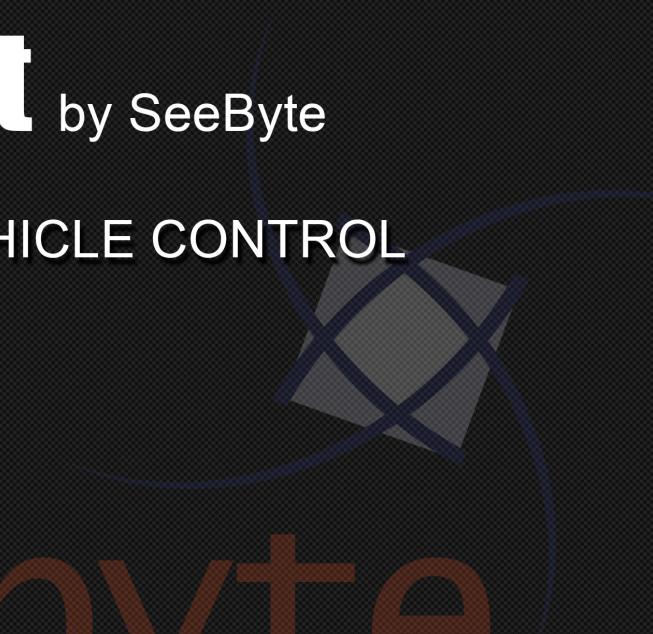




# RI CoPilot

by SeeByte

AUTONOMOUS VEHICLE CONTROL



# seebyte

Awareness Made Easy

## Reacquire and Identify (RI) CoPilot Operator Manual

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## About this Documentation

This manual provides the following:

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

## Target Audience

This manual is designed and developed for operators of the VideoRay Pro 4 MicroROV with a sonar and a DVL who are required to operate the VideoRay remotely operated vehicle (ROV) systems using VideoRay RI CoPilot.

## Document Conventions

Several symbols are used throughout this documentation to add emphasis and to assist in relocating important information. The following table describes these symbols and their uses.

SYMBOL	DESCRIPTION
	The Danger icon is used to indicate there is a potential risk of personal injury or death. Extra care should be taken to understand the risks, and all personnel should exercise caution. It may also be appropriate to warn others in the immediate vicinity.
	The Caution icon is used to indicate there is a potential risk of damage to the equipment or surrounding property. Personnel should receive training in the appropriate procedures before attempting to operate or maintain the equipment.
	The Note icon is used to emphasize a specific detail or point of information.
	The Tip icon is used to highlight a suggestion.

## Quality Commitment

VideoRay strives to design, manufacture, deliver and support the highest quality products and services, including this documentation. We have made every effort to ensure that this documentation is accurate and provides you with the most up-to-date information. However, there is no substitute for experience and/or training, especially with respect to the real purpose for which you plan to use this equipment. We encourage you to explore options beyond the scope of these materials to expand your knowledge and skills necessary to support your application. In addition to this documentation, VideoRay offers training and technical support and hosts a general user discussion forum and user image gallery.

We also realize that collectively, users of our products spend considerably more time operating our systems than we do ourselves. Users also encounter more diverse operating environments across an extremely broad range of applications. We highly value this vast experience base, and if you have any questions or suggestions, please feel free to contact us by any of the following methods.

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The information contained herein is deemed accurate at the time of printing and is subject to change without notice.

## Online Manual

The full version of this manual is available in HTML or PDF formats for viewing or download from VideoRay's website at:

<http://www.videoray.com/support/manuals.html>.



## Product Overview



## 2 - General Overview

VideoRay RI CoPilot provides the latest generation of SMART software tools in a simple to use, pilot-friendly form. Training using VideoRay RI CoPilot is painless and the intuitive tools help novice users tackle even the most complex operations.

VideoRay RI CoPilot automates the VideoRay Pro 4 MicroROV control process. The ROV can efficiently maneuver through a mission, automatically reducing the consideration of the effects of currents. The ROV can also take better quality video pictures due to the improved stability when using VideoRay RI CoPilot.

Pilots normally control a VideoRay ROV using thruster inputs to follow a desired course and speed. Constant adjustments are required to correct the course and account for water current and tether drag. Using VideoRay RI CoPilot, operators are able to identify objects suitable for tracking and can then maintain a stable heading and range to the target as desired, without the concern of current and tether drag. Pilots using the Pro 4 ROV equipped with VideoRay RI 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 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 actual action of piloting;
- visualize current field of view as captured by the sonar;
- track and hold position relative to a selected target;
- alter the colormap of the interface to suit personal preference and current conditions;

### 2.1 Requirements

VideoRay RI CoPilot requires that the Pro 4 ROV is equipped with a Doppler Velocity Log (DVL) and a BlueView P900 Sonar.

### 2.2 Dynamic Positioning System

A dynamic positioning (DP) system allows the 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 maneuvers the joystick to the forwards position, the ROV will move forwards whilst automatically compensating for cross-currents and tether effects. VideoRay RI CoPilot enables object relative station-keeping and approach; the system will maintain a constant range to target whilst keeping the target at the center of the sonar field of view. The user can then perform object-relative advances / retreats (reduce or increase range to target); or change depth/altitude while keeping a constant distance from the target.

### 2.3 VideoRay RI CoPilot Core Features

The core features of VideoRay RI CoPilot are::

- **Pilot Interface:** The VideoRay RI 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.
- **Autohover 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).
- **Autofly 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 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.
- **Compatibility:** VideoRay RI CoPilot is compatible with the latest upgrade of the Teledyne RDI (RS-232) DVL and BlueView

P900 Sonar.

- **Survey Module:** This core module comprises the additional navigation tools of Pathpoint and Waypoint, which allow the user to plan specific missions for the ROV with ease and precision.
- **Sonar overlay for identification:** Visualize current field of view as captured by the sonar.

## 3 - Pilot Interface Overview

The VideoRay RI 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 to be easy to read and intuitive to use.

