VROV Instructor's Control Console (ICC) User Manual

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1 Introduction

Welcome!

This document is intended to provide a full reference for the operation of the Instructor's Control Console (ICC), a module of the Virtual Remotely Operated Vehicle (VROV) system manufactured by GRi Simulations Inc.

If you have questions about a topic that is not covered in this document, please visit our *web support* for assistance.

1.1 System Requirements

To run the VROV simulator, you will need:

System Element	Minimum Requirement
Operating System	Windows 10
Processor	i5 (i7 recommended)
RAM	4 GB (8GB recommended)
Graphics Card	NVIDIA RTX 2060

1.2 Quick Start Guide

Software installation:

1. Run the provided installer to install the VROV software.
   - This will install all software and drivers required to run the VROV simulator.

To quickly start a VROV scenario:

1. Double-click the ⋁ (**ICC** icon) on the Desktop.
2. In the ICC Command Dialog, select a vehicle and a scenario from their respective dropdown menus.
3. Click the ▶ (**Play** button) to start the scenario.

To quickly start a previously recorded log file:

1. Double-click the ⋁ (**ICC** icon) on the Desktop.
2. In the ICC Command Dialog, click the **Profile** button and select **Load** from the displayed options.
3. Choose the profile associated with the desired log file.
4. In the ICC Command Dialog, click the **Replay** dropdown menu and select the desired log file.
5. Click the ▶ (**Play** button) to start the log file.

1.3 Definitions

Below are definitions for some of the terms that will be encountered in this document:

GRi Simulations Inc. (GRi)

- Developer of the VROV simulator, an instructional platform for the training of ROV pilots with unparalleled dynamic realism.

ICC

- Instructor's Control Console.
- The control centre for the VROV simulator, which allows the instructor to monitor the trainee's progress while performing a mission in real-time, and initiate various commands that change the operational status of the VROV and peripheral equipment, as well as modify undersea environmental parameters.

Log File

- A saved file that contains time-stamped records of ICC activity during mission execution.

Profile

- A user account that provides a method of indexing logged missions (log files) and summary reports by the name and ID of the pilot.

Snapshot

- A saved file that contains all information of the current state of a simulation, and allows the user to resume operations from that exact point at a later time.

Summary Report

- A saved file that generates details of task success and efficiency to support performance evaluation and competency assurance programs.

VSonar

- Virtual Sonar.
- The VROV module dedicated to creating and displaying simulated sonar data to mimic typical acoustic instrumentation.

VROV™

- Virtual Remotely Operated Vehicle
- The VROV simulator was designed and developed by GRi as a training tool to be incorporated into existing and planned ROV pilot training programs. VROV applies Virtual Reality (VR) and computer modeling technologies to generate realistic, scenario-based ROV simulations. It also simulates all standard components of a real-life ROV system, such as acoustic imaging, obstacle avoidance, unit tracking,

underwater cameras and lights, manipulator arms, and environmental factors like currents, variable turbidity, and tether effects.

2 ICC Window

The ICC's main application window, shown below, may be minimized or resized as desired in the same way as a typical Windows program.

It is composed of three parts:

Title Bar

- o   A standard windows title bar, containing:
  - ▪   The title of the application (*VROV*).
  - ▪   An information menu (*?* icon) with links to product info and a help manual.
  - ▪   Generic window controls (*Minimize*, *Restore Down*/*Maximize,* and *Close*).
  - ▪   If a scenario/log file is loaded, the scenario name will also be displayed.

Viewport (left frame)

- o   A visual display of the currently running scenario or log file.
- o   Before a scenario/log file is started, the vehicle configuration for the selected scenario is displayed.
- o   Displays all available vantage points of a scenario, including the external Aerial view, Map/NAV views, and custom cameras and sonars.

Command Dialog (right frame)

- o Interface for initiating various VROV system level commands, including scenario/log file selection, startup, recording, and replay, as well as ocean environment controls.

2.1 Viewport

The *Viewport* presents a visual display of the currently running scenario or log file.

Most viewport selections such as ROV cameras and sonars are constrained to objects and are not adjustable, except by moving the objects to which they are attached. Exceptions to this include the *Aerial*, *Map* and *NAV* views, which may be adjusted using the mouse.

Viewport/Camera Settings Menu

- o The currently selected camera/sonar is displayed in the top-left corner of the Viewport.
    - ■ If these are not visible, hovering the mouse in the top-left corner of the Viewport will make them appear.
- o Clicking the current camera/sonar name with the left or right mouse button will display a dropdown with:
    - ■ All available cameras and sonars.
        - ● The right and left arrow keys on the keyboard may also be used to cycle through available cameras/sonars.
    - ■ Options to **Add** or **Remove** cameras/sonars to the cycle (when using arrow keys or multiple viewports).
        - ● Added cameras appear after the camera view in which the option was selected.
    - ■ Options to change the configuration of the **Viewports** when multiple viewports are activated using the *Screen Settings Menu* in the top-right corner of the Viewport or by pressing the *F5* key.
        - ● The configuration of multiple viewports (positions of each viewport) may be modified using the **Use Vertical Split** option. This defines the primary split as being either horizontal (default) or vertical when adding viewports.
        - ● When multiple viewports are visible, they may be resized using the mouse by dragging the viewport boundaries to the desired positions.
            - o Each viewport has a camera/sonar name in the top-left corner, which may be used to select the camera view for that viewport.
        - ● The user may **Save Settings** for multiple viewports so they load automatically on the next scenario startup.
            - o The saved configuration is loaded for any scenario that uses the same combination of vehicles.
            - o The user may **Restore Defaults** to revert the Viewport settings to the initial layout, ignoring any modifications.
    - ■ Options to change the **Lighting** in the Aerial View.
        - ● **Global** lighting is the default selection with the ambient Aerial View lighting activated.
        - ● **Viewer** lighting is similar to Global lighting, but without the *Global Lighting* or *Global Shadows* enabled.
        - ● **Scene** lighting uses no ambient lighting at all, and is lit using only the lights defined in the scenario.
    - ■ Options to **Save Aerial View** positions.
        - ● Clicking *Save Aerial View* will display a dialog to name the saved position and orientation.
        - ● Note that this does not create an additional *Aerial View* camera, but a defined position to which the Aerial camera may be moved.
        - ● The saved Aerial View position is then selectable in the **Select Aerial View** list

unless it is removed using the **Remove Aerial View** option.
- The added Aerial Views are available only until the scenario is ended.

