VU-GUI USER MANUAL

PROJECT:	LSV_AUV
ACTIVITY NAME:	ToT – SW GUI
DRAWN BY:	STEFANO GABIELE(SG)
APPROVED BY:	Michele Cocco (MC)
DATE:	23-10-2019
FILENAME:	VU_GUI_User_Manual
DISTRIBUTION LIST:	Teams + L&T
STATUS:	Confidential
NOTE:	

Summary

1 The VU-GUI

The VU-GUI (FIGURE 1 – THE VITAL UNIT GUIFigure 1n with the Amogh AUV, the creation of mission files and the control of the vehicle. Schematically, its main functions can be summarized in the following points:

- Create, edit, upload and synchronize the mission and log files
- Perform all the operations of starting, controlling and terminating a mission
- Continuous monitoring of vehicle status
- Remote control of the vehicle status

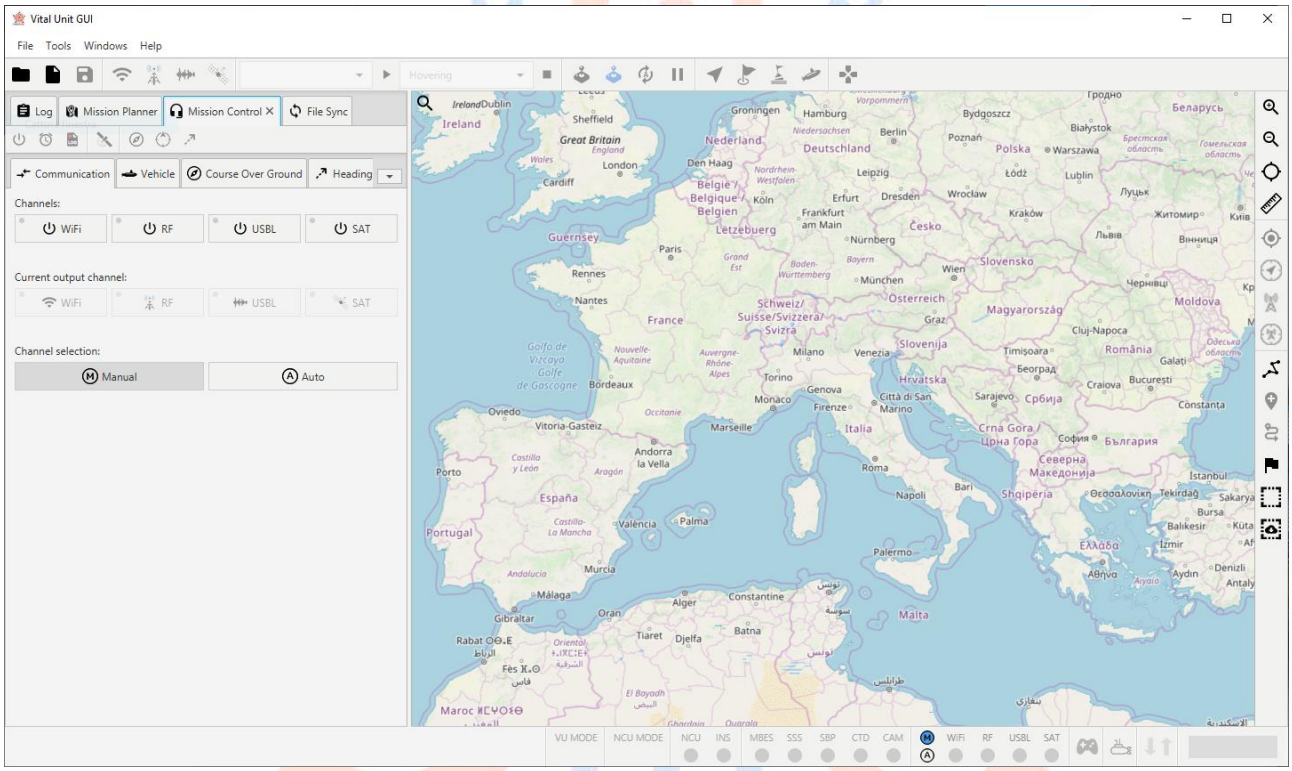


Figure 1 – The Vital Unit GUI

2 Software Output

The VU-GUI produces as output two kind of files: mission file and log file.
The mission file has the extension ".csv" and is generated according to its own specification using the mission planning tools of the VU-GUI (13.1 MISSION PLANNER).