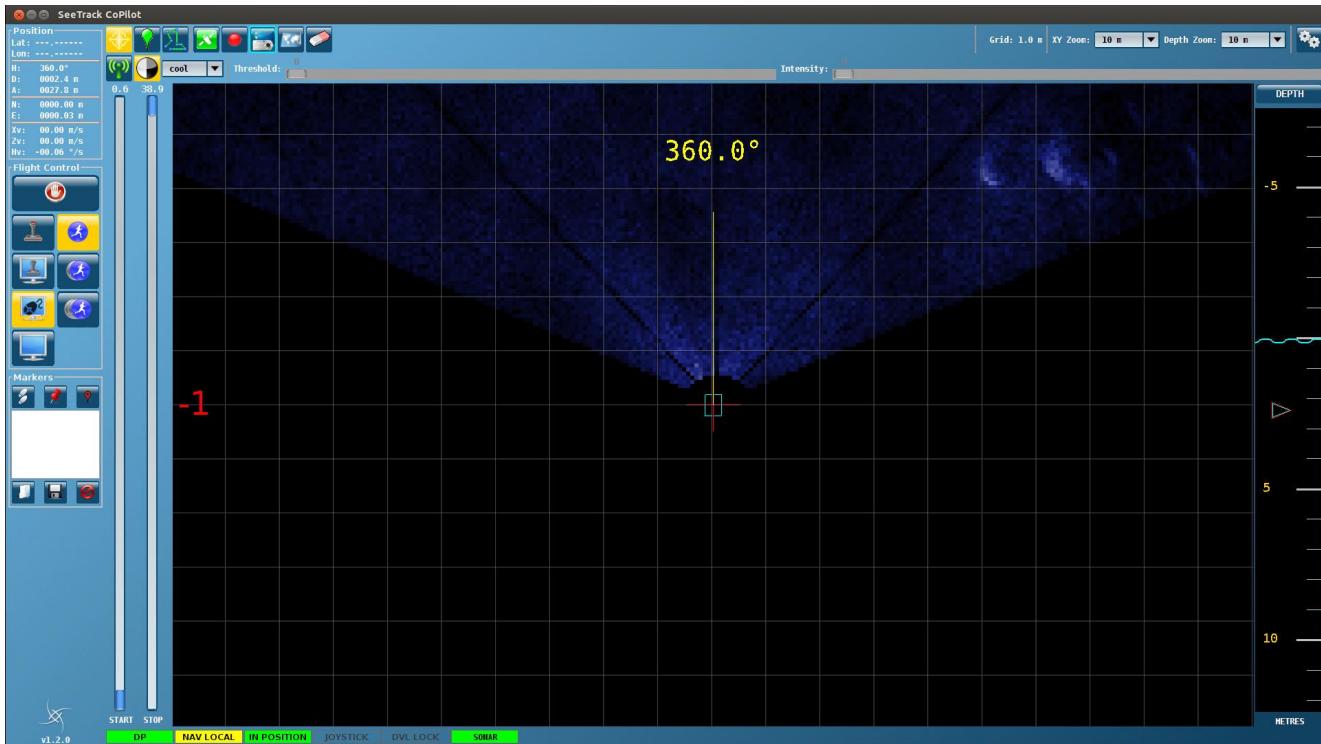


Figure 1 - VideoRay CoPilot User Interface

The VideoRay RI CoPilot pilot interface comprises 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. The Navigation Chart Display can also be used to show sonar tracking. This allows the user to monitor the sonar field of view in real-time, identifying and classifying possible targets.
- **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 functionality of the interface that is not immediately visible.

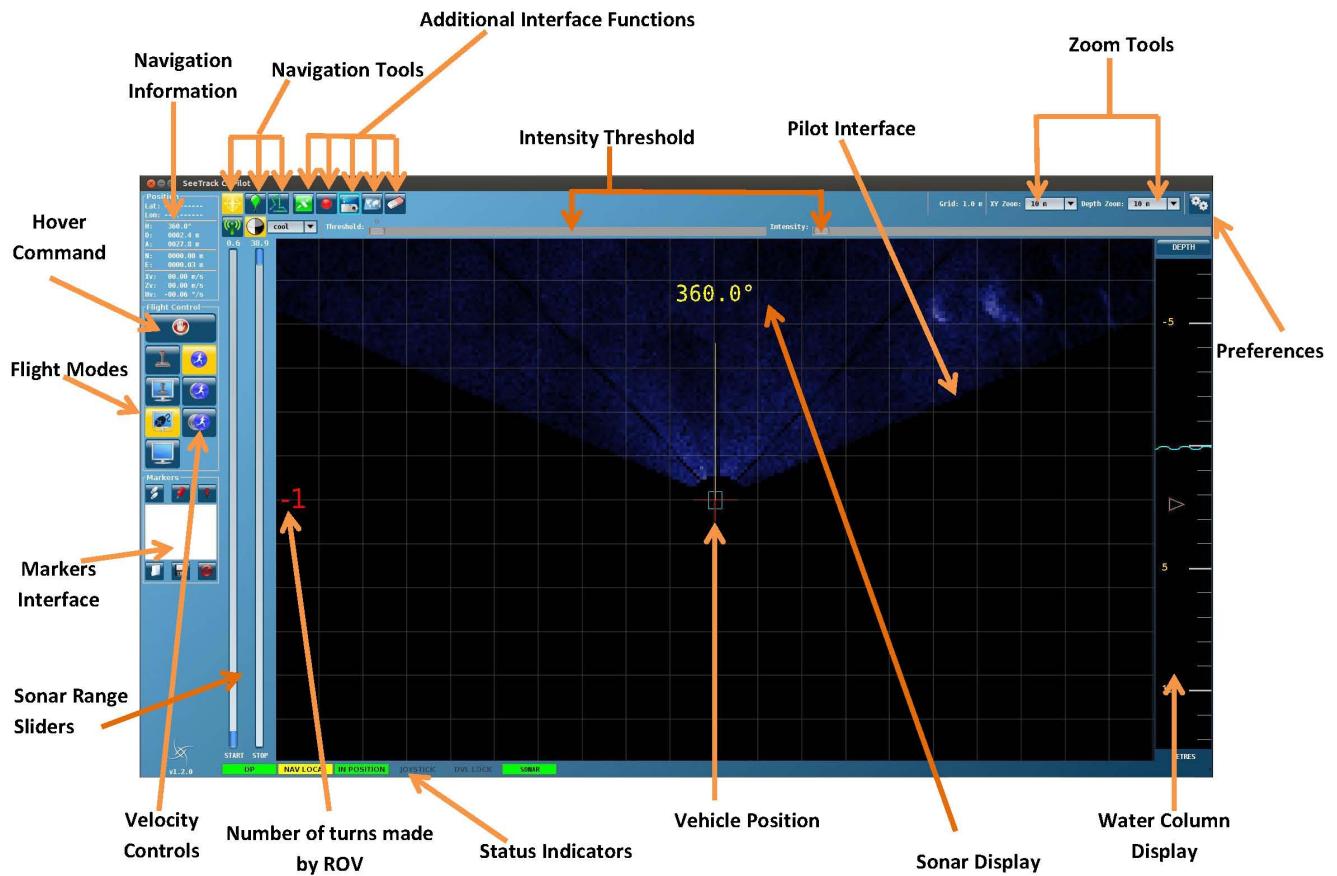


Figure 2 - VideoRay RI CoPilot Interface Explained



### 4 - Navigation Chart Display

The navigation chart display is centered on the ROV. It displays a plan view of the ROV and the surrounding area. The ROV position is estimated by VideoRay RI CoPilot's navigation system - the accuracy of which depends on the frequency and quality of the absolute navigation fixes.

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

When in **AUTOFLY** mode, the ROV is controlled in X (Surge), 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.

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

#### 4.1 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 center of view to the right or left edge of the viewable area. The scales are set to pre-defined values of 2m, up to 50,000m (or their equivalent values in feet).



### 5 - 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 center of the display at all times. If the seabed is within range of the DVL 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 center 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 an arrow the same color as the ROV and the target depth/altitude selected by the user is represented by an arrow the same color as the target waypoint in the navigation chart.

