The system will continue holding position.

7.4.4.5 Online Follow



SeeTrack CoPilot can receive waypoint data from an external interface when the mode  is selected. As soon as a new waypoint is received the vehicle will move automatically to it. This tool can only be used when SeeTrack CoPilot is in Auto-Fly mode. The user should click on the toggle button in order to activate this tool. Clicking on any other navigation tool or the Hover button will result in the SeeTrack CoPilot system disabling the Online Follow tool. Therefore the system will ignore incoming waypoint data.



Note: This mode is only available if the required interface is present. This feature can be used if the ROV needs following the main vessel.

7.4.5 Flying in CRUISE Mode



CRUISE mode  is ideal for survey work when the ROV must keep a constant heading and speed irrespective of the currents.

In CRUISE mode the DP system is in total control and the ROV moves in a straight line at a constant depth/altitude, heading and forward velocity. The joystick or mouse can be used at any time to alter the heading, depth/altitude and velocity of the ROV – without interrupting the CRUISE mode. The pilot may also adjust the position of the ROV to an alternative trajectory parallel to the vehicle's current heading using the joystick or a left-button mouse click.



Note: If the user selects any of the cursor tools except Click & Go while in CRUISE flight mode, the system will automatically default to AUTOFLY mode.

Example

1. Set ALTITUDE mode.
2. Select 'CRUISE'  button.
3. The ROV is now moving forward at the chosen speed (SLOW, MEDIUM or FAST) and is keeping its altitude and heading.
4. The altitude of the ROV can be changed at any time using the water column display.

- **Mouse Commands**

- A right-button mouse click on the navigation chart display will change the heading of the ROV (a new line at the chosen heading will appear).
- A left-button mouse click on the navigation chart will select a new position for the ROV. (Whilst in this mode, however, a command to adjust the position of the vehicle will only allow the user to direct the ROV to a point that is parallel to the ROV's current heading.)
- The requested position will appear on the screen represented by a cross and it will move parallel to the ROV.
- The ROV will then be aligned with the chosen position, whilst maintaining a constant depth/altitude, heading and forward velocity.
- The ROV will continue cruising until the user exits 'CRUISE' mode or interrupts the flight using the 'HOVER' button.

- **Joystick Commands**

- The joystick can be used to adjust the position of the ROV. (Whilst in this mode, however, a command to adjust the position of the vehicle will only allow the user to direct the ROV to a point that is parallel to the ROV's current heading.)
- The requested position will appear on the screen represented by a cross and it will move parallel to the ROV.
- The ROV will be aligned with the chosen position, whilst maintaining a constant depth/altitude, heading and forward velocity.
- The ROV will continue cruising until the user exits 'CRUISE' mode or interrupts the flight using the 'HOVER' button.

7.5 Velocity Controls

As with the flight mode buttons, the **Velocity Control** buttons serve to change the ROV velocity and indicate the current setting by highlighting the selected button in green.

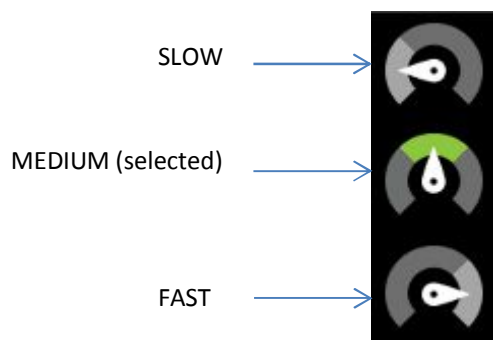


FIGURE 47 – VELOCITY CONTROL BUTTONS DEFINED AS FAST- MEDIUM AND SLOW

This velocity control is only available in AUTOFLY and CRUISE modes.



Note: Velocities are defined during the commissioning of the system and are dependent on the capability of the ROV. Usually MEDIUM is half of FAST and SLOW is one eighth. All axes are affected by the change in velocity.

7.6 Single Axis Auto Modes

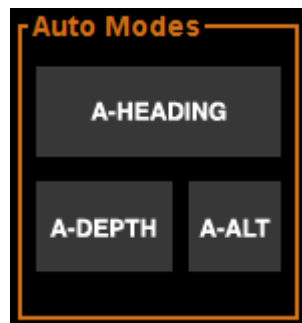


FIGURE 48 – SINGLE AXIS AUTO MODES



Note: All single axis auto modes are only available when DP is enabled. It is possible to engage multiple auto-modes at the same time such as auto-heading and auto-depth or auto-altitude.

7.6.1 Auto-Heading

This is a single axis control. The ROV will maintain current heading or change heading if a right-click mouse command is issued. The ROV will turn to the new specified heading.

7.6.2 Auto-Depth

This is a single axis control. The ROV will maintain current depth or change depth if a left-click mouse command is issued (clicking in the water column). The ROV will fly to the new specified depth.

7.6.3 Auto-Altitude

This is a single axis control. The ROV will maintain current altitude or change altitude if a left-click mouse command is issued (clicking in the water column). The ROV will fly to the new specified depth.

7.7 Sonar



Note: A sonar device needs to be connected to SeeTrack CoPilot computer.



Note: Sonar controls and features are device dependent and might not be available to all sonar devices.

7.7.1 Sonar Communications



FIGURE 49 - SONAR COMMS

If the user wishes to close any existing connections to the sonar and open a new connection, they can do so by simply clicking on the **Sonar Comms** button. This function should be utilized in instances when communication with the sonar has been interrupted.

7.7.2 Auto-Intensity On/Off



Note: Sonar dependent, might not be available or replace with different controls.



FIGURE 50 - ENABLE / DISABLE AUTO-INTENSITY

By default, CoPilot automatically adjusts the image intensity to produce an optimum image for most situations. However, there are some cases where you may wish to disable this feature. You can do so by un-checking Auto Intensity under the Pilot Interface Toolbar. With auto-intensity disabled, CoPilot shows the horizontal Threshold and Intensity sliders in the toolbar.

7.7.3 Intensity/Threshold



Note: Sonar dependent, might not be available or replace with different controls.



FIGURE 51 - INTENSITY AND THRESHOLD SLIDERS

Lowering the threshold will allow more of the background to be displayed in the image. Increasing the threshold will suppress background noise, increasing the contrast of the image. The intensity control affects the brightness of the image. This is similar to brightness controls on a camera. Setting the intensity too low or too high will make the image dim or blown out respectively, making image details difficult to see.

7.7.4 Colour map



Note: Sonar dependent, might not be available or replace with different controls.



FIGURE 52 – SONAR IMAGE COLOUR MAP

The colors used in displaying the sonar image are referred to as the colour map. The selected colour map for the image is displayed in a drop down box on the CoPilot Interface toolbar. It is recommended to experiment with the different colour maps to best understand their individual strengths and weaknesses.

7.7.5 Target Size Slider



FIGURE 53 - TARGET SIZE SLIDER

The target size slider allows the user to specify which size range of potential targets should be tracked whilst using the tracking navigation tool. The slider must be set to close to the real target size. Refer to section 7.4.4.4 for more information regarding the tracking navigation tool.

7.7.6 Sonar View Range Sliders



Note: Sonar dependent, controls might be limited.



FIGURE 54 - SONAR RANGE SLIDERS

The sonar range sliders (along the immediate left side of the interface) allow you to change both the start and stop range. The Stop Range selects how far out the sonar is looking, whereas the Start Range selects the point where the sonar starts acquiring data. By using both controls you can zoom in on a target. However, note that zooming in too far can create a degraded picture because not enough data is available to fill the screen pixels, resulting in pixilation.

7.8 Alarm Panel

The **alarm panel** is displayed across the bottom of the pilot interface. It displays the current status of each software component that allows SeeTrack CoPilot to run smoothly.