The log files are created automatically by the software to record run time errors or debug messages. A log is generated for each run of VU-GUI and have ".txt" extension; its name is coded as follow: YEAR_MONTH_DAY_HOURMINUTE, e.g. 2018_09_09_1820.txt.

Both the mission files and log files are saved inside the workspace directory "*home_dir*/vu-gui".

E.g. for Windows 10:

`%USERPROFILE%\vu-gui\log`	(Contains log file)
`%USERPROFILE%\vu-gui\missions`	(Contains saved missions)

3 Software Version

The first stable release of the VU-GUI software is the version 1.0.0 RC8.

4 Software and hardware requirements

The VU-GUI was implemented using JavaFX 8 software platform. Java SE 8+ must be installed on your system.

Windows

Windows 10 (8u51 and above)
Windows 8.x (Desktop)
Windows 7 SP1
Windows Vista SP2
Windows Server 2008 R2 SP1 (64-bit)
Windows Server 2012 and 2012 R2 (64-bit)
RAM: 128 MB
Disk space: 124 MB for JRE; 2 MB for Java Update
Processor: Minimum Pentium 2 266 MHz processor
Browsers: Internet Explorer 9 and above, Firefox

Mac OS X

Intel-based Mac running Mac OS X 10.8.3+, 10.9+
Administrator privileges for installation
64-bit browser

A 64-bit browser (Safari, for example) is required to run Oracle Java on Mac.

Linux

Oracle Linux 5.5+
Oracle Linux 6.x (32-bit), 6.x (64-bit)
Oracle Linux 7.x (64-bit) (8u20 and above)
Red Hat Enterprise Linux 5.5+, 6.x (32-bit), 6.x (64-bit)
Red Hat Enterprise Linux 7.x (64-bit) (8u20 and above)
Suse Linux Enterprise Server 10 SP2+, 11.x
Suse Linux Enterprise Server 12.x (64-bit) (8u31 and above)

Ubuntu Linux 12.04 LTS, 13.x
Ubuntu Linux 14.x (8u25 and above)
Ubuntu Linux 15.04 (8u45 and above)
Ubuntu Linux 15.10 (8u65 and above)
Browsers: Firefox

5 Development environment and libraries

The VU-GUI software has been developed using NetBeans IDE 8.2 an integrated development environment (IDE) for Java released under a Dual License consisting of the Common Development and Distribution License (CDDL) v1.0 and GNU General Public License (GPL) v2. VU-GUI uses also the following third-party libraries:

Developer	Library name	License
Apache Commons	commons-net-3.6.jar	Apache License v2
Apache Commons	commons-validator-1.6.jar	Apache License v2
Fazecast, Inc.	jSerialComm-2.0.2.jar	Dual-license LGPLv3 and Apache License v2
JInput	Jinput-2.0.9.jar	BSD License
Stefano Gabriele	jmap-1.0.0.jar	GPLv3
Stefano Gabriele	jlib-1.0.0.jar	GPLv3
ktuukkan/marine-api	marine-api.jar	GPLv3

6 Project setup

Open NetBeans IDE, locate the File menu item of the Top menu bar and click File -> Open Project… (FIGURE 2 – OPEN PROJECT). Select the root directory of the VU-GUI project; a cup of coffee icon indicate that is a valid NetBeans project (FIGURE 3 – PROJECT SELECTIONFigure 3); select it and press the "Open Project" button. Now the project is ready to be modified, built and run (FIGURE 4 – THE TOOLS TO BUILD RUN AND DEBUG THE PROJECTFigure 4).