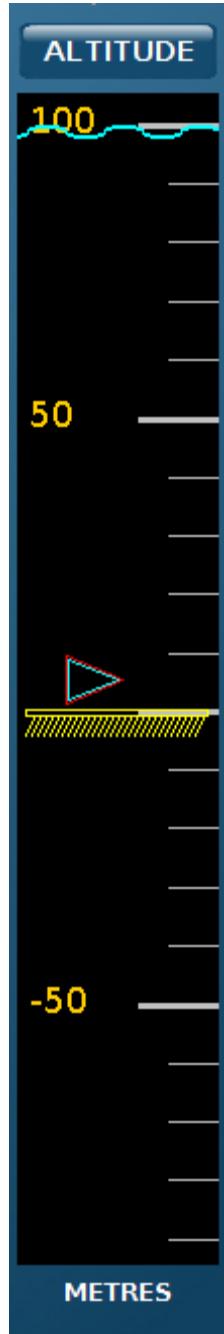


Figure 3 - Water Column Display

### 5.1 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 center 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 center 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).

## 6 - Pilot Display Information

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.

### 6.1 Navigation Information

This navigation information panel provides the user with the following ROV information: heading (**H**), depth (**D**) and altitude(**A**). 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.

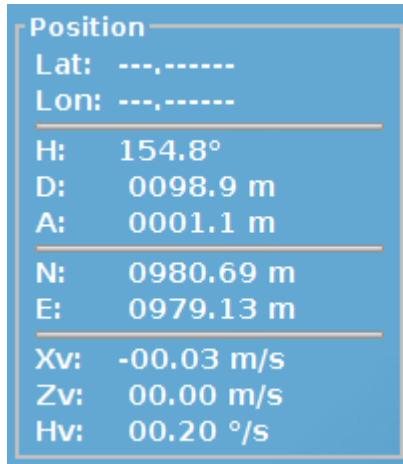


Figure 4 - Navigation Information

### 6.2 Status Indicators

The status indicators on the pilot information display allow the user to monitor the status of the ROV.

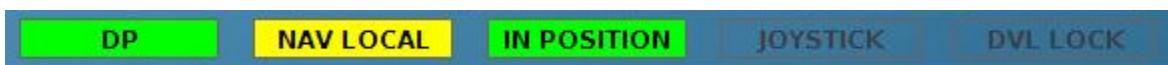


Figure 5 - Status Indicator

#### 6.2.1 The DP Status Indicator

This indicator displays the status of the DP system:

The indicator is green when the DP system is running.



Figure 6 - DP System Running

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



Figure 7 - DP System Standby

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 VideoRay RI CoPilot changes into MANUAL mode and the pilot has full control.

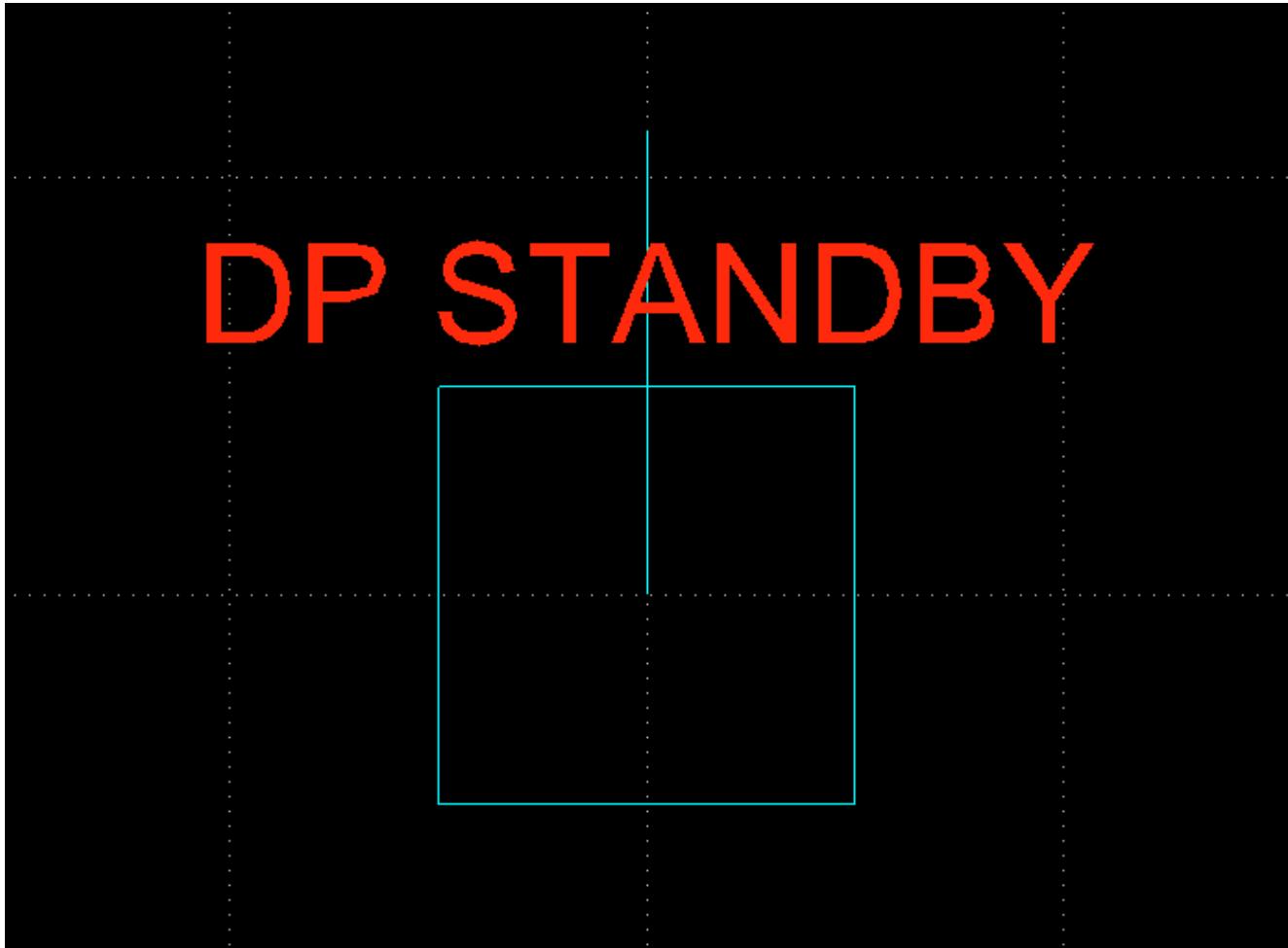


Figure 8 - DP Standby Display

#### 6.2.2 The Position Status Indicator

This indicator is illuminated 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 9 - Position Status Indicator

#### 6.2.3 The Joystick Indicator

This indicator is displayed 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

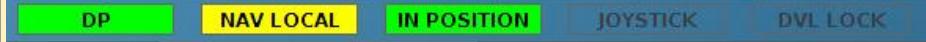
Figure 10 - Joystick Indicator

#### 6.2.4 The Navigation Status Indicator

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

INDICATOR APPEARANCE	STATUS
DP    NAV LOCAL    IN POSITION    JOYSTICK    DVL LOCK	The navigating system is operating correctly, and the global position is accurate.