If a software component fails, its name is illuminated in the alarm panel situated along the bottom of the pilot interface.

In normal operation, the bar illustrated below should have no alarms illuminated, and it will remain invisible to the user until any failure occurs.



FIGURE 55 – ALARM PANEL



Note: Please refer to the *Troubleshooting and FAQ* guide for more details on the pilot interface alarms and the appropriate response to each.



Caution: If any alarm is activated, the DP system must be immediately cut off by pressing the emergency stop button.

7.9 Additional Functions



FIGURE 56 - ADDITIONAL INTERFACE FUNCTIONS

7.9.1 Enable/Disable External Position Fix

Pressing the Control External Position  button will enable or disable the reading of Latitude and Longitude data.

7.9.2 External Position Fix

By selecting the External Position Fix  button, the user is presented with the Update Global Reference window which gives them two options:

1. Reset Navigation Origin

It allows the user to reset the navigation origin, by selecting this and pressing the OK button the vehicles north and east values are reset to 0.



Note: This can be used when the user needs to run the same survey path (pattern) multiple times. A survey path can be designed in North and East positions, saved and loaded. The user would first fly the ROV to position, reset the Navigation origin and finally load the path.

(See section 7.4.4.3 for more information regarding the survey plan navigation mode).

2. Manually enter updated global position

It allows the user to manually enter the global position of the ROV to update the navigation system.



Note: If an external position fix device is fitted to the computer the global position can automatically be updated to SeeTrack CoPilot without having to manually update it.

FIGURE 57 - UPDATE GLOBAL REFERENCE DIALOG

By checking the 'remember this choice' box before exiting the dialogue box, the system will store the details of the request and remember them the next time SeeTrack CoPilot starts-up

7.9.3 Log Recording

The Log Recording  button allows the user to record sonar sequences and mission data which are automatically saved to the data directory. Refer to section 7.11 for more information.

Once selected, the button will blink to indicate recording in process. When the button is pressed for a second time this will stop the recording and the button will stop blinking to indicate the logs are not being recorded.

7.9.4 Taking a Screenshot

A screenshot of the current interface display can be taken by selecting the Screenshot  button. By selecting this icon, a screenshot of the current interface display will be captured and saved to the data directory.

7.9.5 Load Vector Chart



The Load Vector Chart button allows the user to add a vector chart to the navigation chart display. It can only display one chart at a time. The vector chart must be an AutoCAD® 14 DXF file in UTM WGS84 format and the chart must not exceed the boundaries of the relevant UTM zone.



Important Note: The Navigation Status indicator on the pilot information display must be green in order for the chart to be loaded. Please refer to section **7.2.4 – The Navigation Status Indicator** for more information.



Note: The user must know which UTM zone the chart was created in.

Load Vector Chart

Step 1: Select Chart File

Step 2: Select Chart UTM Zone

UTM Zone Number: 1 UTM Zone Letter: C

Step 3: Ensure Vehicle Position is Correct

FIGURE 58 – LOAD VECTOR CHART

The Load Vector Chart dialogue box comprises three steps:

- **Step 1:**

Selecting the 'Browse' button opens up a dialogue box, through which DXF chart files may be selected. When the appropriate file is located and the 'Open' button is selected, the chart is ready to be loaded, and the appropriate file name should appear in the file name display.

- **Step 2:**

When a valid file has been selected the file name will be displayed. The user must then select the correct UTM zone to position the chart using the drop-down lists.



Important Note: If an incorrect zone is chosen the chart will not be positioned correctly but may still appear in the view.

▪ **Step 3:**

The user must ensure that the vehicle position is correct before loading the vector chart. If the Navigation Status indicator is green (GLOBAL Position), this step is optional. If the Navigation Status sensor is yellow (GLOBAL Position not seeded to SeeTrack CoPilot), this step should be performed by selecting the 'Set Vehicle Position' button. Refer to section 7.2.4 for more information about indicators.

Select the 'Add' button to insert the chart on to the navigation chart display. Select the 'Exit' button to close the dialogue box.

Removing a Chart

Selecting the 'Remove' button removes the current chart displayed in the navigation chart display. If no chart is present, no action is taken.

7.9.6 Clearing Breadcrumb Trail

As the ROV moves across the Pilot Interface, a breadcrumb trail will be left, highlighting the path of the vehicle. This path can be cleared by simply selecting the Clearing Breadcrumb Trail  button.



Note: To disable the breadcrumb trail, refer to section 7.10.2.2

7.9.7 Grid mode

Pressing the Grid mode button  will allow the user to change the main navigation grid orientation. Three modes are available.

1. Default; North is up. The icon shows .
2. Follow vehicle heading; the grid will rotate as the vehicle is changing. The icon shows .

3. Fixed heading; the user inputs a heading value. The map will rotate to that orientation. The icon



7.10 Preferences

Pressing the Preferences  button will display the system settings and other configuration items.

7.10.1 Units

The user can change the display measurement (position) units used in the interface to **meters** or **feet**. The velocity units can also be changed to **m/s**, **ft/s** or **knots**.

The global position can also be changed to decimal degrees (DD.dddddd), degrees and decimal minutes (NDD MM.mmm), or degrees, minutes and seconds (NDD MM' SS.sss").

7.10.2 Additional Features

The features tab in the preferences menu provides the user with some added features which can be enabled or disabled by clicking the check box.

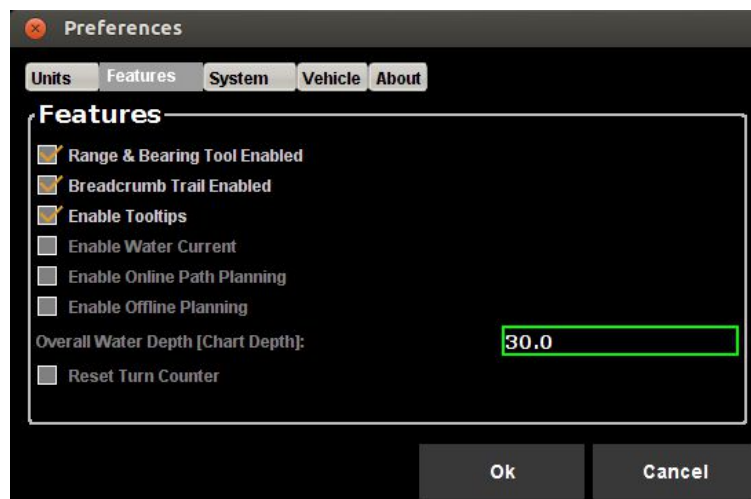


FIGURE 59 - ADDITIONAL FEATURES

7.10.2.1 Range and bearing tool

It displays the range and bearing information from the ROV to the cursor.

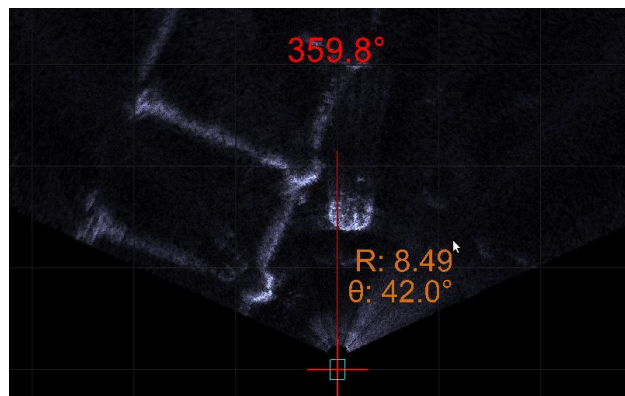


FIGURE 60 - RANGE AND BEARING TOOL

7.10.2.2 *Breadcrumb Trail Enabled*

A history of the ROV's positions is displayed on the navigation chart.