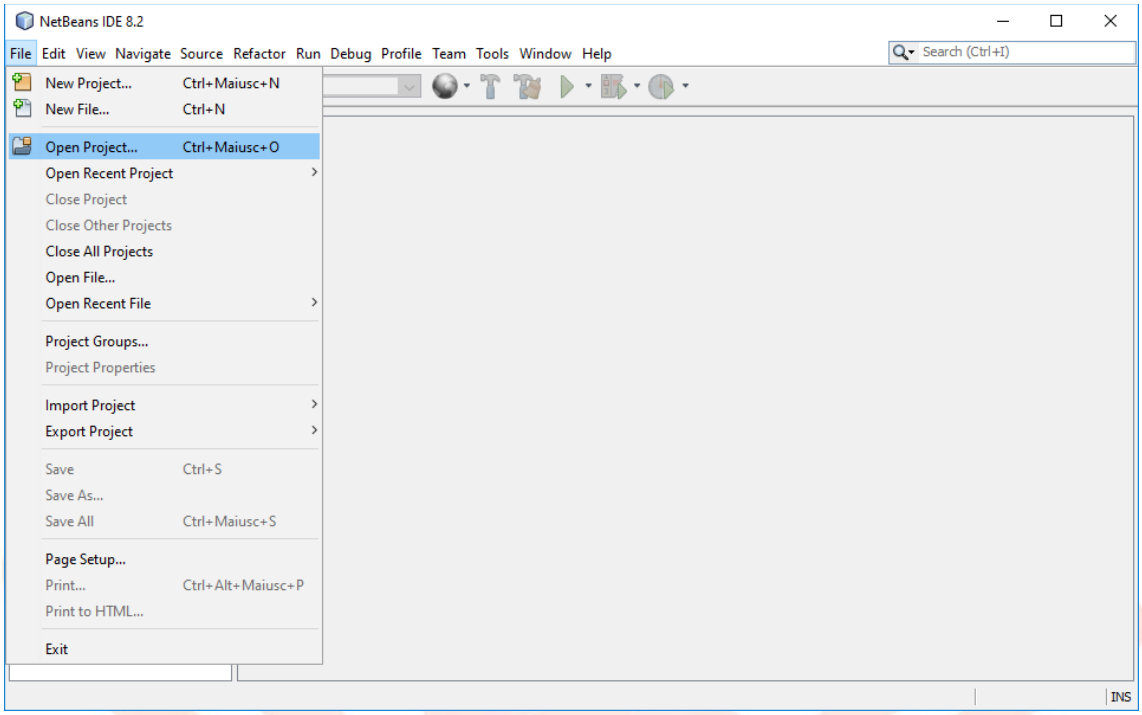


Figure 2 – Open project

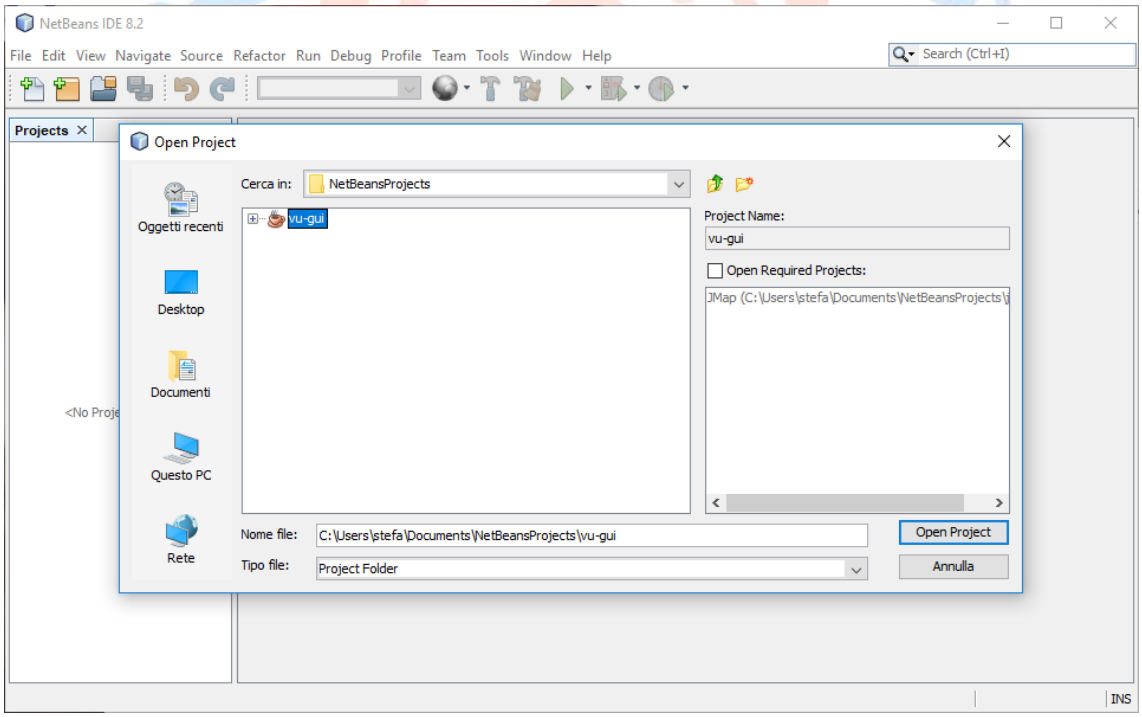


Figure 3 – Project selection

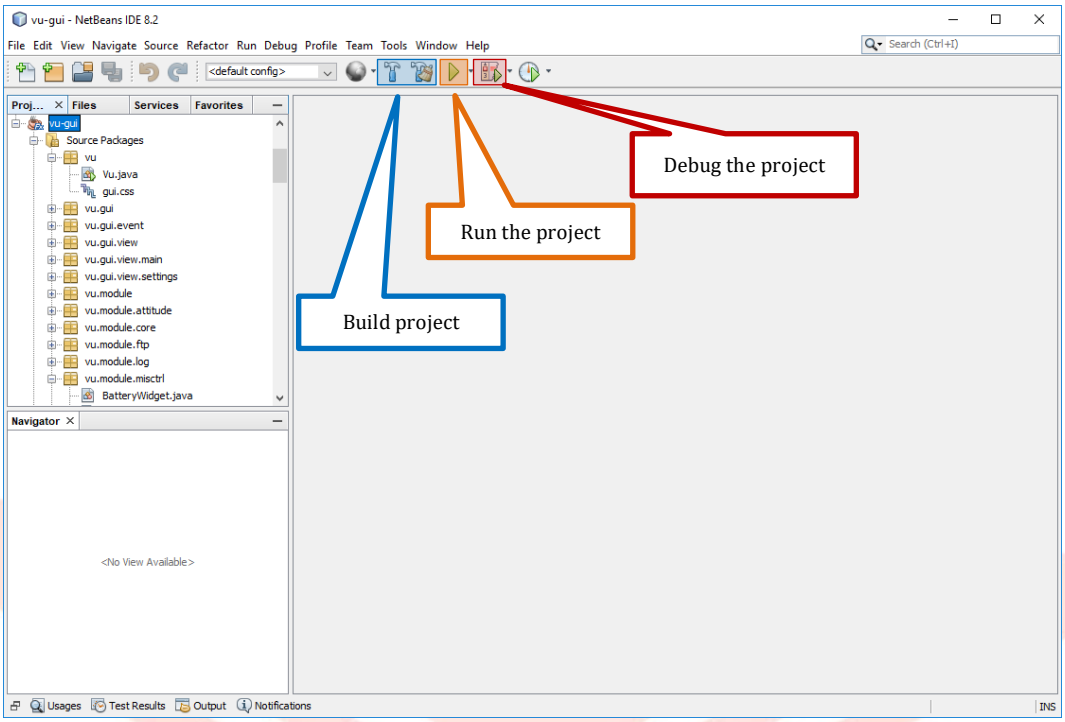


Figure 4 – The tools to build run and debug the project

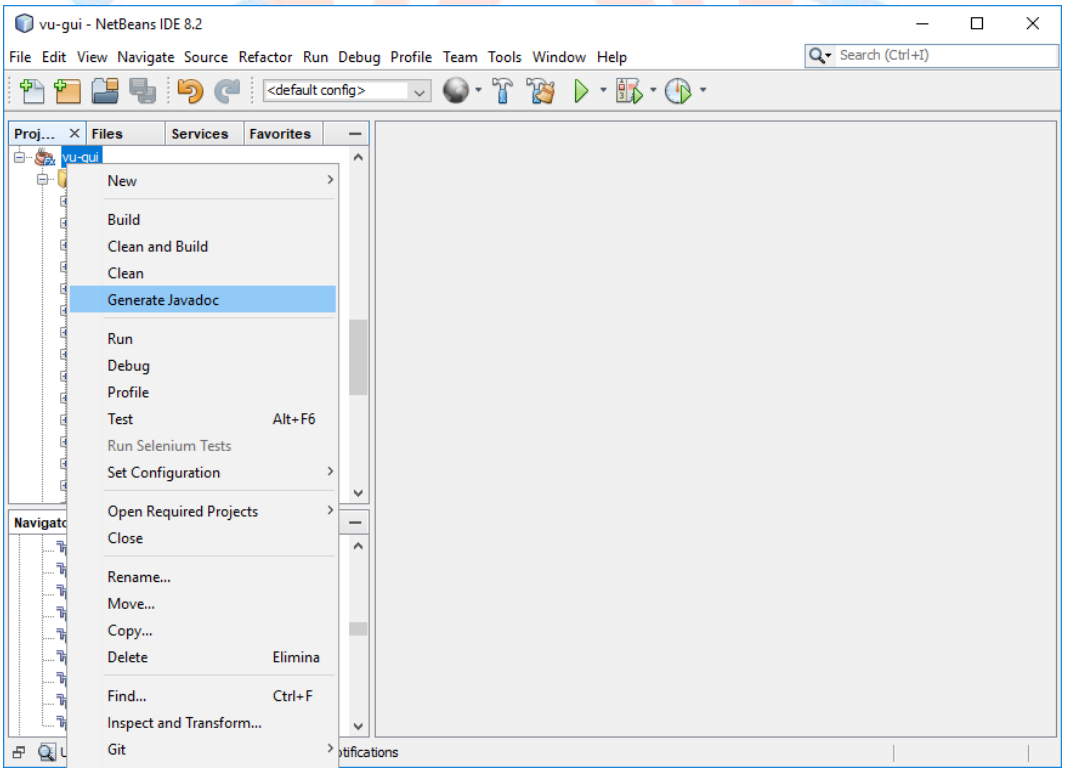


Figure 5 – Source Code Generation

7 Generation of source code documentation

The source code documentation can be easily generated by clicking with right mouse button on **vu-gui** project and select **Generate Javadoc** from the window (FIGURE 5). The generated documentation is placed at the following path: *project_dir*/dist/Javadoc, where *project_dir* is the project directory selected when the project was created or opened.

8 Project Directory Structure

The project directory has the following structure:

```
\---vu-gui
    +---dist
    +---ext
    |   \---target
    |       \---natives
    +---lib
    |   +---commons-io-2.6
    |   +---commons-net-3.6
    |   +---CustomizedJinput1.0.0
    |   +---jlib1.0.0
    |   +---jmap1.0.0
    |   +---jSerialComm-2.0.2
    |   +---marine-api
    |   \---preloader
    +---nbproject
    \---src
        +---img
        |   \---icons
        \---vu
            +---gui
            |   +---event