Figure 11 - Navigation Indicator

 Figure 12 - Lat/Lon Indicator	The global position may have a degree of imprecision - but it is still compatible with effective ROV operation.
 Figure 13 - Position Indicator	The navigation system is not operating at an adequate level of accuracy and is no longer reliable. Only the MANUAL flight mode is accessible.
 Figure 14 - Nav Fault Indicator	The navigation system has failed. Only the MANUAL flight mode is accessible.

### 6.2.5 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 the DP system will lose precision after a short amount of time. The ROV can be flown in MANUAL mode under these circumstances.

When the DVL gets a fix on the seabed, the indicator is not shown and the system will return to normal operation.



Figure 15 - DVL Lock Indicator

### 6.2.6 The Emergency Stop

If the user is required to force an Emergency Stop, this can be achieved using the VideoRay Cockpit Interface and clicking on the Wireless Icon to disengage RI CoPilot.

## 6.3 Flight Modes

Selecting the flight mode buttons on the pilot information display changes the flight mode and the active button is highlighted with a blue outline.



Figure 16 - Flight Modes

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

### 6.3.1 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.

**⚠** The selected flight mode defaults to AUTOFLY whenever the "HOVER" button is pressed - except when the AUTOHOVER flight mode is in use.

### 6.3.2 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.

**⚠** 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.

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

### 6.3.3 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:

1. Select the "AUTOHOVER" button.
2. Fly the ROV with the joystick.
3. Release the joystick.
4. The ROV holds position automatically.
5. Fly the ROV around again via the joystick.

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

### 6.3.4 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 17 - Navigation Tools

#### 6.3.4.1 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 maneuver 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.

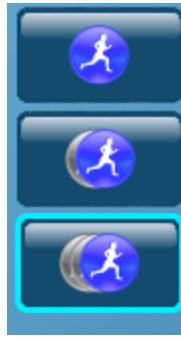


Figure 18 - AUTOFLY Speeds

- 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.



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

#### 6.3.4.2 Survey Plan Tool

The Survey Plan tool is used to prepare a mission for the ROV by either planning a survey or uploading a saved survey.

The user can specify the coordinates, depth/altitude 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 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:

Planning a Survey Using the Mouse

The user must indicate the position for each of the waypoints using the mouse.

- The position must be determined first, with a left-button mouse click; and
- The heading is determined automatically.

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

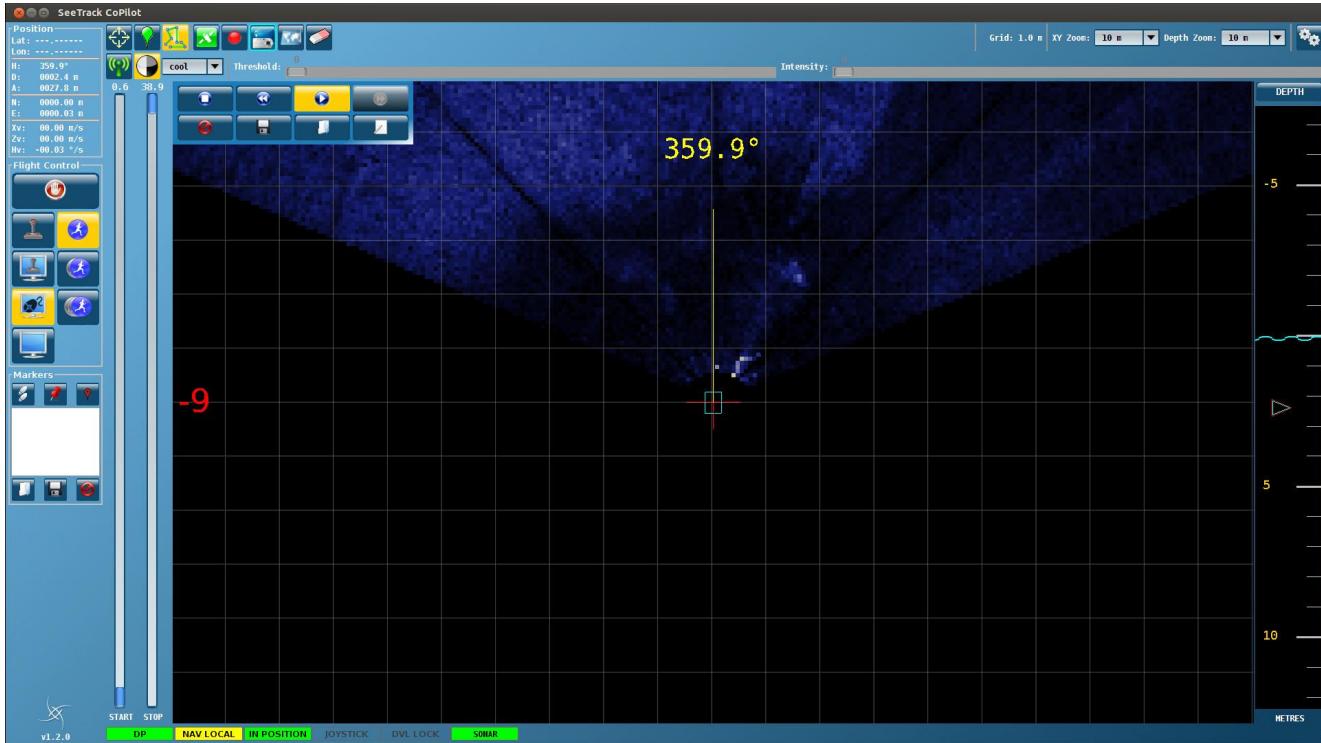


Figure 19 - Path

#### Planning a Survey Using the Editor

It is also possible to plan a survey by selecting the "Survey Plan" icon and entering the required data manually for the series of waypoints by selecting the "edit the current path" icon.