Object Selection Menu

- o The currently (or most recently) selected object is displayed in the top-left corner of the Viewport next to the camera/sonar selection.
  - If it is not visible, hovering the mouse in the top-left corner of the Viewport will make it appear.
  - This menu is only available in the *Aerial View*.
- o Clicking the object name with the left or right mouse button will display a list of selectable objects in the scenario and the option to lock the camera in relation to the selected object.
  - **Lock** constrains the position of the camera to that of the selected object, regardless of orientation.
  - **Follow** constrains both the position and orientation of the camera to that of the selected object.
  - **Auto** constrains the position of the camera to that of the selected object and orientates the camera to the object orientation (similar to *Follow*) but has a list of preset camera angles (**Auto Camera View**) and definable smoothing options to *customize movement of the automatic camera*.
- o Below the camera constraint options, there are categories for all the objects in the scenario. Hovering the mouse over any of the categories will expand to show the objects included in the category.

Screen Settings Menu

- o Options to modify the Viewport(s) on the selected screen are displayed in the top-right corner of the Viewport, including:
  - **Add Viewport**
    - The leftmost button adds a viewport to the current screen up to a maximum of 4.
    - The button is displayed differently, depending on the current number of active viewports on the screen and vertical split screen option (⊟ , ⊓ , ⊞ , ⊞ , ⊞ , or ▢).
      - o The button graphic indicates the viewport configuration for the current screen after the button is clicked. For example, if there is currently one viewport visible, the button is displayed as or to indicate that clicking the button will split into two views.
      - o Each viewport has a camera/sonar name in the top-left corner, which may be used to select the camera view for that viewport.
    - When screens are added, this button is available at the top-right corner of each screen as well.
      - o Viewports may also be added using the *F5* key.
      - o To add viewports to the second screen using *F5*, that screen must first be activated by clicking on it with the mouse.
      - o When 4 viewports are displayed, clicking this button will set the screen back to 1 viewport.
    - When multiple viewports are visible, they may be resized using the mouse by dragging the viewport boundaries to the desired positions.
  - **Fullscreen**
    - The center button hides the currently displayed menus and toolbars, expanding the

viewport(s) on the first screen to cover the entire area of the screen
- o This button is only available on the first screen, as each additional screen is always in fullscreen mode.
- The button is displayed as [ ] when not in fullscreen mode (default) and as [ ] when in fullscreen mode.
- Fullscreen mode may also be activated/deactivated using the *Enter* key.
  - ▪ **Add Screen**
    - Adds a viewport on the next available screen/display.
      - o When additional screens are activated on all available displays, clicking this button will deactivate the additional displays.
      - o This button is only available when multiple displays are connected.
      - o Additional screens may also be added/removed using the *F9* key.
    - The button is displayed as [+] .

2.1.1 Aerial View

The *Aerial View* is the default camera displayed in the *Viewport*.
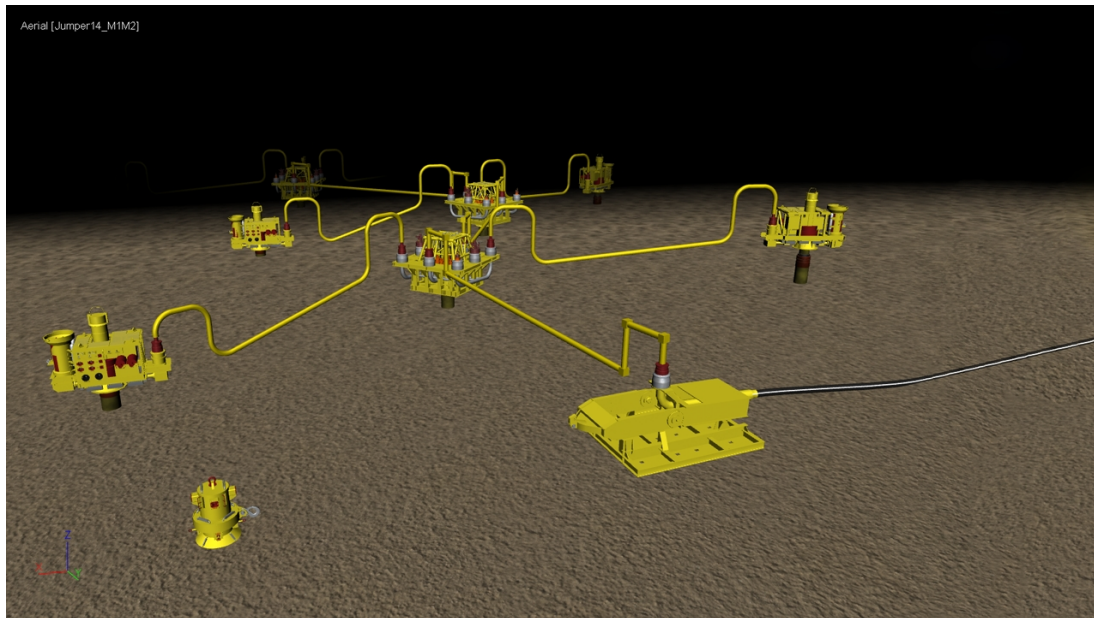
It is an adjustable camera that may be freely movable, or centered on an object. Double-clicking on any object in the scene (excluding the terrain and ocean surface, as well as any tether, umbilical, or cable) makes that object the center of focus/rotation.

The position and orientation of the *Aerial View* can be modified using the mouse:
- o Holding down the left mouse button while moving the mouse will change the orientation of the camera.
- o Holding down the right mouse button while moving the mouse will zoom in or out in the current view.
  - ▪ Using the mouse scroll wheel will also zoom in and out.
- o Holding down the middle mouse button (scroll wheel) while moving the mouse will change the position of (or pan) the camera.
  - ▪ If the user pans the camera, it becomes freely movable, and is no longer locked to any object.

2.1.2 Map / NAV Views

The *Map View* and *NAV View* are orthographic top-down camera views of the running scenario/log file.

These views are freely movable using the mouse. The position of the *Map View* or *NAV View* can be modified using the mouse:
- o Holding down the left mouse button while moving the mouse will change the position of (or pan) the camera.
- o Using the mouse scroll wheel will zoom in or out in the current view.

Clicking the right mouse button will display an option to switch to the *Aerial View*, which will be located at the position in the scene where the mouse is clicked.

The *Map* view is not included by default in the camera cycle (using arrow keys or multiple viewports), but may be added by clicking the name of the current camera in the top-left corner of the viewport and choosing *Add > Map* from the menu. It will appear after the camera view in which the option was selected.