            |   \---view
            |       +---main
            |       \---settings
            \---module
                +---core
                +---editor
                |   \---missionfile
                +---filesynch
                +---gamepad
                +---gps
                +---instrumentation
                +---log
                +---misctrl
                |   +---event
                |   +---protocol
                |   \---sat
                +---motor
                +---status
```

```
\---viewer
    \---protocol
```

A brief description of the content of the directories follows.

The **vu-gui/dist** contains the executable .jar file.

The **vu-gui/ext/target/natives** contains the Dynamic-link librariy (DLL) used by the *Customized Jinput* lib needed to control the gamepad.

The **vu-gui/lib/** contains the third party libraries used by VU-GUI; they are correctly linked automatically when the project is opened.

The **vu-gui/nbproject/** contains the project files used by *NetBeans IDE* to configure the project correctly.

The **vu-gui/src/** contains the source code of the VU-GUI.

The **vu-gui/src/image/icons** contains the icons used by the application; each icon is provided in four different dimension: 48x48, 36x36, 24x24 and 18x18.

The **vu-gui/src/vu/** is root package containing the application main class.

The **vu-gui/src/vu/gui/event** contains the custom event classes used by the GUI.

The **vu-gui/src/vu/gui/view** package contains the definition of the abstract class `VuView`, the base class that must be extended to add new Window to the VU-GUI application.

The **vu-gui/src/vu/gui/view/main** package contains the classes needed to build the Main Scene of the application.

The **vu-gui/src/vu/gui/view/settings** package contains the classes needed to handle application properties.

The **vu-gui/src/vu/module** package contains the module foundation classes which define the skeletons to develop a VU-GUI module.

The **vu-gui/src/vu/module/core** module contains classes that define the base structure of a `Packet` and a `CommunicationChannel`; installs on the status bar useful widgets to monitor the channels activity and notify messages.

The **vu-gui/src/vu/module/editor** module provides the classes needed to implement the mission planning features.

The **vu-gui/src/vu/module/editor/missionfile** provides all classes needed to define and parse a mission file.