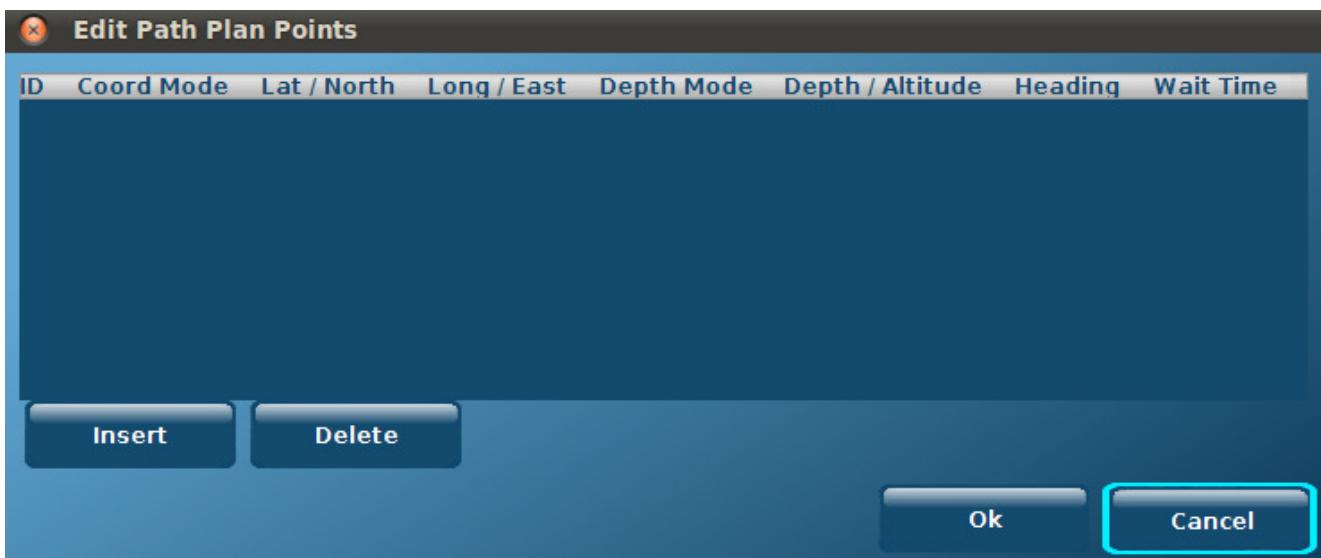


Figure 20 - Survey Planning

To begin planning a survey using the editor, the user must select the "Insert" button. This will produce a line of data detailing the ROV's current position, which the user can then amend to specify the first waypoint for the ROV's path.

Additional waypoints can then be added by repeating this process.

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

- latitude/longitude (in decimal degrees); or
- north/east.

 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 survey will be loaded and displayed on the navigation chart by selecting the "Ok" button.

#### Editing a Survey

Whether it was created using the mouse or editor, the user can edit the details of a path by selecting the "Edit the current path" icon at the top of their screen.

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.

Alternatively, by holding the control key and pressing Z the user can delete the last waypoint entered.

#### Running a Survey

To run the mapped survey, the user must select the ">" (play) button. The ROV will then visit each of the waypoints, 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 survey can be removed at any time by selecting the "Clear" button.

It is possible to begin the Survey Plan journey at the last numbered waypoint, and visit the numbered positions in descending order, by selecting the "<<" (backward) button instead of the ">" (play) button.

The "<<" (backward) and ">>" (forward) buttons can be used to skip waypoints.

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



Figure 21 - Running a Survey

#### Saving a Survey Plan

A survey can be saved at any point by selecting the "Save" icon. The survey file will automatically be saved to the data directory.

#### Loading a Survey

Saved Surveys can be loaded by selecting the "Load" icon and opening the appropriate file.

 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

#### 6.3.4.3 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. Any incorrect data fields will be highlighted in red and the tooltip will indicate what is wrong with the user entry when using the navigation tool.



Figure 22 - Waypoint

There are three methods of identifying the 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.



Latitude and longitude coordinates are always on WGS84 reference datum.

2.

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 four fields:

3. 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.
4. 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.
5. 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.
6. 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.

Global Position	Local Position	Relative Position	
Format			
Decimal Deg.	▼	Depth	▼
Format			
Latitude:	+ 00.000000°		
Longitude:	+ 000.000000°		
Depth:(m)	0.00m		
Heading:	000.0°		
Send			

Global Position	Local Position	Relative Position	
Format			
Depth			
Format			
North:(m)	0.00m		
East:(m)	0.00m		
Depth:(m)	0.00m		
Heading:	000.0°		
Send			



Figure 23 - Waypoint Navigation

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.

**⚠️** If the user attempts to send the ROV to an invalid coordinate, a dialog box will appear to advise that the waypoint request is impossible.

### 6.3.5 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.

**⚠️** 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. Select "CRUISE".
2. The ROV is now moving forwards at the chosen speed (SLOW, MEDIUM or FAST) and is keeping its depth/altitude and heading.
3. The depth/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. (While 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, while 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. (While 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, while 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.

## 6.4 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 cyan.

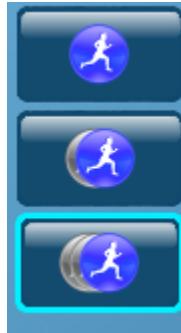


Figure 24 - Velocity Controls

This velocity setting is only available in AUTOFLY and CRUISE modes. Only X (Surge) is controlled by these settings.

## 6.5 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 VideoRay RI 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 25 - Alarm Panel

## 6.6 Sonar View 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.

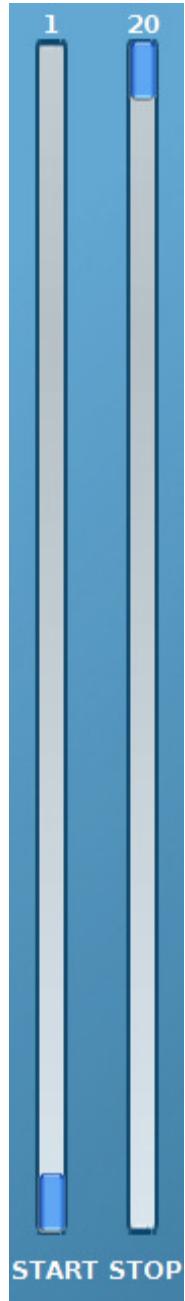


Figure 26 - Sonar Range Sliders

### 7 - Additional Interface Functions

There are further interface options available to users. These options can be found to the top center, above the pilot interface, and right, above the waterfall, of the interface toolbar. These additional functions include:

- **Chart Loading**



Figure 27 - Chart Loading

- **Taking a Screenshot**



Figure 28 - Screenshot

- **Log Recording**



Figure 29 - Log Recording

- **External Position Fix**



Figure 30 - External Position

- **Clearing Breadcrumb Trail**



Figure 31 - Clear Breadcrumbs

- **Preferences**



Figure 32 - Preferences

- **Reset Sonar Comms**



Figure 33 - Reset Sonar Comms

- **Auto-Intensity On/Off Figure**



Figure 34 - Auto-Intensity On/Off

- **Colormap**



Figure 35 - Colormap

- **Intensity/Threshold**



Figure 36 - Intensity/Threshold

## 7.1 Chart Loading

The Chart Loader icon 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 or an ENC chart and the chart must not exceed the boundaries of the relevant UTM zone.

 The Navigation Status indicator on the pilot information display must be green in order for the chart to be loaded. Please refer to section 6.2.4 - The Navigation Status Indicator for more information.