Map view

- o Has ambient lighting, and is not affected by scene (ROV) lights.
- o Displays all objects, terrain, tethers, umbilicals, cable, etc.
  - ▪ Does not display ocean surface.
- o Double-clicking on any object in the scene (excluding the terrain, as well as any tether, umbilical, or cable) temporarily makes that object the center of focus.
  - ▪ The center of the screen stays in the selected object's position (does not follow the object if moved).
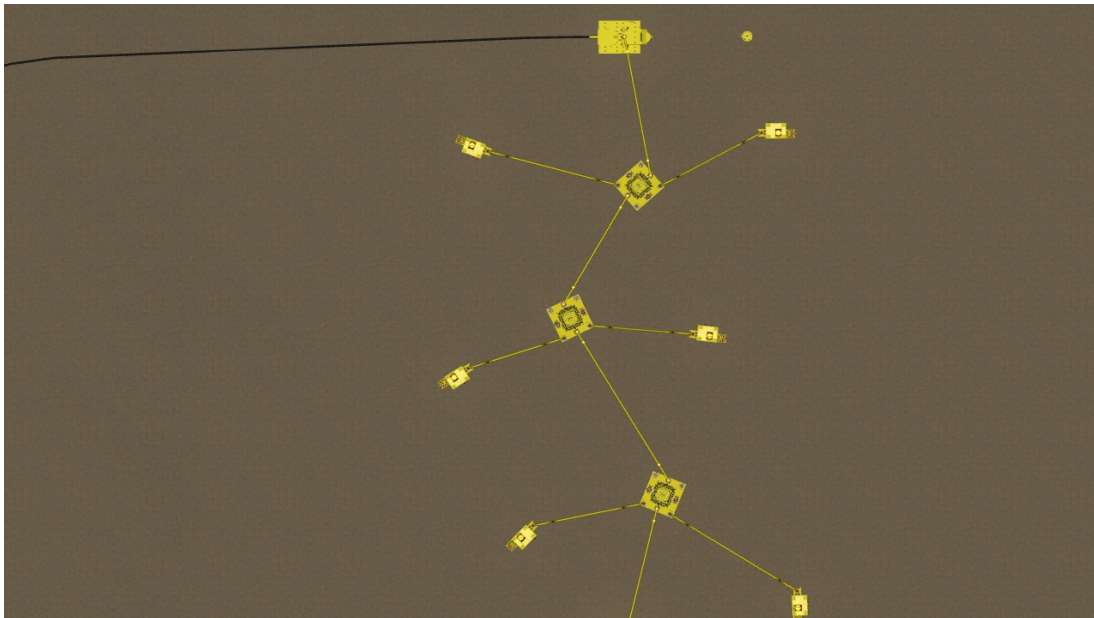
NAV view

- o Displays all objects' associated DWFs as opposed to the simulated objects/models.
  - ▪ Does not display ocean surface or terrain.
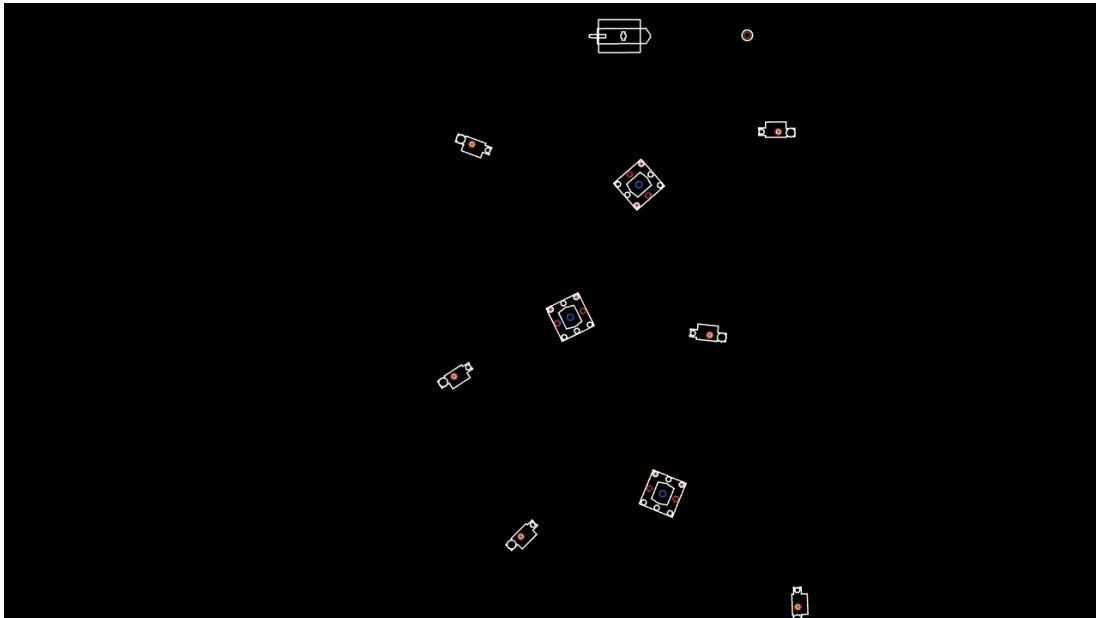
2.1.3 Objective Overlay

The **Objective Overlay** is a tool that helps guide and evaluate independent learning. It is a central application of the VROV system that describes mission instructions and completion status as the user progresses through a mission. This progressive instruction ensures that training points are completed in a specific order, allowing students to self-monitor training, without the need for constant supervision.

It is displayed during training in the top-right corner of the screen, with options to display the *Last Completed*, *Current*, and *Next* objectives or to display only the *Current* objective.

After all objectives have been completed, the **Objective Overlay** displays a *Mission Complete* message. The user may then *Save Summary Report* in the *ICC Command Dialog*, which displays:

- o Scenario information (Time, Date, Pilot ID, Environmental Conditions)
- o Objective List
- o Completion Verification with Time Stamps
- o Level of Difficulty
- o Pilot and Supervisor Verification

Summary Reports are saved in secure PDF format and cannot be altered by the student. They can be reviewed and compared against other pilots to compare strengths/weaknesses, and the best pilot for a particular mission.

2.2 Command Dialog

The **Command Dialog** contains the controls required for running scenarios/log files, along with a selection of options and tools.

2.2.1 Settings

The ⚙ (**Settings**) button allows the user to activate/deactivate specific visual features. These are primarily performance based settings (deactivated only when the hardware is incapable of keeping an acceptable visual frame rate).

Note that not all of the menu items below are in the menu at all times. They are only available if the feature has been activated.

Aerial Shadows

o   Activates/deactivates global shadows in the Aerial camera.

Light Scatter

o   Activates/deactivates backscatter lighting in all camera views.

Surface Reflections

o   Activates/deactivates surface reflections in all camera views.

Surface Foam

o   Activates/deactivates surface foam in all camera views.