The **vu-gui/src/vu/module/editor/filesynch** provides the "File Sync" window that allows to upload and download files to and from the vehicle.

The **vu-gui/src/vu/module/gamepad** provides the classes that allow to control vehicle by the gamepad.

The **vu-gui/src/vu/module/gps** provides the "GPS" window and tools to track the ground station.

The **vu-gui/src/vu/module/instrumentation** provides the "Instrumentation" window that displays a set of widgets showing several information about the Vehicle, such as attitude, speed, depth, etc.

The **vu-gui/src/vu/module/log** installs the `RuntimeExceptionHandler` and provides the window showing all log messages generated by the application.

The **vu-gui/src/vu/module/misctrl** module provides the classes and services to implement the VU-GUI communication protocol; adds to the application a new window containing tools to establish connection with the vehicle and send commands to it.

The **vu-gui/src/vu/module/misctrl/event** contains event classes.

The **vu-gui/src/vu/module/misctrl/protocol** provides the classes needed to implement the VU-GUI communication protocol.

The **vu-gui/src/vu/module/misctrl/sat** provides the classes needed to communicate with the SAT module.

The **vu-gui/src/vu/module/misctrl/motor** provides the "Motor Status" window that displays information about the status of the motors.

The **vu-gui/src/vu/module/status** provides the "Vehicle Status" window that displays information about the status of the vehicle.

The **vu-gui/src/vu/module/viewer** module provides the classes and services that implement the File Transfer protocol used to request and receive an image produced by a sensor of the vehicle; adds to the application a new window containing tools to request and view the image.

The **vu-gui/src/vu/module/protocol** package provides the classes needed to implement the File Transfer protocol.

9 Installation and Execution

The VU-GUI software needs no installation, it can be executed also on a removable device such as a flash pen. The executable .jar file produced by the compilation process can be launched with a double click or by command line executing the following command:

```
java -jar path\to\executable\file\vu-gui.jar
```

So, if the produced file is stored in `D:\Development\projects\java\vu-gui\dist` and its name is `vu-gui.jar` the command that must be launched is:

```
java -jar D:\Development\projects\java\vu-gui\dist\vu-gui.jar
```

10 The VU-GUI User Interface

The VU-GUI User Interface follows basic Windows style and functionality convection. The interface is composed of two main views: the Main View (11 THE MAIN VIEW) and the Setting View (12 THE SETTING VIEW); in each view, there is a menu bar on the top and a status bar on the bottom (FIGURE 6 – USER INTERFACE).