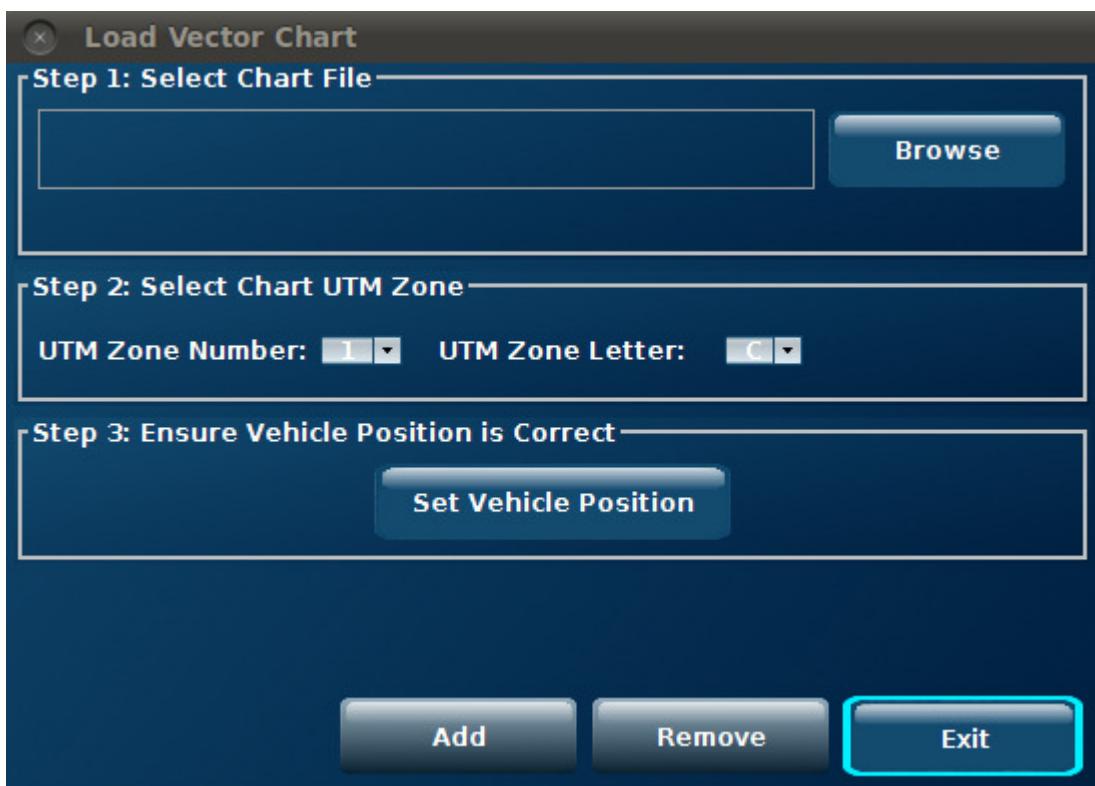


Figure 37 - Loading a Chart

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

The Load Vector Chart dialog box comprises three steps:

1. Selecting the "Browse" button opens up a dialog 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.
- 2.

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



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

3. The user must ensure that the vehicle position is correct before loading the vector chart. If the Navigation Status indicator is green, this step is optional. If the Navigation Status sensor is yellow or red, this step should be performed by selecting the "Set Vehicle Position" button.

Select the "Add" button to insert the chart on to the navigation chart display. Select the "Exit" button to close the dialog 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.

## 7.2 Taking a Screenshot

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

### 7.3 Log Recording

The Log Recording icon allows the user to record a sequence of system activity into a file, which is automatically saved to the data directory. Once selected, the icon will blink to indicate recording in process.



Pressing the log button on the VideoRay hand-controller will trigger the same effect.

The process can be stopped, and the log completed, at any time by re-selecting the Log Recorder icon.

## 7.4 External Position Fix

By selecting the Change Vehicle Position menu item, the user is presented with two options:

1. Take a new position from external fix

If the system has been configured to receive the calculated global position of the ROV from an external positioning system, the user has the option to force VideoRay RI CoPilot to update its location for the vehicle from this external source.

The pilot has the option to tell the navigation system to take a reading from this external source, if they consider it to be reliable at that time.

2. Manually enter updated global position

This option allows the user to manually enter the global position of the ROV and update the navigation chart display.

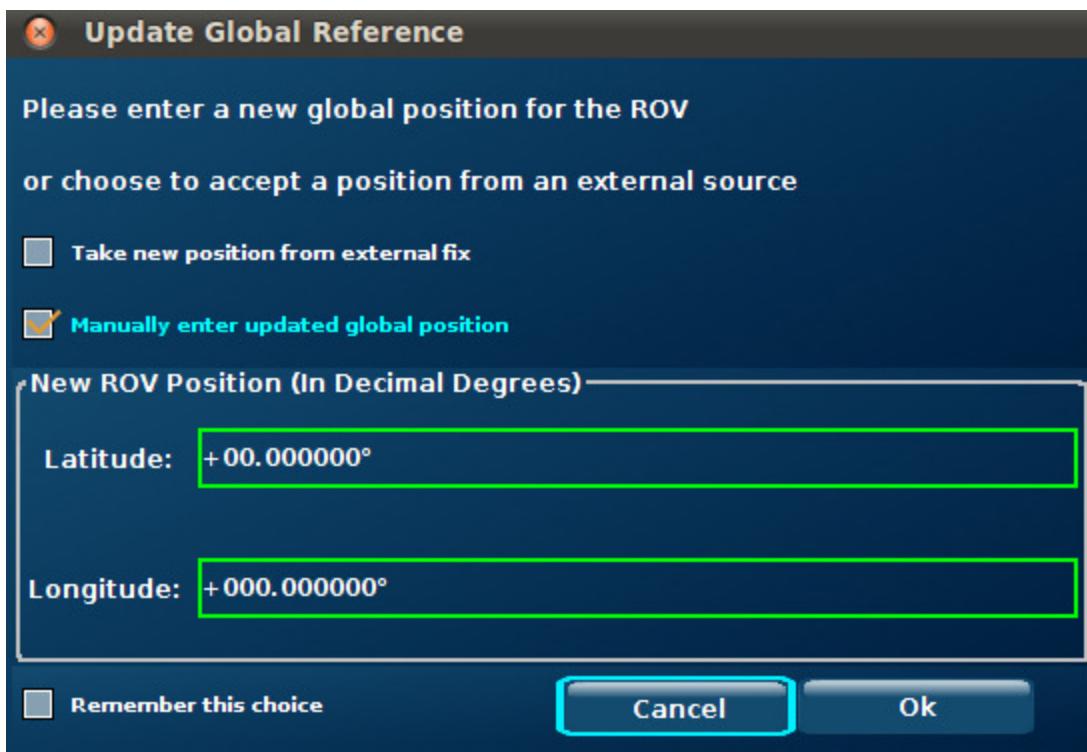


Figure 38 - External Position Fix

By checking the "remember this choice" box before exiting the dialog box, the system will store the details of the request and remember them the next time the user accesses the Change Vehicle Position menu item.

### 3. Manually reset Navigation Origin

This option will reset the navigation system. This is useful when planning mission or adding markers where no global position is available. The user can re-use the same marker and/or mission data anywhere in the world.

## 7.5 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 icon.

 To disable the breadcrumb trail, refer to section: 7.6.3 Features

## 7.6 Preferences

The preferences icon can be located on the top right of your screen, above the waterfall. The preferences icon will allow users to control:

1. Units
2. Joystick Calibration
3. Features
4. Vehicle

### 7.6.1 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.

 If the user changes the display measurements in cockpit, the effects will be evident throughout the system.

The global position can also be changed to decimal degrees, degrees and decimal minutes, or degrees, minutes and seconds.