Aerial Camera Settings

o   Opens the *Aerial Camera Settings* dialog.
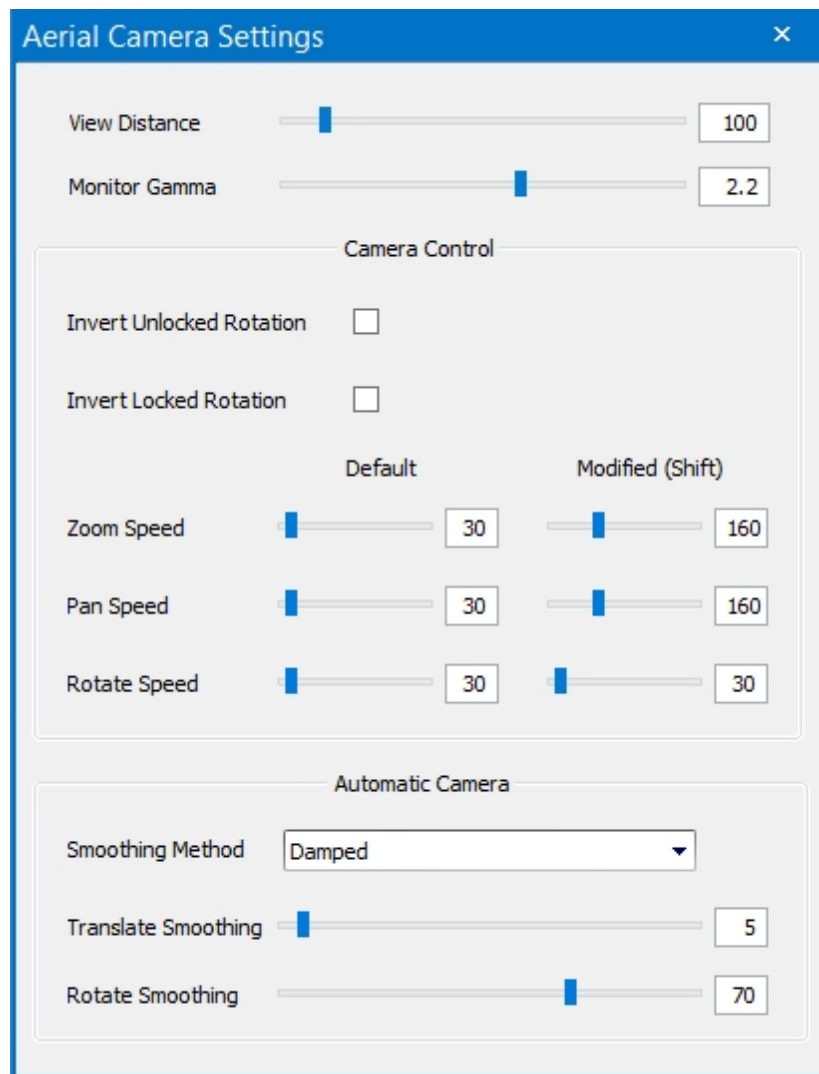
- *View Distance*
  - Sets the maximum visible distance (in meters) in the *Aerial* view.
- *Monitor Gamma*
  - Modifies the brightness of the *Aerial View* camera to accommodate different hardware specifications.
- *Camera Control*
  - *Invert Unlocked Rotation* reverses *Aerial* camera rotation with the mouse when not locked to any object.
  - *Invert Locked Rotation* reverses *Aerial* camera rotation around an object with the mouse when locked to the object.
  - *Zoom Speed* changes the speed of *Aerial* camera movement when zooming using the right mouse button or scroll wheel.
    - *Default* displays the selected *Zoom Speed* when no modifier key is used.
    - *Modified (Shift)* provides a second option for *Zoom Speed*, which is used when holding down the *Shift* key.
  - *Pan Speed* changes the speed of *Aerial* camera movement when panning using the *middle mouse* button.
    - *Default* displays the selected *Pan Speed* when no modifier key is used.
    - *Modified (Shift)* provides a second option for *Pan Speed*, which is used

when holding down the *Shift* key.

- *Rotate Speed* changes the speed of *Aerial* camera movement when rotating using the *left mouse* button.
  - ○ *Default* displays the selected *Rotate Speed* when no modifier key is used.
  - ○ *Modified (Shift)* provides a second option for *Rotate Speed*, which is used when holding down the *Shift* key.
- ■ *Automatic Camera*
  - The dropdown box provides options for different smoothing algorithms for the smoothness of the *Auto Camera* movements.
  - *Translate Smoothing* changes how closely the *Auto Camera* position matches that of the object it is following.
  - *Rotate Smoothing* changes how closely the *Auto Camera* rotation/orientation matches that of the object it is following.

2.2.2 Simulation Control

The **Simulation Control** section allows the user to choose from a list of predefined scenarios, or to replay a log file of a previously recorded scenario.

Play/Pause Button

- ○ Prior to loading a scenario/log file, the button is displayed as ▷ (Play).
  - ■ Starts the selected scenario/log file, or resumes the scenario/log file after it has been paused.
- ○ While a scenario/log file is loaded, the button is displayed as ❚❚ (Pause).
  - ■ Temporarily suspends dynamics of the current simulation, or pauses the replay of a log file.

Stop Button

- ○ The button is displayed as ▣ (Stop).
  - ■ Stops the current scenario/log file.
- ○ Requires a scenario/log file to be loaded. Otherwise, the button is inactive.

Record Start/Stop Button

- ○ The button has two modes - *Log file* (default) and *Video.* The mode is determined by an option in the Profile dropdown menu, which is saved when the ICC is closed.
- ○ Prior to beginning a recording, the button is displayed as 🔴 (Start Recording Log File) or 🟢 (Start Recording Video).
  - ■ Begins recording the scenario in progress.
  - ■ Before the recording commences, a file name will be requested. The default file name provided is the current date and time.
- ○ While a recording is in progress, the button is displayed as 🚫 (Stop Recording Log File) or 🚫 (Stop Recording Video).
  - ■ Stops the recording in progress.
- ○ Requires a scenario and profile to be loaded. Otherwise, the button is inactive.

Profile Button

- ○ When a profile is loaded, the default text (*Profile*) will be replaced with the ID of the loaded profile.

- o Using trainee profiles provides a method of indexing log files and summary reports by the name and ID of the pilot.
- o The use of logging functions and profiles is optional, and omitting them will have no impact on ICC operations.
- o Clicking the *Profiles* button will give a dropdown menu with the following options:
  - **Load**
    - Allows the user to select a previously created profile.
  - **Create**
    - Allows the user to create a new profile.
  - **Close**
    - Closes the currently active profile.
  - **Delete Profiles**
    - Allows the user to delete previously created profiles.
      - o All log files and summary reports associated with this profile will also be deleted.
  - **Delete Log Files**
    - Allows the user to delete previously created log files.
    - If no profile is currently loaded, the user will be prompted to select one of the previously created profiles.
  - **Save Summary Report**
    - Saves a Summary Report at the current state of the scenario.
    - This option is not available unless a scenario/log file is in progress and a profile is loaded.
  - **Record To Video File**
    - Determines whether the *Record* button produces a log file or a video.
      - o When there is a check (✓) next to this option, a video file is produced.
      - o When there is no check (✓) next to this option, a log file is produced.
    - When the ICC is closed, the current setting for this option is saved, so it will remain the same for the next time the ICC is opened.
    - This option is always not displayed while viewing a log file, since it is always on (records to a video file).
  - **Record Interface**
    - Determines whether the user interface (*Command Dialog*) is included in the video recording.
      - o When there is a check (✓) next to this option, the *Command Dialog* is included in the recording.
      - o When there is no check (✓) next to this option, the *Command Dialog* is not included in the recording.
    - This option is only visible when the *Record* button is set to produce a video file.
  - **Open User Folder**
    - Opens the folder where videos and Summary Reports are saved for the currently loaded profile.
    - This option is not available unless a profile is loaded.
    - The User Folder is created upon saving the first video or Summary Report. If neither has been previously created, this button will not open a folder, since the directory has not yet been created.
- o Loading a profile (pre-existing, or by creating a new one) will cause a new line to appear in the *Scenario Selection* section, which allows selection of all available log files for the loaded profile.