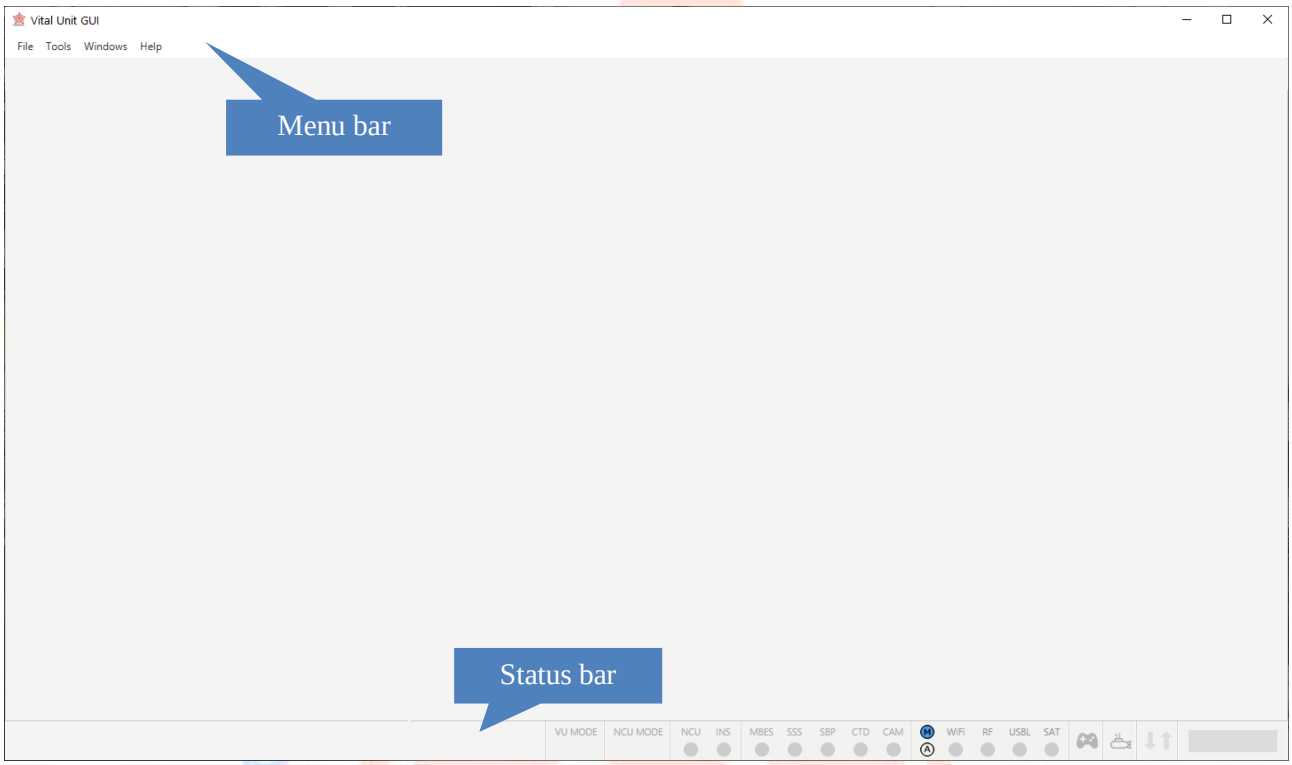


Figure 6 – User Interface

10.1 The Menu Bar

The menu bar consists of four drop-down menus:

- File: shall allow to create a new mission, save the current mission, load a previously saved mission, save mission with different name and close the mission;
- Tools: shall allow to switch to Setting View or browse the workspace;
- Windows: shall allow to open a specific window containing a set of functionalities or reopen a previously closed one;
- Help: shall show information about the software.

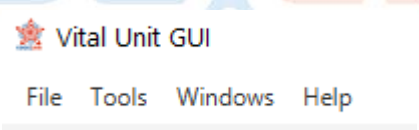


Figure 7 – The Menu Bar

10.2 The Status Bar

The Status Bar shows widgets that give some useful information such as the remaining capacity of the battery, the selected output channel, the TX/RX packet indicator and the vehicle status.
Furthermore, the status bar has a notification area where the system messages are shown.

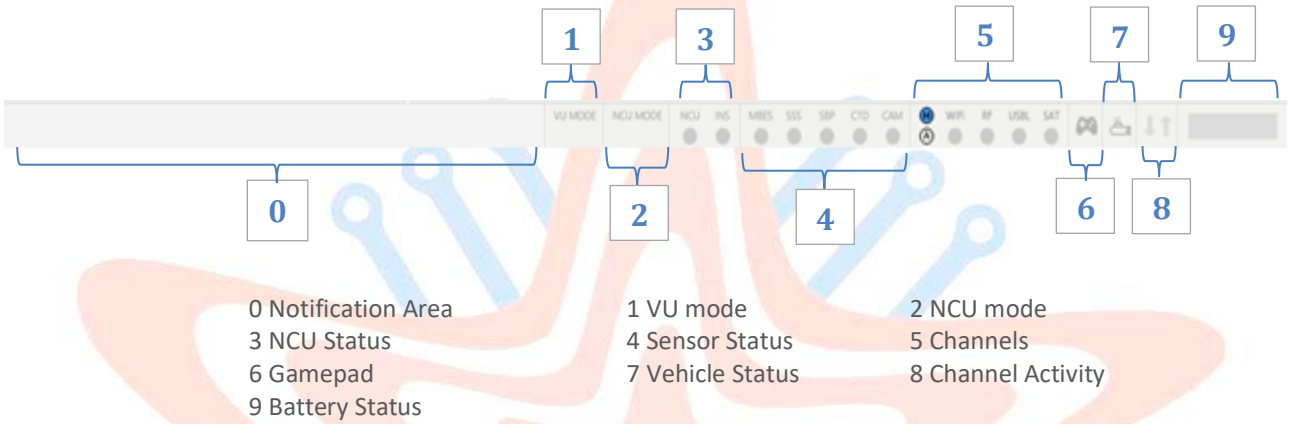


Figure 8 – The Status Bar

10.2.1 The Notification Area

The Notification Area is placed on the left side of the status bar (FIGURE 8 – THE STATUS BAR). All system messages such as action confirmation, warning or error messages are displayed in this area.