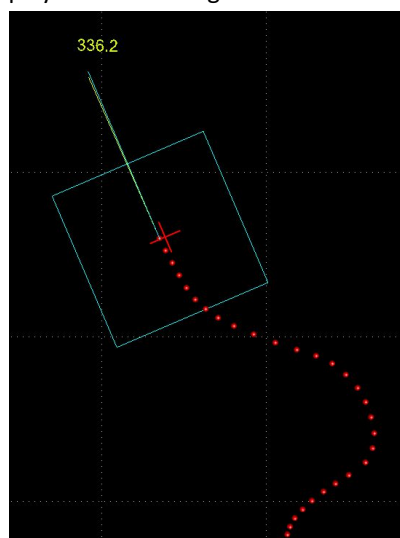


FIGURE 61 – VEHICLE TRAIL

7.10.2.3 *Enable Tooltips*

Tooltips are available on most of the buttons and features on the pilot interface. The tooltips are used to inform the user of the function and purpose of a certain feature or button.

7.10.2.4 *Enable Water Current*

The Water Current feature offers the user the option of entering the heading and speed of the current, and then displaying this information on the navigation chart.

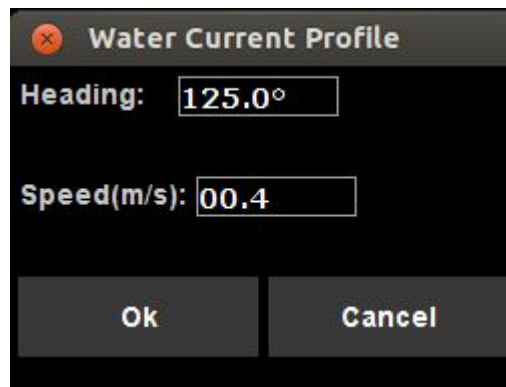


Figure 62 – Water Current Profile

In order to apply the specified values for the heading and speed of the water current, the user must check the box marked 'Enabled' and then select 'OK'. The information will then be displayed on the right edge of the navigation chart.



FIGURE 63 – WATER CURRENT DISPLAY

7.10.2.5 Enable Online Path Planning



Note: An external interface is required to enable this feature.

When SeeTrack CoPilot receives a sequence of waypoints it will then automatically load the mission path in the navigation chart display.

The mission file will always be saved in a specific folder for the user to use at a later time if required. The format of the file is a .csv file and it is dated and time stamped.

7.10.2.6 Enable Offline planning

This mode allows the user to plan a survey mission, load a chart, fly the ROV without the need of having the ROV deployed in water. The user is also able to add markers and make the ROV fly to the desired marker.

7.10.2.7 Set Overall Water Depth

When in offline mode the user can specify the overall water depth by entering a value in the text field and pressing the OK button.

7.10.2.8 Reset Turn Counter

Selecting this box and then pressing the Ok button will reset the turn counter value to zero.

7.10.3 System

7.10.3.1 Vehicle Chooser

The Vehicle Chooser allows the user to select the preferred control settings. These settings are stored for different vehicle types or payloads. The user should select the appropriate settings from the list available and then press the 'OK' button to confirm the choice.

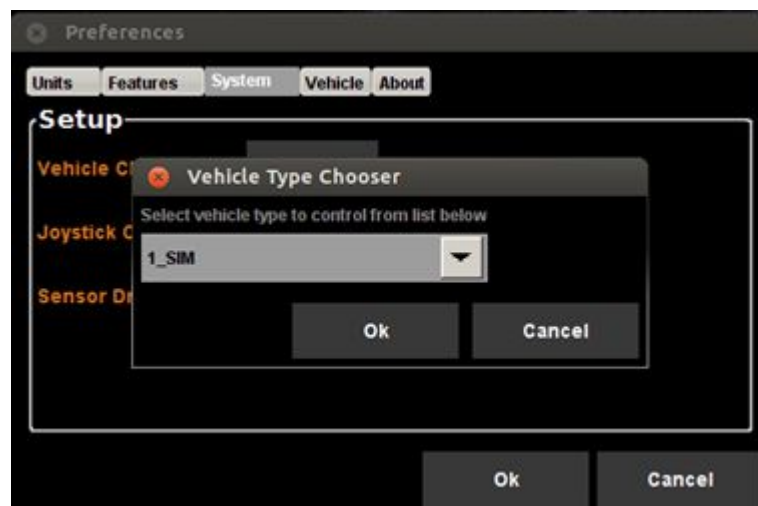


FIGURE 64 - VEHICLE CHOOSER

7.10.3.2 Joystick Calibration

This menu item is used to calibrate the joystick that is currently connected to the SeeTrack CoPilot system.



Caution: The joystick calibration should be completed before the ROV is ready to be operated – i.e. before it is in the water.

After selecting this menu item, the user has the option to begin the sequence of interactive processes required to complete the calibration of the joystick. The user is led through this series of steps by a wizard.



Important Note: Once the calibration process has started it cannot be stopped and must be completed.

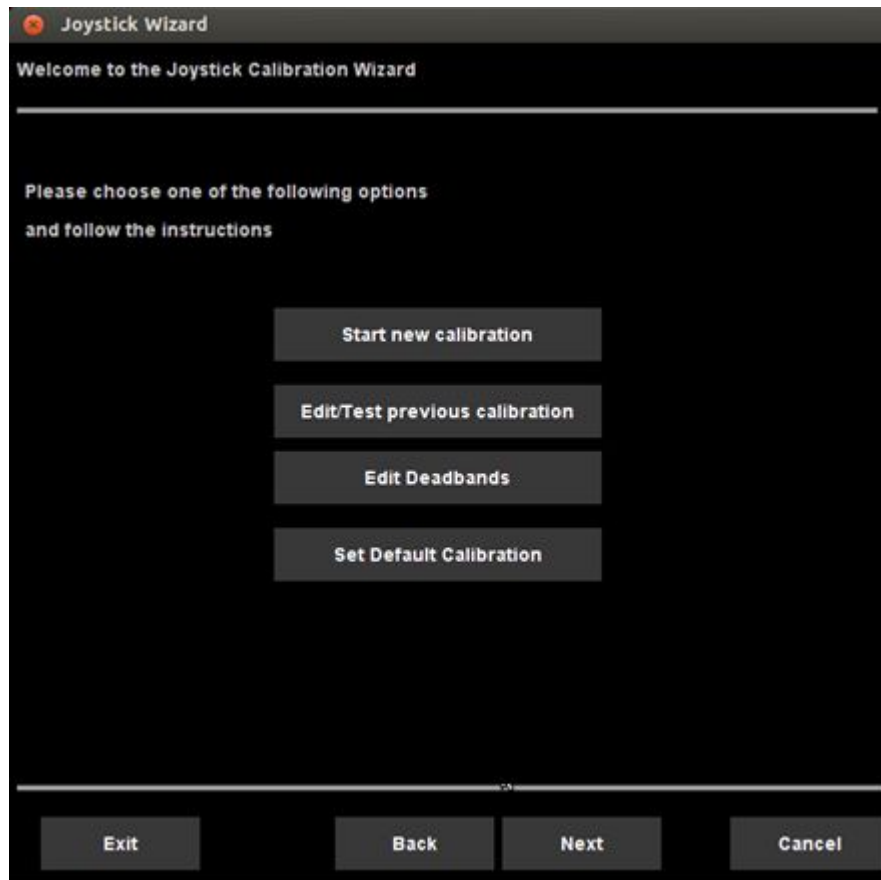


FIGURE 65 – JOYSTICK CALIBRATION

The Joystick Calibration menu item also offers three other options regarding joystick settings:

1. The 'Set Default Calibration' button will restore the joystick settings that were pre-defined during the SeeTrack CoPilot installation process.
2. The 'Edit/Test previous calibration' button opens previous settings which can be edited and then the changes can be saved.
3. The 'Edit Deadbands' button generates a dialogue box that will allow the user to adjust the deadband settings of the joystick.