2.2.3 Scenario Selection

To select the desired scenario/log file, the user is presented with a hierarchy of dropdown lists, presenting all available scenario options.

Once the scenario loads, these options are no longer available to add or edit.

Replay

- o A dropdown list, displaying all log files available for the currently loaded profiles.
  - ▪ The currently selected *Vehicle*, *Scenario*, or *Snapshot* has no effect on which log files are displayed in the list. The selected log file will use the vehicle and scenario selected during recording.
- o Requires a profile to be loaded, as well as an existing recorded log file. Otherwise, this line is not visible.

Vehicle

- o A dropdown list, displaying all available vehicles.

Scenario

- o A dropdown list, displaying all scenarios available for the currently selected *Vehicle*.

Snapshot

- o A dropdown list, displaying all snapshots available for the currently selected *Scenario*.

Fault

- o A dropdown list, displaying all created *Faults* available for the currently selected *Scenario*, along with a button to edit faults.
- o For more detailed information on fault creation and editing, please see the *Faults* section.

Description

- o A text box, displaying the description of the selected *Scenario*.

2.2.3.1 Ballast

Adding **Ballast** to objects (typically ROVs) applies buoyancy force (upward or downward) at specified positions on the object.

The UI for ballast creation and editing consists of a pair of dropdown lists and a button:
- o The first dropdown list displays all objects that may have ballast applied. These are typically ROVs.
- o The second dropdown list displays previously created ballast configurations.
  - ▪ The selected configuration will be applied only to the selected object in the first dropdown list. For each vehicle that requires ballast, a ballast file must be applied individually.
- o The ⬚ Edit ⬚ (Edit Ballast) button (located next to the second dropdown list) provides options to *Modify*, *Create*, and *Delete* the selected ballast configuration file.
  - ▪ Note that if no ballast file is selected (dropdown list displays *None*), the only option

available is *Create*.

- When *Modify* is selected (or a new ballast file is created), the *Ballast Edit* dialog appears, which includes:
  - **Block dropdown**
    - displays a list of previously defined ballast blocks.
    - also includes buttons to add a new block or delete the selected block.
  - **Block Edit**
    - displays the editable position of the currently selected ballast block in relation to the vehicle.
      - Note that the position of the block is indicated by a white cube in the Viewport on the vehicle load screen.
    - also displays an entry box for the amount of ballast to apply.
      - positive ballast amounts indicate weight added (downward force), whereas negative ballast amounts indicate buoyancy added (upward force).

2.2.3.2 Current

Adding *Current* to a scenario applies current at a specified speed and direction.

The current may be applied using one or multiple depths using a current profile. Current profiles are a set of defined depths with current speed and directions defined for each depth. Current speed and direction gradually changes between the defined depths.

The UI for current profile creation and editing consists of a dropdown list and a button:
- The dropdown list displays previously created current profiles.
- Next to the dropdown list is the [Edit] (Edit Current) button which, when clicked, provides options to *Modify* or *Delete* the selected current profile or *Create* a new current profile.
  - Note that if no current profile is selected (dropdown list displays *None*), the only option available is *Create*.
  - When *Modify* is selected (or a new current profile is created), the *Current Edit* dialog appears, which includes:
    - **Depth Edit**
      - displays a dropdown list of previously defined depths at which the current speed and direction are specified.
      - also includes buttons to add a new depths or delete the selected depth.
      - For any depth greater than those defined, the current speed and direction will be the same as that defined for the greatest depth in the dropdown.
    - **Current Speed and Direction Edit:**
      - displays two sliders to edit the current speed and direction at the selected depth.

2.2.3.3 Fault

Adding a *Fault* to a scenario allows the instructor to program mechanical errors/malfunctions in the simulated vehicle during training, testing the pilot's response to unforeseen errors in equipment function.

Prior to loading a scenario, the UI for fault creation and editing consists of a dropdown list and a button. While a scenario is in progress, the UI for real-time faults control consists of a dropdown list and two buttons:
- The dropdown list displays all created faults available for the currently selected *Vehicle*.
- The [Start] (Start Fault) button initiates the selected fault file.

- o The ⬛ Edit (Edit Fault) button provides options to *Modify*, *Create*, and *Delete* the selected fault file.
    - ▪ Note that if no fault file is selected (dropdown list displays *None*), the only option available is *Create*.
    - ▪ When *Modify* is selected (or a new fault file is created), the **Fault Edit** dialog appears, which includes buttons to:

        - ● **Add**
            - o Opens the *Add Fault Entry* dialog, which enables the creation of new faults.
            - o Note that several faults may be included in a single fault (*.FLT) file.
        - ● **Edit**
            - o Opens the *Add Fault Entry* dialog with the settings of the individual fault currently selected in the window, which enables editing of the fault.
        - ● **Delete**
            - o Deletes the individual fault currently selected in the window.
        - ● **Clear**
            - o Clears the currently loaded fault (*.FLT) file or fault configuration in progress without saving.
        - ● **OK**
            - o Saves the current configurations and closes the **Fault Edit** dialog.
        - ● **Cancel**
            - o Closes the **Fault Edit** dialog without saving any changes.