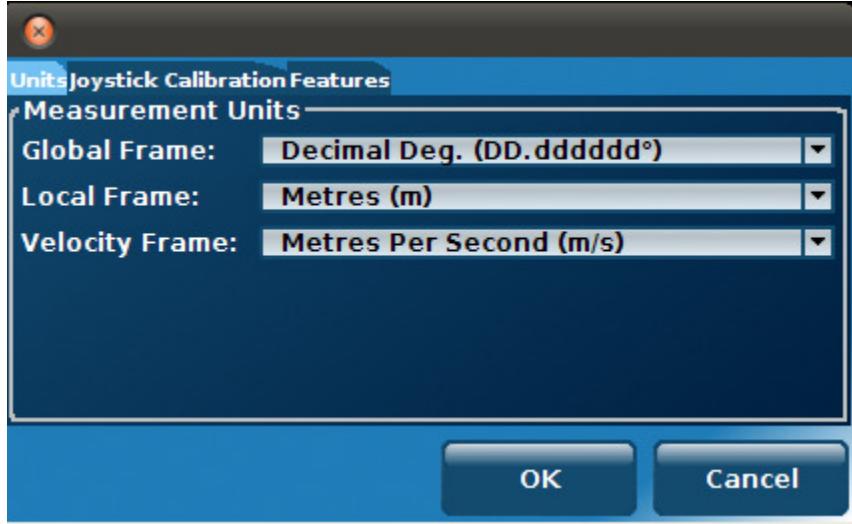


Figure 39 - Units

#### 7.6.2 Joystick Calibration

This menu item is used to calibrate the joystick that is currently connected to the VideoRay RI 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 item, the can configure the region in which the joystick will be classed as "deadstick."

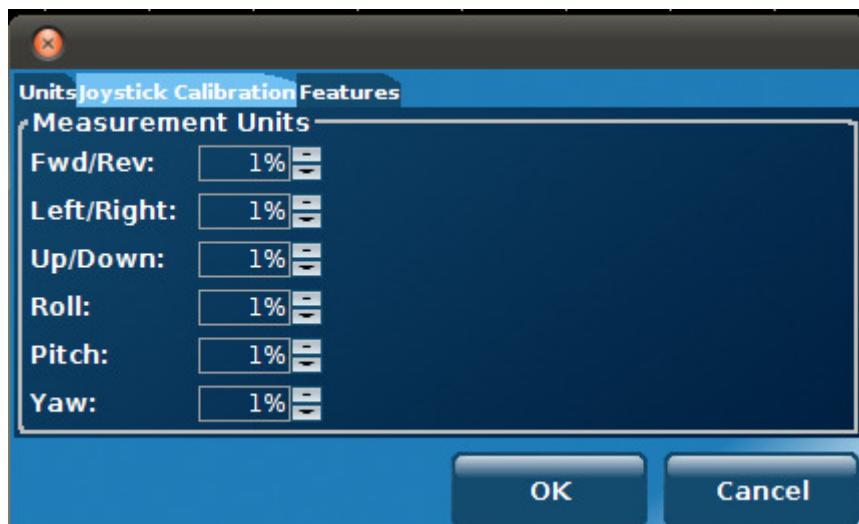


Figure 40 - Joystick

#### 7.6.3 Features

This menu item allows the user to enable or disable the following features:

- Range and Bearing Tool
- Breadcrumb Trail Enabled
- Tooltips Enabled
- Enable Station Keeping
- Enable Offline Planning

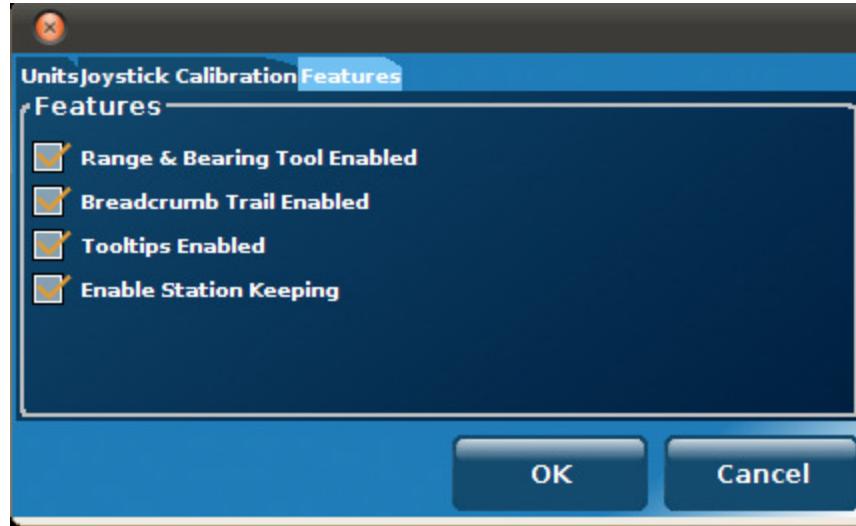


Figure 41 - Features

**Station Keeping:** In this mode the ROV will hover at the desired location.

**Offline Planning:** This mode allows the user to plan a survey mission (See section 6.2.3.4.2.) without the need of having the ROV deployed in water. The user is also able to add markers and make the vehicle move to the desired marker. See section Markers.

Each feature can be enabled or disabled by simply clicking on the tick box to the left of the description. A tick indicates the feature is enabled.

#### 7.6.4 Vehicle

This menu item allows the user to set the position of the DVL by altering the coordinates contained within the boxes on the left hand side of the Preferences toolbar. The user must enter the correct settings for the DP system to perform smoothly.

The sonar position and orientation can also be changed for display purpose.

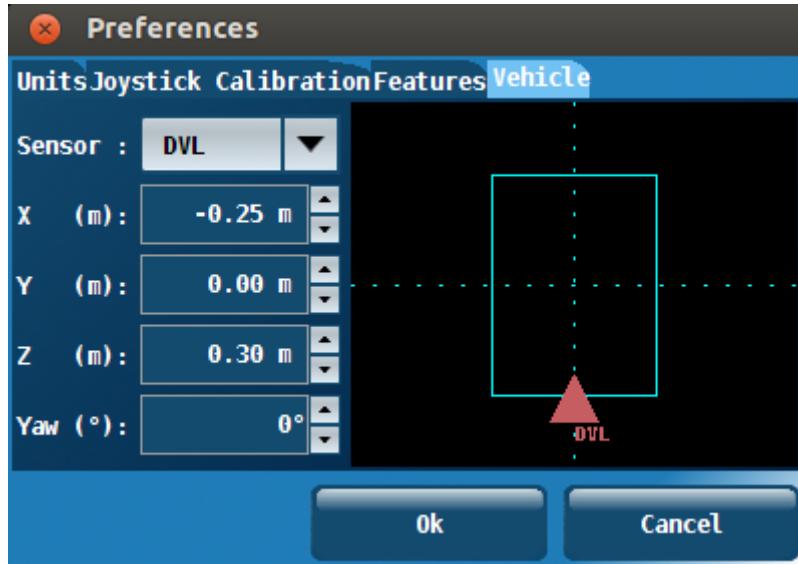


Figure 42 - Vehicle

#### 7.7 Reset 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 Reset Sonar Comms icon. This function should be utilized in instances when communication with the sonar has been interrupted, for example if the vehicle is restarted or there is a communications failure.