Caution: Do not attempt to access or operate the 'Deadband' feature unless advised otherwise by SeeByte.



Note: Selecting the 'Exit' button in the 'Deadband' feature will close the dialogue box, but will not save the settings.

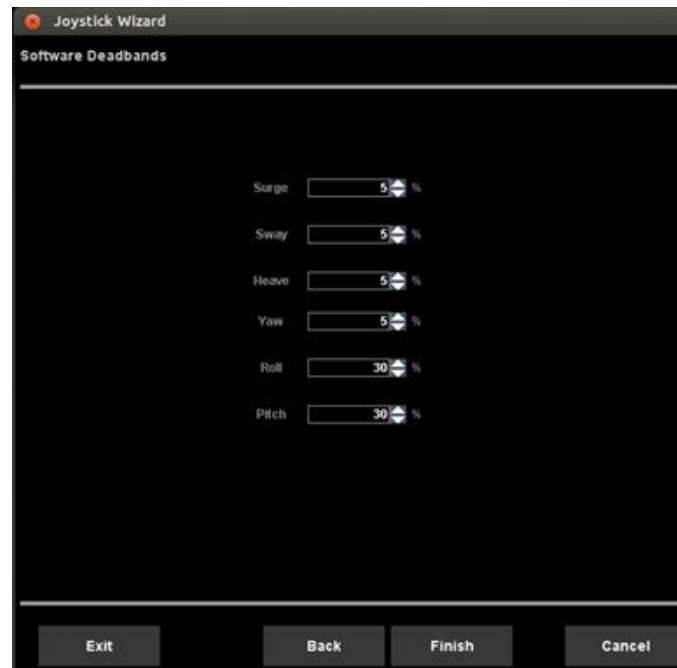


FIGURE 66 – DEADBAND SETTINGS

7.10.3.3 *Sensor Driver*

The Sensor Driver menu item is used to manage and set up the serial data for the drivers that are either present or active in the system.

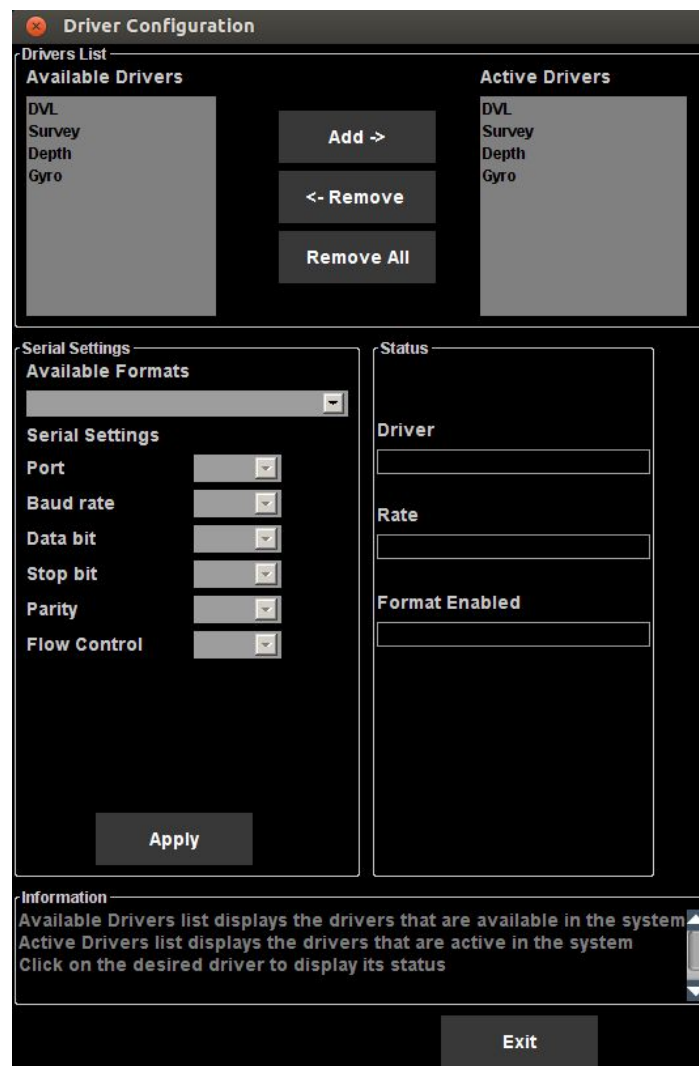


FIGURE 67 – DRIVERS CONFIGURATION

The **Driver List** box is used to manage the available and active drivers within the system. The drivers that are present in the system can be added to the 'Active' list by selecting the driver name and then pressing the 'Add' button. They can be deactivated and returned to the 'Available' drivers list by selecting the driver name and then pressing the 'Remove' button. All of the drivers can be removed from the 'Active' list by selecting the 'Remove All' button.

The **Serial Settings** box is used to set up the serial data for each of the active drivers. To change the settings of a particular driver, the user must click on the appropriate title in the **Drivers List** box, which will populate the settings for that driver into the **Status** and **Serial Settings** boxes.

The serial settings can only be applied once the driver appears in the 'Active Drivers' list in the **Driver List** box. If a driver is already enabled – meaning that its status is either 'ON', 'WRONG FORMAT' or 'NOT CONNECTED' – it will automatically appear in the 'Active' list. Therefore this driver will appear in both lists. At that point serial settings and/or driver formats can be changed.

- **WRONG FORMAT:** This means that the selected driver format is wrong and should be changed. This can be debugged by using the serial tool as explained in the *Troubleshooting and FAQ* guide.
- **NOT CONNECTED:** This means that the driver is not receiving data. Either the sensor is not sending data to SeeTrack CoPilot or the cable is not plugged into the SeeTrack CoPilot hardware unit. This can be debugged by using the serial tool as explained in the *Troubleshooting and FAQ* guide.
- **ON:** This means that the driver is correctly receiving data.



Note: If the driver status is displayed as 'ON' but the rate is displayed as 0 msg/sec, the serial data for that driver are not properly set.

If the status of the driver is set to 'OFF' it will remain in the Available Drivers list. At this point the driver can be added. Once it appears in the Active Drivers list, its serial settings can be retrieved by clicking on the driver name.

Once the driver has been selected from the 'Active Drivers' list, the user can enter the serial data for the driver into the corresponding fields in the **Serial Settings** box. In order to apply these settings the user must select the 'Apply' button. The pre-defined default settings for the driver can be resumed at any point by selecting the 'Restore' button.



Note: It is important to remember to click the 'Apply' button after entering the serial settings for the selected driver. If the user does not do this before selecting another driver or exiting the dialogue box, the driver settings will not be applied.

The **Status** box allows the user to monitor the current status, rate and enabled format of the selected driver.

7.10.4 Vehicle

The vehicle tab in the preferences menu allows the user to set the position of the sensors that are being used on the vehicle.