Add Fault Entry

The **Add Fault Entry** dialog opens when the *Add* or *Edit* button is selected in the *Fault Edit* dialog. This dialog enables the user to create new and modify existing individual faults, and includes the following items:

- o **Fault Category**
    - ▪ A dropdown list, displaying the predefined fault groups for the selected fault set.
        - ● The groups are defined in the *Fault.ini* for the selected fault set.
- o **Description**
    - ▪ A dropdown list, displaying the predefined individual faultable item entries in the selected *Fault Category*.
        - ● The faultable item entries are defined in the *Fault.ini* for the selected fault set.
- o **Time For Fault to Occur**
    - ▪ Input for the time at which the fault occurs.
    - ▪ This time corresponds to the dynamics run time of the simulation.
        - ● This is not the mission time according to scenario objectives, which typically begins when the ROV is unlatched from the TMS).
    - ▪ The fault will continue to occur until the scenario ends or until the same entry is faulted again with a *Fault Type* of *None* at a later time.
- o **Fault Type** and **Input Values**
    - ▪ Definitions how the fault occurs over time as described under *Fault Types*.
- o **OK**
    - ▪ Accepts the current fault configuration and returns to the *Fault Edit* dialog.
        - ● If a new fault was created, it is added to the list in the *Fault Edit* dialog.
        - ● If an existing fault was edited, no change will be noticeable in the *Fault Edit* dialog.
- o **Cancel**

■ Discards the current fault configuration and returns to the *Fault Edit* dialog.

Fault Types

Fault Types specify how the fault occurs over time. The type is selected using radio buttons in the *Fault Type* group box, which then determines the parameter fields in the *Input Values* section (the range of *Input Values* is defined in the *Fault.ini* for the selected fault set). Note that not all *Fault Types* are available for each fault category.

None

- Disables any previously existing fault on the same entry.
- The options is used to stop a previously initiated fault without removing the fault from the fault (*.FLT) file.
- There are no *Input Values* for this *Fault Type*.

Fixed

- A fault that forces the selected entry to remain at a specified value.
- *Input Values*
  - *Fix At*:
    - Defines the value at which the selected entry will remain once the fault initiates.

Intermittent

- A fault that occurs at a user-defined intermittent probability.
  - This is intended to replicate the symptoms of a loose wire.
- *Input Values*
  - *Value:*
    - Defines the input value used when the fault is active.
  - *% of Time:*
    - Defines the proportion of simulation time during which the fault condition occurs (after the fault initiates).

Noisy

- A fault that applies a noise to the subsystem, and then the input or output subject to the fault has its value randomly modified by adding or subtracting a noise value.
- *Input Values*
  - *Value:*
    - Defines the input value used when the fault is active.
    - This value should be a ratio of the applicable parameter (-1 to 1 or 0 to 1) within which it will vary from the actual value.
      - For some faults, it is possible to enter values outside these ranges, but it is recommended to keep within the suggested values.

Ramp

- A fault that specifies a constant change over time until a specified value is reached.
  - This is intended to replicate symptoms of fluid leaks and failures in mechanical or control

systems.

- o *Input Values*
  - ▪ *Ramp Value:*
    - ● Defines the value at which the selected entry will be set once the ramping process is complete.
  - ▪ *Rate per/sec:*
    - ● Defines the rate (per second) at which the entry changes from its current value to the specified *Ramp Value* after the fault initiates.

2.2.4 Replay Control

After a profile has been selected, the user can select a log file from the *Replay* dropdown menu, and then click ▶ (Play) to begin playback.

During log file replay, the ⏸ (Pause) and ⏹ (Stop) buttons may be used as described on the *Simulation Control* section.

Once a log file is loaded, the following additional functionality is loaded in the Command Dialog, providing information and controls specific to log file replay:
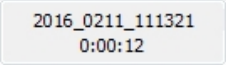
Fast Forward Button

- o The button is displayed as ⏩ (Fast Forward).
  - ▪ Plays the currently replaying log file forward at 2x speed.
- o Requires a log file to be loaded. Otherwise, the button is not visible.

Reverse Button

- o The button is displayed as ⏪ (Reverse).
  - ▪ Plays the currently replaying log file in reverse at 2x speed.
- o Requires a log file to be loaded. Otherwise, the button is not visible.

Log File Info Box

- o A display box that appears as 2016_0211_111321 / 0:00:12 .
- o Displays the name of the log file, as well as the current play time in the log file.

Replay Time Slider

- o A time slider representing the timeline of the log file.
- o It allows the user to skip to a desired position in the log file.

2.2.5 Ocean Environment

The **Ocean Environment** settings allow the user to choose specific environmental conditions (above or below the ocean surface) to mimic a real-world scenario, or to adjust the difficulty of the task(s) required.

These settings can be modified before a scenario is started or in real-time during the simulation.

Time of Day

- A slider, which changes the time of day, and consequentially, the lighting of the selected *Scenario*.

Fog

- A slider, which changes the fog cover of the selected *Scenario* as a percentage.

Rain

- A slider, which changes the amount of rain in the selected *Scenario* as a percentage.

Camera Visibility

- A percentage of visual clarity for virtual cameras (excluding the *Aerial* and *Map* views).
  - 0% presents an environment with the maximum amount of suspended particles.
  - 100% presents a virtually perfect view of the undersea environment through the cameras.

Sonar Noise

- Relative amount of acoustic noise that appears on the VSonar display.
  - 0% represents no sonar noise.
  - 100% represents a maximum amount of sonar noise.

Beaufort

- Sea state, as indicated by the Beaufort scale.
- The simulated environment accounts for Beaufort numbers up to 6.
  - 0 - Calm (wave height 0m).
  - 1 - Light Air (wave height 0m - 0.2m).
  - 2 - Light Breeze (wave height 0.2m - 0.5m).
  - 3 - Gentle Breeze (wave height 0.5m - 1m).
  - 4 - Moderate Breeze (wave height 1m - 2m).
  - 5 - Fresh Breeze (wave height 2m - 3m).
  - 6 - Strong Breeze (wave height 3m - 4m).
- This option is not visible if the simulated environment for the selected scenario has no Beaufort available (wave height of 0m).

Current Speed

- Speed, in knots, of the ocean current.
- The simulated environment accounts for current speeds up to 2 knots.
- This option is not visible if the simulated environment for the selected scenario has a specified constant current or if a *current profile* is selected.

Current Direction

- Direction, in degrees, of the ocean current.
  - 0° indicates North

- 90° indicates East
- 180° indicates South
- 270° indicates West
- This option is not visible if the simulated environment for the selected scenario has a specified constant current or if a *current profile* is selected.

2.2.6 Snapshots

Snapshots allow the user to get the maximum benefit of time on the VROV simulator if focused practice at a particular simulation point is needed. Some useful snapshots include the initial approach to an object, complicated manipulator operations, or a difficult position requiring careful manoeuvres.

The *Snapshots* button is only visible if a scenario/log file is loaded.

Clicking the *Snapshots* button will give a dropdown menu with the following options:
- **Save**
  - Allows the user to create a new snapshot.
  - Before the snapshot is created, a file name will be requested. The default file name provided is the current date and time.
  - After creating a snapshot, it will be available with its associated scenario when starting a simulation.
- **Delete**
  - Allows the user to delete previously created snapshots.
    - Since snapshots are associated with the scenario that was running when the snapshot was created, it is necessary to select the proper scenario in order to locate the snapshot to delete.