#### 7.8 Auto-Intensity On/Off

By default, VideoRay RI 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, VideoRay RI CoPilot shows the horizontal Threshold and Intensity sliders in the

toolbar.

## 7.9 Colormap

The colors used in displaying the sonar image are referred to as the colormap. The selected colormap for the image is displayed in a drop down box on the Pilot Interface toolbar. The following list describes the available colormaps and their characteristics. We recommend that you experiment with the different color maps to best understand their individual strengths and weaknesses.

COLORMAP	CHARACTERISTICS
Cool	Softer colors that work well in low light conditions.
Copper	Great image definition and contrast. Best general purpose colormap.
Green	Great image definition and contrast. Best general purpose colormap.
Bone	Best image definition, but low contrast makes it hard to use in bright sunlight conditions.
Hot	Good image definition and contrast. Good general purpose colormap.
Jet	High contrast with low image definition. Jet is ideal for quickly spotting targets in bright light conditions.

## 7.10 Intensity/Threshold

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.

## 8 - Markers

VideoRay RI CoPilot allows the user to drop 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 43 - Markers Interface

### 8.1 Placing a Marker at the Current Position

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.



Figure 44 - Place Marker Icon

### 8.2 Manually Placing a Marker

The user can manually place a marker by selecting the Manually Place Marker icon:



Figure 45 - Manually Place Marker

The user will then be instructed to enter the coordinates of their chosen location into the window. Once entered, the user should click "save" to place the marker. If incorrect coordinates have been entered, a warning message will alert the user of this, and correct coordinates should be entered before saving. The location of the placed marker will appear within the Markers interface.

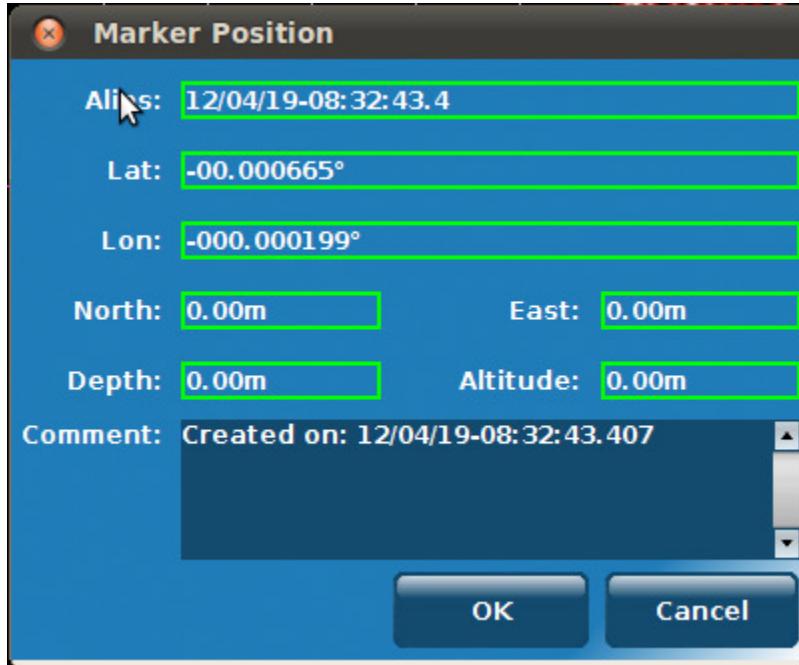


Figure 46 - Entering the Coordinates of a Marker

### 8.3 Fly to Marker

Once a marker has been placed, the user, at any time during their mission, can instruct the vehicle to fly to the Marker by clicking on the chosen marker(s) within the Markers Interface, and then selecting the Fly to Marker Icon.



Figure 47 - Fly to Marker

### 8.4 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.



Figure 48 - Save Marker Positions

### 8.5 Load a Marker File

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



Figure 49 - Loading a Marker File

By selecting the appropriate file from its location and selecting "open", the saved markers will be loaded onto the current Pilot Interface.

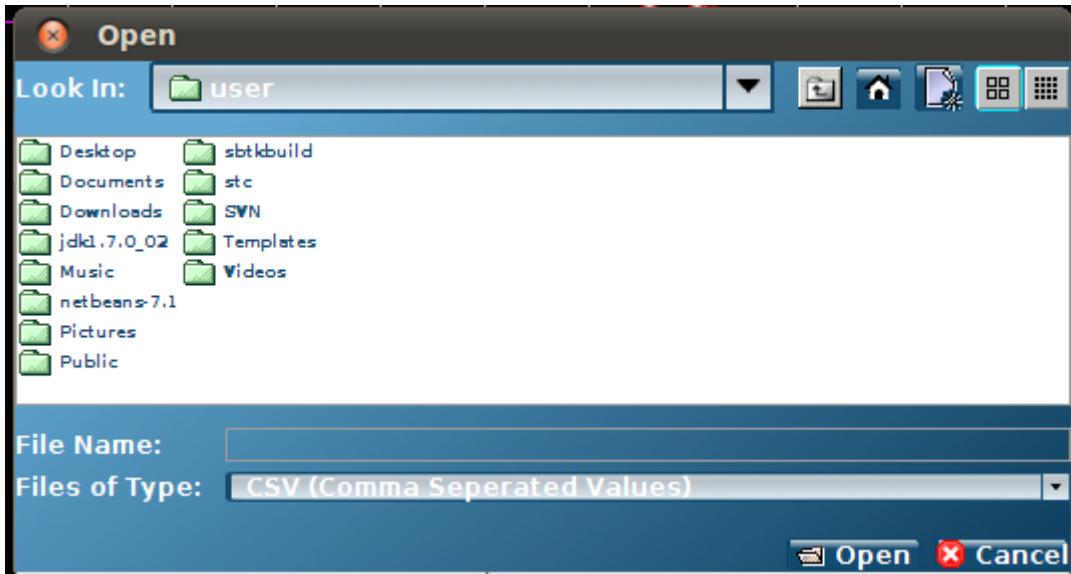


Figure 50 - Selecting a File

## 8.6 Editing Markers

To change the location of a specific marker, there are two possible actions that can be undertaken:

1. Using the Pilot Interface
  - o Select the Marker you wish to edit by right clicking on the Marker shown in the Pilot Interface
  - o Edit the details as shown in section 2.8 Manually Placing a Marker and save. The marker position will now be changed
2. Using the Markers Interface
  - o Right click on the marker to be deleted within the Markers Interface list of markers
  - o Select "Edit" from the options provided
  - o Edit the details as shown in section 2.8 Manually Placing a Marker and save. The marker position will now be changed

## 8.7 Deleting a Marker

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

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



Figure 51 - Deleting a Marker

2. Using the Markers Interface
  - o Right click on the marker you wish to delete from the Markers Interface list of Markers
  - o Select Delete from the available options

Your chosen marker will now be deleted.

### 8.7.1 Selecting Multiple Markers for Deletion

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

Deletion can continue as described previously.