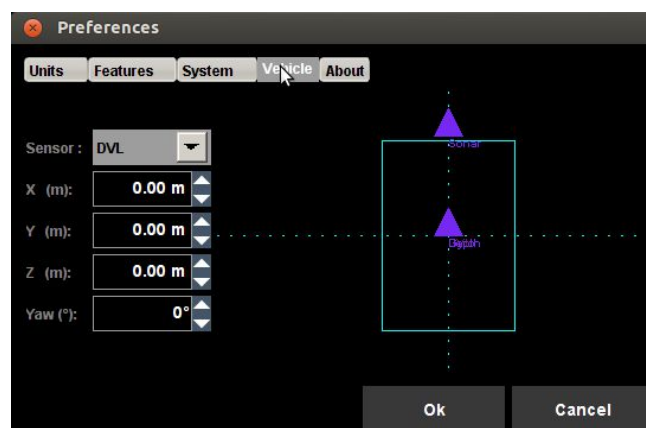


FIGURE 68 - VEHICLE SETUP



Note: Sensor positions are measured from the origin being the top centre of the buoyancy of the vehicle as shown by the dotted lines.

- Positive X is forward (bow)
- Positive Y is starboard
- Positive Z is down
- Positive Yaw is clockwise



Note: It is important to accurately measure sensors' position on the vehicle in order to improve the DP performance.

7.10.5 About

The about tab provides information regarding SeeTrack CoPilot.

7.11 Data Directory

All data is saved to a data directory. A shortcut (Link To Data) on the Desktop is available to navigate to the data folder

Within the directory subfolders are divided as follow:

- **Chart**
 - This folder is where all Charts should be stored as it is the default location that CoPilot checks for charts when the load chart button is pressed.
- **Marker**
 - This is where the user should store all marker lists and is where marker lists will be saved when the save marker list button is pressed.
- **Mission**
 - Where previous missions that have been saved can be found, is also the default folder for when a mission is saved.
- **Navigation**
 - This is where the navigation logs can be found when the log recorder has been activated.
- **Screenshot**
 - This is where screenshots can be found when the screenshot button is pressed.
- **Sonar**
 - Sonar logs can be found here when the log recorder has been activated.

8 Flying with Dynamic Positioning

Dynamic positioning allows an ROV to automatically hold a requested position.

SeeTrack CoPilot controls Surge (X), Sway (Y), Heave (Z) and Yaw (Heading). The origin of each axis, such as where the depth is measured from, is usually set to the centre of the ROV for surge and sway, the forward centreline of the ROV for yaw, the top of the ROV for depth and the bottom for altitude (both are components of heave).

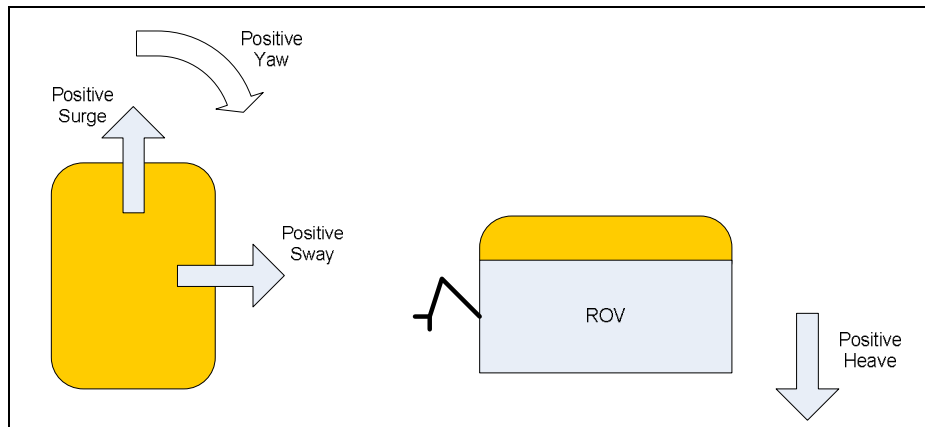


FIGURE 69 – CONTROL AXIS

When the DP system tries to HOVER in a fixed position, the set points are set to the ROV's actual position at that moment. If moving at speed the ROV's inertia will carry it past the waypoint; however the DP system will attempt to counter this by using maximum reverse thrust. The DP system will stop the ROV a little way past the waypoint then gently reverse back to the waypoint, as shown below in Figure 70.

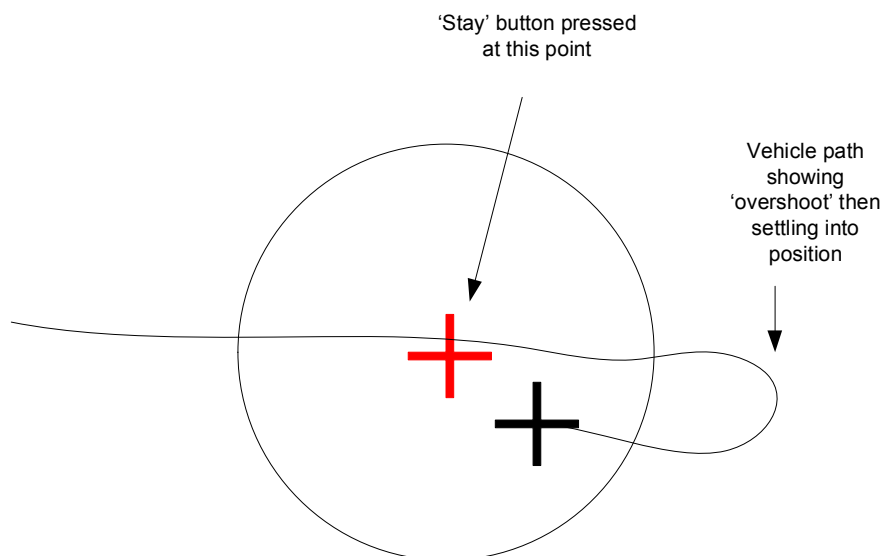


FIGURE 70 – FLYING WITH DP

A DP system automatically does what a pilot would do in adjusting the thrusters to keep the desired position. However, just as a pilot can only keep a position to within a certain tolerance, the DP system also has a tolerance.

Inside that tolerance, or footprint, the ROV position is unpredictable but will generally only change slowly. It is very difficult to move the ROV's actual position for distances less than the footprint.

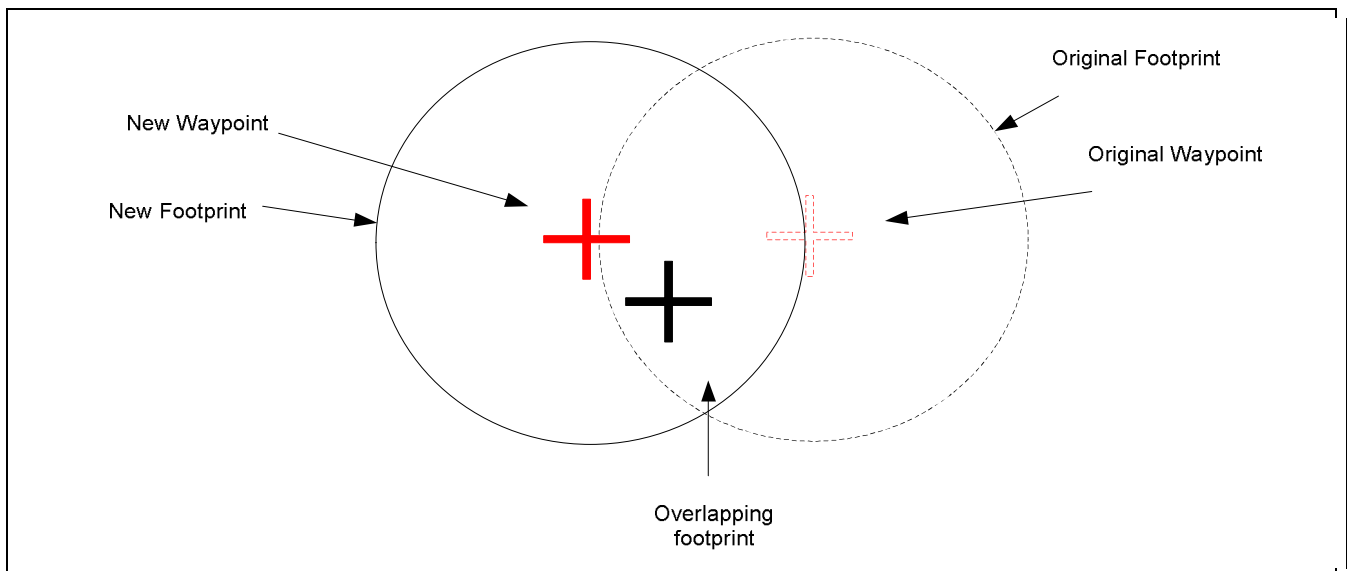


FIGURE 71 – TOLERANCE OVERVIEW

If the tolerance is, say, 0.3m, the ROV will be within 0.3m of the requested position. If, however, the pilot wants the ROV to move 0.1m to the left, the waypoint can be moved 0.1m to the left – but there is no guarantee that the ROV's actual position will move 0.1m to the left because it is still within the footprint of the new position.