2.2.7 Measure

The *Measure* tool, when enabled, allows the user to select any two points in the scene (excluding the ocean surface, as well as any tether, umbilical, or cable) and instantly display distances in the ICC Viewport, including the exact measurement (in 3 dimension), horizontal distance (in the X,Y plane), and vertical distance (Z direction) as three separate values.
- Note that the terrain is only selectable for measurement by holding the *Ctrl* key.

The displayed measurements are dynamic. If movable objects are selected, the information will update accordingly as the objects change position in relation to each other.

The *Measure* button is only visible if a scenario/log file is loaded.

2.2.8 Controls

The *Controls* section allows the user to control movement, rotation, and the paying in/out of various elements of a simulation. Depending on the type of object selected, some control options may be inactive (the entire section may be hidden if the currently loaded scenario does not contain elements controllable by this feature).

Control Selection Dropdown
- A dropdown menu that displays all items controllable in the currently running scenario.

Heading Display
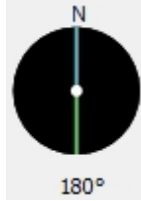
- A circle with lines indicating the selected object's current and set headings.
  - The green line indicates the current heading of the selected object.
  - The blue line indicates the set heading of the object (heading selectable by clicking within the area of the circle, or by typing into the Set Heading entry box).
- Below the circle display is the numerical value of the heading displayed in degrees.

Position Control

- Includes an entry box (default value of 0 meters), followed by a *Move* button.
- To move the selected object:
  1. Choose a heading at which to move the object by either:
     - clicking within the area of the heading display circle,
     - or
     - typing a heading in the Set Heading box.
  2. Enter a distance (in meters) to move the object at the selected heading in the entry box.
     - If a value of 0 is used, no limit will be placed on the position (the object will continue to move until it is manually stopped).
  3. Click the *Move* button to begin repositioning the object.
     - While the object is in motion, the entry box will display the distance remaining to the specified distance.
     - While the object is in motion, the text on the *Move* button will change to *Stop*. Motion may be stopped at any time by clicking *Stop*.

Set Heading

- Includes an entry box (default value displays the current heading of the object), followed by a *Rotate* button.
- To rotate the selected object:
  1. Choose a heading at which to set the object by either:
     - clicking within the area of the heading display circle,
     - or
     - typing a heading in the entry box.
  2. Click the *Rotate* button to begin rotating the object.
     - While the object is rotating, the Rotation Control entry box will display the number of degrees remaining to the specified heading.
     - While the object is rotating, the text on the *Rotate* button will change to *Stop*. Rotation may be stopped at any time by clicking *Stop*.

Rotation Control

- o Includes an entry box (default value of 0 degrees), as well as counter-clockwise and clockwise rotation buttons.
- o To rotate the selected object:
    1. Enter an amount (in degrees) to rotate the object.
        - If a value of 0 is used, no limit will be placed on the rotation (the object will continue to rotate until it is manually stopped).
    2. Click either the Counter-Clockwise button or the Clockwise button to begin rotating the object.
        - While the object is rotating, the entry box will display the number of degrees remaining.
        - Rotation may be stopped at any time by clicking the same directional button that started the rotation.

Depth/Length Control

- o Depending on the type of object selected, the depth/length control may have slightly different options:

    - ▪ **Configuration 1:**
        - Includes an entry box (default value of 0 meters), as well as *In* and *Out* buttons.
            - o The *In* button moves the object closer to the ocean surface (or shortens a tether/umbilical).
            - o The *Out* button moves the object farther from the ocean surface (or extends a tether/umbilical).
        - To modify the depth/length of the selected object:
            1. Enter an amount (in meters) to modify the depth/length.
                - ▪ If a value of 0 is used, no limit will be placed on the movement (the object will continue to move until it is manually stopped, or until it reaches its minimum or maximum depth/length).
            2. Click either the *In* or the *Out* button to begin moving the object.
                - ▪ While the object is in motion, the entry box will display the distance/length remaining.
                - ▪ Motion may be stopped at any time by clicking the same directional button that started the motion.
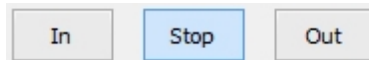
    - ▪ **Configuration 2:**
        - Includes *In*, *Out*, and *Stop* buttons.
            - o The *In* button moves the object closer to the ocean surface (or shortens a tether/umbilical).
            - o The *Out* button moves the object farther from the ocean surface (or extends a tether/umbilical).
            - o The *Stop* button immediately stops movement.
        - To modify the depth/length of the selected object:
            1. Click either the *In* or the *Out* button to begin moving the object.
                - ▪ Motion may be stopped at any time by clicking the *Stop* button.
                - ▪ There is no limit on the movement (the object will continue to move until it is manually stopped, or until it reaches its minimum

or maximum depth/length).

Speed

- A slider that modifies the speed of movement and rotation of the selected object.
- It acts as a scale, where the full-left position indicates minimum (0%) of the predefined speed of motion/rotation, and full-right position indicates the maximum (100%) of the predefined speed of motion/rotation.

Follow

- The *Follow* button turns on the function of following another object, as predefined in the simulation.
  - This is generally used on a ship to have it follow the ROV.
- When the *Follow* function is enabled, it may be disabled by clicking the *Follow* button again.
- This button may be inactive if:
  - The selected object has not been preassigned an object to follow.
  - The *Follow* function has been designated as always on for the currently running scenario, which does not allow it to be disabled.

3 Sonar

The VROV simulator creates simulated sonar data that can be processed, controlled, and displayed on a VSonar module or OEM topsides.

VROV has integrated into several different single beam (avoidance) sonars for ROVs and AUVs including:
- o   Tritech Super SeaPrince
- o   Tritech Super SeaKing
- o   Tritech Micron
- o   Kongsberg MS1000
- o   Imagenex 881

In addition to single beam sonars, VROV also offers multi-beam (imaging) sonar options, including:
- o   Tritech Gemini
- o   Teledyne BlueView

For information on how to use specific OEM topsides, please see the manual provided by the manufacturer.