This effect can also be seen in both heading and depth as shown below in Figure 72.

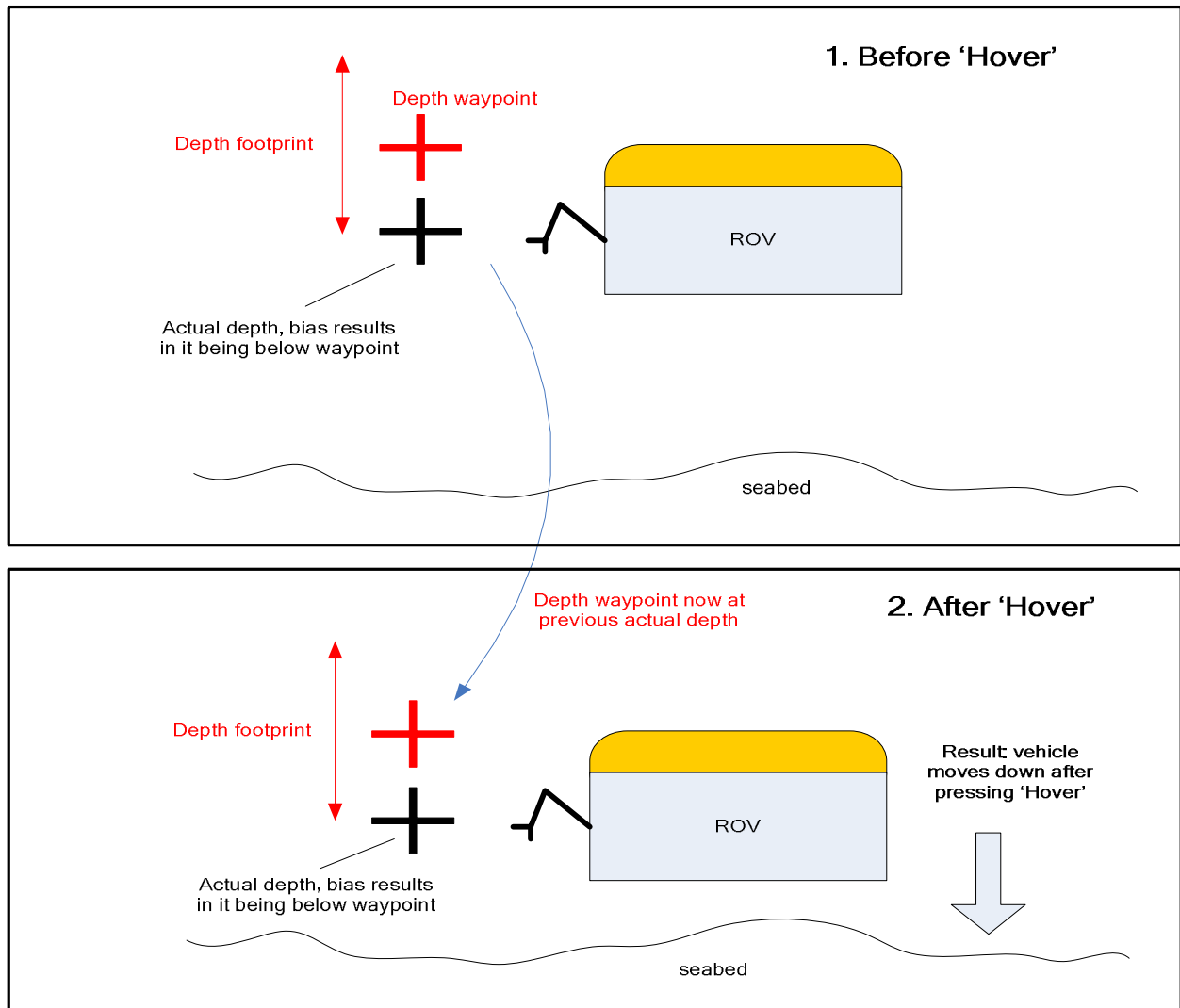


FIGURE 72 – DEPTH TOLERANCE OVERVIEW

9 Appendix A - Technical Specifications

ENVIRONMENTAL	
Operating Temperature	0° C to 40° C
Weight	< 10 kg
Size	Standard 19" 2U rack mount
POWER	
Supply Voltage	100 VAC to 240 VAC
Surge Power	170 W
SYSTEM REQUIREMENTS	
Doppler Velocity Log	Teledyne RDI Workhorse Navigator (preferred model)
Data Format Supported	PD0/PD6/PD13 (Teledyne RDI formats) Supplied with updates > 5Hz
Depth and Heading	Supplied with updates > 5Hz
ROV Thrusters Control	Analogue joystick or digital command system with updates > 5 Hz
Sonar	The Tracking module requires an input from a sonar
USER INPUTS AND OUTPUTS	
Connectors	4 Serial RS232, 4 USB, 2 Ethernet (SeeByte use only)
Indicators	Status LEDs (Power, System)
INSTALLATION	
Compatibility	Simple retrofit, no modification needed to ROV
Integration	1 day (12 hours) of ROV dry commissioning 1 day (12 hours) of ROV in-water commissioning; 2 hours for SAT - Additional time for training if required - Water space: minimum of 20m long x 20m across x 10m depth

TABLE 5 – TECHNICAL SPECIFICATION

10 Appendix B – Interface Box

10.1 Interface Box

The interface box itself is ROV-specific but allows the interfacing of generic controls such as surge, sway, heave and heading to the SeeTrack CoPilot hardware unit. The interface box connection provides power and switching control lines to allow control to be switched between SeeTrack CoPilot and the default joystick manual control.

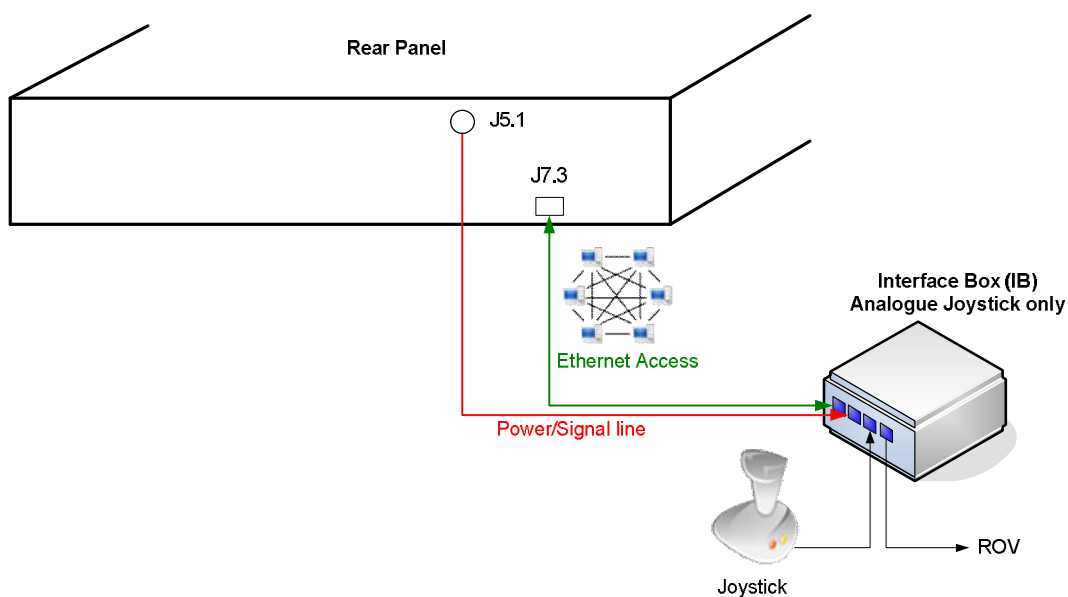


FIGURE 73 – CONNECTING THE ROV INTERFACE BOX TO THE UNIT

10.2 Interface Box Front Panel Layout

The position and description of each connector are detailed in and :

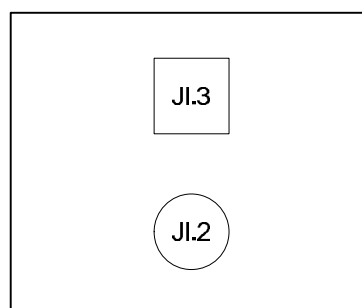


FIGURE 74 – INTERFACE BOX FRONT PANEL CONNECTORS

PART	DESCRIPTION	TYPE
Jl.2	Power/control lines	3-pin female
Jl.3	10/100Base-T Ethernet	RJ45

TABLE 6 – INTERFACE BOX FRONT PANEL CONNECTOR DESCRIPTIONS

10.3 Interface Box Rear Panel Layout

The position and description of each connector are explained in the following Figure 75 and Table 7 – Interface Box Rear Panel Connector Descriptions

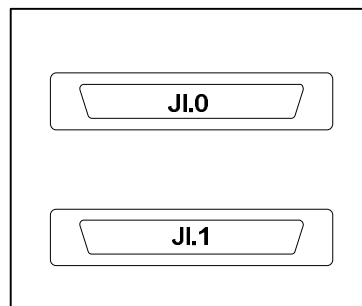


FIGURE 75 - INTERFACE BOX REAR PANEL CONNECTORS

PART	DESCRIPTION	TYPE
Jl.0	Joystick connector	DB25 female
Jl.1	ROV connector	DB25 male

TABLE 7 – INTERFACE BOX REAR PANEL CONNECTOR DESCRIPTIONS

10.4 Operation

It is designed to be plugged into the SeeTrack CoPilot hardware unit that gives power (using a provided 3-pin power cable) and a network connection (using an Ethernet RJ45 cable).

The user then needs to plug in the DB25 connectors its joystick and ROV cables.

11 Appendix C – Checking CoPilot

The following section is an example of how to check SeeTrack CoPilot

- Run the pilot interface by double clicking on the **SeeTrack CoPilot** icon. Alternatively use mouse right-click and select Open.
- Check if any **alarms** present in the system.
- Check navigation data and corroborate this data with other equipment if available.
- Check that the **indicators** are reporting correctly.
- Check that the thrusters are responding when using the joystick.
- Check the **water column display** gives information on altitude and depth. The vehicle might need to be deployed in the water at this stage.
- **MANUAL Mode** - In this mode, fly as usual and check that the behaviour is the same as it would be without SeeTrack CoPilot.
- **AUTOFLY Mode** –In this mode use the click and go navigation mode; issue waypoint command using the left and right click and ensure that the vehicle is moving smoothly
- **JOYSTICK** – Still in AUTOFLY mode use the joystick to fine manoeuvre the vehicle. Ensure that the vehicle is responsive.

12 Appendix D – Providing a log file for support request

The following steps explain what to do in case of issues being reported by customers while operating SeeTrack CoPilot.

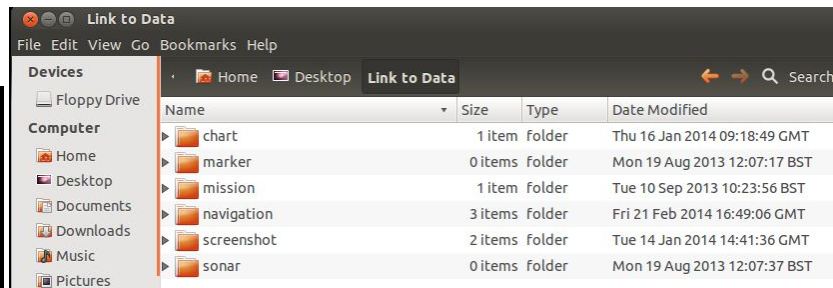
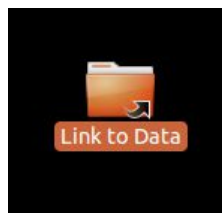
Describe clearly the issue including all steps to reproduce when possible.

1. Take a screenshot of the CoPilot interface using the dedicated “Screenshot”  button.

This will give information about the version used. The time-stamped screenshot can be found in the data folder under screenshot.



Note: To access data folders click on the Desktop shortcut Link to Data that will open the data folders – chart, marker, mission, navigation, screenshot and sonar.



2. Record a log file
 - CoPilot is running.
 - Press the “Log recording”  button to start recording data. The button will start flashing indicating data is being recorded.
 - Repeat the steps that lead to the issue reported.
 - Once the issue is captured press the “Log recording” button to stop recording data. The button will stop flashing.
 - Navigate to the navigation data folder as explained in the previous note.
 - Copy the latest time-stamped (date and time) file from navigation folder to a USB device for instance.
 - The file has an .osh extension and its name contains the date and time in UTC format matching the computer date and time.
 - Send file(s) to SeeByte.