3.1 Integrated Sonar

If no OEM sonar has been installed, GRi may supply an integrated, non-manufacturer specific sonar.
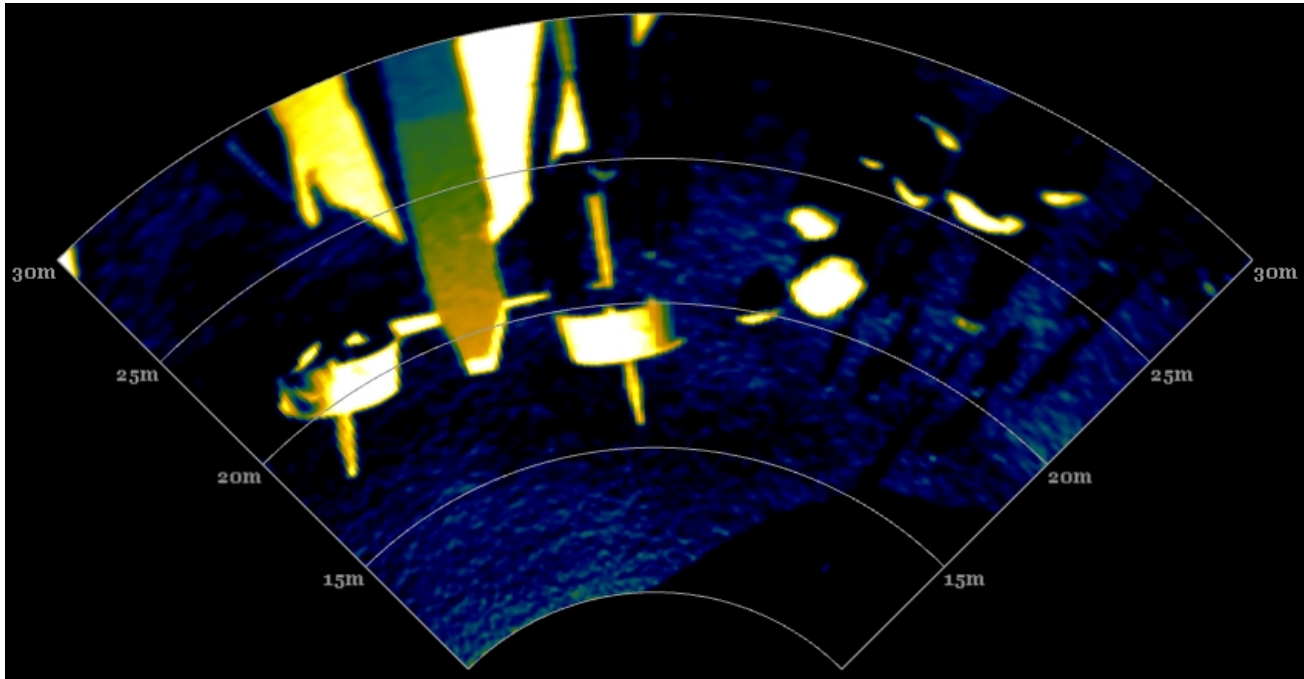
This sonar may be accessed from the ICC Viewport by clicking on the camera name in the top-left corner of the viewport with the left or right mouse button, which will display a list of all available cameras and sonars.

- o If the camera name is not visible, hovering the mouse in the top-left corner of the viewport will make it appear.

Standard sonar settings for the integrated multi-beam sonar may be modified using the mouse:
- o Holding down the left mouse button while moving the mouse up and down:
    - for a single beam sonar will change the sweep range.
    - for a multi-beam sonar will change the minimum view boundary of the sonar.
        - Note that the minimum distance between minimum and maximum view boundaries is 4m, so after the minimum boundary is increased to within 4m of the maximum, the maximum view boundary will automatically increase to keep the distance at least 4m.
- o Scrolling with the scroll wheel (or holding down the middle mouse button/scroll wheel while moving the mouse up and down) will change the maximum view boundary of the sonar.
    - Since the minimum distance between minimum and maximum view boundaries is 4m, after the maximum boundary is decreased to within 4m of the minimum, the minimum view boundary will automatically decrease to keep the distance at least 4m.
    - Using the mouse scroll wheel will also change the maximum view boundary.
- o Clicking the right mouse button will display a list of sonar palette options. Left-clicking the option will select it.

4 Keyboard Commands

Below are keyboard commands for some of the controls in the ICC:

Keyboard Command	Description
F3	Toggles *Aerial* camera lock/unlock function.
F5	Cycles multiple camera views.
F6	Toggles *Aerial* camera global lighting vs scenario lighting.
F9	Activates / Deactivates additional view(s) on a second monitor.
Ctrl + C	Activates / Deactivates compass.
Ctrl + F	Begins, Pauses, or Resumes a scenario/log file.
Ctrl + G	Stops the current scenario/log file.
Ctrl + H	Begins or Ends recording of a log file/video.
Ctrl + J	Displays / Hides joystick designations (if applicable).
1	Cycles through items controllable by Joystick 1 (if applicable).
2	Cycles through items controllable by Joystick 2 (if applicable).
Enter	Toggles fullscreen on/off.
← → (Arrows)	Cycles display of available cameras/sonars.
W, A, S, D	Move the *Aerial*, *Map*, or *NAV* cameras forward, left, back, and right (Holding *Shift* with any of these keys will enable the "Run" camera movement. speed setting - View > *Aerial* Camera Settings).
Q, E	Move the *Aerial*, *Map*, or *NAV* cameras up and down (Holding Shift with any of these keys will enable the "Run" camera movement speed setting - View > *Aerial* Camera Settings).

5 Troubleshooting

If you have questions about a topic that is not covered in this document, please visit our ***web support*** for assistance.

Common Errors

If a scenario does not start, or does not perform as expected, it is important to know how to go about debugging it. Typically, the most useful information is found in the *debug.txt* file located in the root of the VROV module folder, typically **C:\icc_*(folderName)*\debug.txt** . Below is a list of the most common issues:

1. ICC doesn't start from the desktop icon.
   - Possible Sources of Error:
     - Software License.
       - If using a physical Hasp dongle for licensing, check that hasp light is on. If not, try reinstalling the drivers.
       - If using a software lock for licensing, the license may be expired.
     - Check for an instance of the module already running. Only one instance should be running at a time.
     - Check that the GPU is not overloaded. For example, connecting four monitors at 2160 resolution will cause the VROV software not to run due to strain on the GPU.
2. External Modules (VCam, CIC) don't start.
   - Possible Sources of Error:
     - Network connection.
       - Check that the cables are properly connected to the assigned port on the PC as well as the network switch (if applicable).
     - VROV Server.
       - Check that the VROV Server ( ) is running in the system tray for that module's PC. If the icon is not present in the system tray, it can be started from the module folder, typically located at **C:\vcam_*(folderName)*\vrov\VrovServer.exe.**
3. No image on the sonar
   - Possible Sources of Error:
     - Cable Connection.
       - Ensure any required cables (COM or ethernet) are properly connected to the assigned port on the PC as well as the network switch (if applicable).
     - Sonar Parameters.
       - Ensure the sonar parameters are configured such that the range/intensity should display an object. For example, if the nearest object that the sonar could detect is 30 meters away, ensure that the sonar is configured to display at least that distance.
4. Controls not functioning
   - Possible Sources of Error:
     - Cable Connection.
       - Ensure any required cables (COM or ethernet) are properly connected to the assigned port on the PC as well as the network switch (if applicable).
     - Startup Procedure.
       - Ensure the proper startup procedure for the controlling hardware and software has been executed.