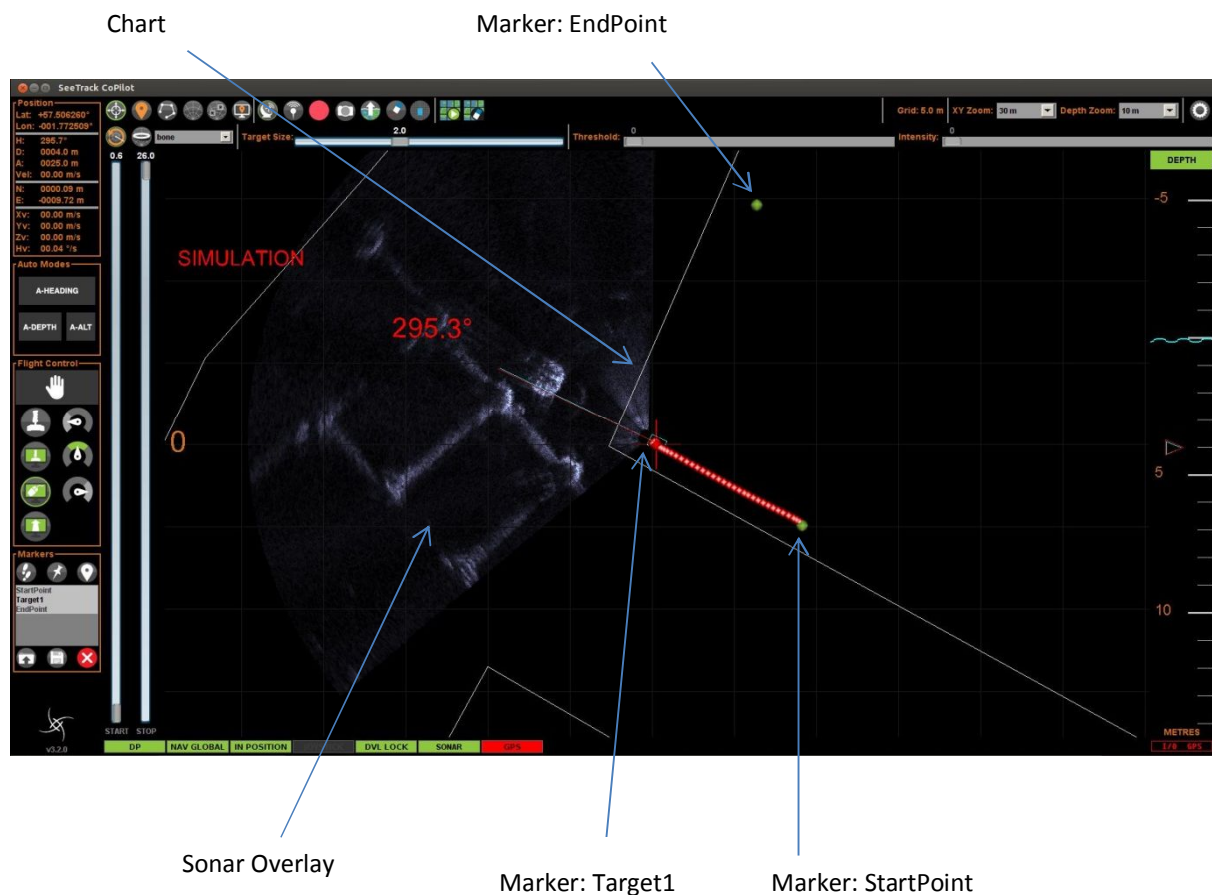
13 Appendix E - Fixed asset inspection with limited manoeuvrability



Note: Do not use the Survey Plan Navigation tool; this tool should only be used for wide areas to survey (running lines of 100 m +) e.g. in open water NOT in a harbour environment.

It is recommended to use a combination of Point and Click Navigation Tool mode clicks and Markers (if GPS/USBL is present) to easily return to a known position. This will allow a more rapid survey of the area.

- Vehicle is in the water at the surface.
- The sonar overlay is displayed in the Pilot Interface.
- A chart of the area is loaded.
- Add markers as a reference to help with survey (hold the control (Ctrl) key and use left-button mouse click).
- Adjust the vehicle heading (mouse right-click) and depth (left-click in water column).
- Use mouse left-click on screen to request vehicle position.



14 Appendix F – Mark and Return to Target (using GPS)



Note: A GPS is required to be fitted to the vehicle to be able to return to a known position within GPS error. The GPS error can be affected by different factors such as quality of the receiver, quality of the antenna, quality of signal received and location and environment.

- Vehicle is in the water at the surface, GPS data is seeded to SeeTrack CoPilot; the Lat and Lon data is displayed and the GPS indicator is green.
- The sonar overlay is displayed in the Pilot Interface.
- A chart of the area is loaded.
- Mark the vehicle current position using the mark current position button .
- A marker name appears in the list.
- Rename it as StartPoint by selecting it and use mouse right-click -> Edit. Enter the new name: Start Point.
- Now submerge the vehicle and navigate to look for a target. (the GPS indicator will turn grey)
- Once the target is seen on the sonar, mark it using keyboard, hold the control (Ctrl) key and use left-button mouse click
- Rename it as Target1 by selecting it and use mouse right-click -> Edit. Enter the new name: Start Point
- Continue navigating if required and surface the vehicle to take a fix.
- Wait for the GPS indicator to turn green and wait another minute to ensure a smoother position update.
- Dive the vehicle. **Note: To achieve the maximum benefit of GPS perform the dive as close to the marker (Target1 in our example) as possible.**
- Once submerged (~1m) select the marker Target1, its position should update after the last GPS update.
- Click Fly to marker button  to return to target.
- Approaching the target position, it should now be visible in the sonar overlay. This will be within GPS error.

15 Appendix G – Mission and Marker format

It is possible to create (offline) mission and marker files that can be loaded in to SeeTrack CoPilot. All the files created should be CSV. There should contain no comments.

15.1 Mission Format



Note: A mission can be programmed using a combination of depth and altitude points.

Fields	Type
Fixed ID	string: - LatLong (for Latitude and Longitude) - Offset (for North and East)
Latitude Value in decimal degrees	double
Longitude Value in decimal degrees	double
Fixed Mode	string: - Depth - Altitude
Depth/Altitude Value	double
Wait Time in seconds	integer

- Latitude and Longitude:

LatLong, LatitudeValue, LongitudeValue, Depth, DepthValue, HeadingValue, WaitTime

LatLong,57.50634227046352,-1.7723935921122125,Depth,4.0077577,96.15469,0

LatLong, LatitudeValue, LongitudeValue, Altitude, AltitudeValue, HeadingValue, WaitTime

LatLong,57.50620974096068,-1.772268851582793,Altitude,4.0094733,196.50954,0

- North and East:

Offset, NorthValue, EastValue, Depth, DepthValue, HeadingValue, WaitTime

Offset,9.273742,-2.8528824,Depth,4.0077577,96.15469,0

Offset,NorthValue,EastValue,Altitude,AltitudeValue,HeadingValue,WaitTime

Offset,3.1329427,7.17922, Altitude,4.008676,121.47142,0

15.2 Marker Format

Fields	Type	LatitudeLongitude example	NorthEast example
Marker ID	integer	1	1
Latitude Value	double	2.45354	100 (Invalid)
Longitude Value	double	-4.5565	190 (Invalid)
Repeat Latitude Value	double	2.45354	100 (Invalid)
Repeat Longitude Value	double	-4.5565	190 (Invalid)
North Value	double	0 (dummy)	5
East Value	double	0 (dummy)	10
Depth Value	double	3	4
Altitude Value	double	27	26
Timestamp (can be the same for all markers as long as it is in the correct format)	ISO8601	2015-06-09T170226432	2015-06-09T170226432
Marker Name	string	LatLonMarker	NorthEastMarker
Marker Comment	string	TestMarker	TestMarker

- Latitude and Longitude:

MarkerID,LatitudeValue,LongitudeValue,RepeatLatitudeValue,RepeatLongitudeValue,NorthValue,EastValue,DepthValue,AltitudeValue,TimeStamp,MarkerName,Comments

Examples:

1,57.506215,-1.772361,57.506259,-1.772346,-4.9002,-0.8992,4,29,2015-06-09T170226432,StartPoint
,Created on: 17:02:26.432-09/06/15

2,57.506259,-1.772509,57.506259,-1.772346,0,-9.771,4,29,2015-06-09T170227974,Target1,Created on:
17:02:27.974-09/06/15

3,57.50639,-1.772407,57.506259,-1.772346,14.5893,-3.6566,4,29,2015-06-09T170230024,EndPoint
,Created on: 17:02:30.024-09/06/15

- North and East

MarkerID,100,190,100,190,NorthValue,EastValue,DepthValue,AltitudeValue,TimeStamp,MarkerName,Comments

Examples:

1,100,190,100,190,5.7,-12.8,0,29,2015-06-10T095459787,StartPoint,Created on: 09:54:59.787-10/06/15

2,100,190,100,190,-5.5,-11.8,5,29,2015-06-10T095500536,Target1,Created on: 09:55:00.536-10/06/15

3,100,190,100,190,-8.6,-4.9,0,29,2015-06-10T095501036,EndPoint,Created on: 09:55:01.036-10/06/15