10.2.2 The Vital Unit Mode widget

The VU Mode widget shows the guidance mode of the vehicle set in Vital Unit (FIGURE 8 – THE STATUS BAR). Could be displayed one of the following values: STANDBY, ROV, AUV or ROV_DIRECT.

10.2.3 The NCU Mode widget

The NCU Mode widget shows the NCU mode (FIGURE 8 – THE STATUS BAR). Could be displayed one of the following values: DISABLED, MANUAL, GOTO DPT, GOTO ALT, HOVERING, SURFACING, FLOATING, DIRECT or HEADING.

10.2.4 The NCU Status widget

The NCU Status widget shows the NCU and INS operational status (FIGURE 8 – THE STATUS BAR). The operational status of the devices is coded using two RGB LEDs indicators with the following meaning:

Led Color	NCU	INS
	Off	Off
		No GPS Fix
	OK	GPS Fix acquired
	Error	Error

10.2.5 The Sensors Status widget

The Sensors Status widget shows the sensors operational status (FIGURE 8 – THE STATUS BAR). The operational status of the sensors is coded using five RGB LEDs indicators with the following meaning:

Led Color	MBES	SSS	SBP	CTD	CAM
	Off	Off	Off	Off	Off
	Startup	Startup	Startup	Startup	Startup
	On	On	On	On	On
	Acquire	Acquire	Acquire		Acquire
	Error	Error	Error	Error	Error

10.2.6 The Channels widget

The Channels widget shows the channel selection mode, the channels operational status and the currently selected one (FIGURE 8 – THE STATUS BAR). The icon indicating the manual selection mode is a circle with an "M" in the middle, while the auto scan is that one with an "A". When the operator select the desired modality the icon associated to the selected one is colored with blue. The operational status of the channels is coded using four RGB LEDs indicators with the following meaning:

Led Color	WiFi	RF	USBL	SAT
	Off	Off	Off	Off
	On	On	On	On
	Error	Error	Error	Error

When the operator select the output channel, its name is enclosed within a blue colored rectangle (FIGURE 9 – THE WIFI CHANNEL IS SELECTED).

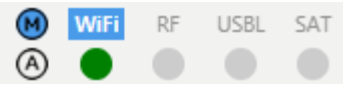


Figure 9 – The WiFi channel is selected

10.2.7 The Gamepad widget

The Gamepad widget indicates the operational status of the gamepad used to control the vehicle in ROV mode (FIGURE 8 – THE STATUS BAR). The widget icon takes on different colors depending on the following situations:

Icon Color	ROV	ROV DIRECT
	Off	Off
		On
	On	
	Error	Error

10.2.8 The Vehicle Status widget

The Vehicle Status widget indicates the connection status between the VU-GUI and vehicle, and provides information about its operational status (FIGURE 8 – THE STATUS BAR). Moving the mouse pointer over the widget is shown a popup window listing messages about the status of the vehicle. The submarine icon takes on different colors depending on the following situations:

Icon Color	Connection Status
	Disconnected
	Connection lost
	Connected

10.2.9 The Channel Activity widget

The Channel Activity widget provides a visual feedback of the channels activity represented by two opposite arrows one pointing to the north of the status bar, and one to the south. When a channel receive a packet, the arrow pointing the south blinks, contrariwise when is sent a packet on the channel, the arrow pointing the north blinks (FIGURE 8 – THE STATUS BAR). Moving the mouse pointer over the widget is shown a popup window displaying information about the number of packets sent and received on the currently selected channel.

10.2.10 The Battery Status widget

The Batter Status widget shows the remaining charge of the battery alimenting the vehicle (FIGURE 8 – THE STATUS BAR). Moving the mouse pointer over the widget are displayed information about the LB voltage, VU voltage, current and remaining capacity.

11 The Main View

The Main View provides a toolbar immediately below the menu bar and a split pane at the window center. The split pane contains on the left side the Windows Pane that organizes with a tabbed pane all the features offered by the system, and on the right side the geographical map with its own toolbar (FIGURE 10 – VU-GUI: MAIN VIEW). Each sides are separated by a divider, which can be dragged by the user to give more space to one of the sides, resulting in the other side shrinking by an equal amount.

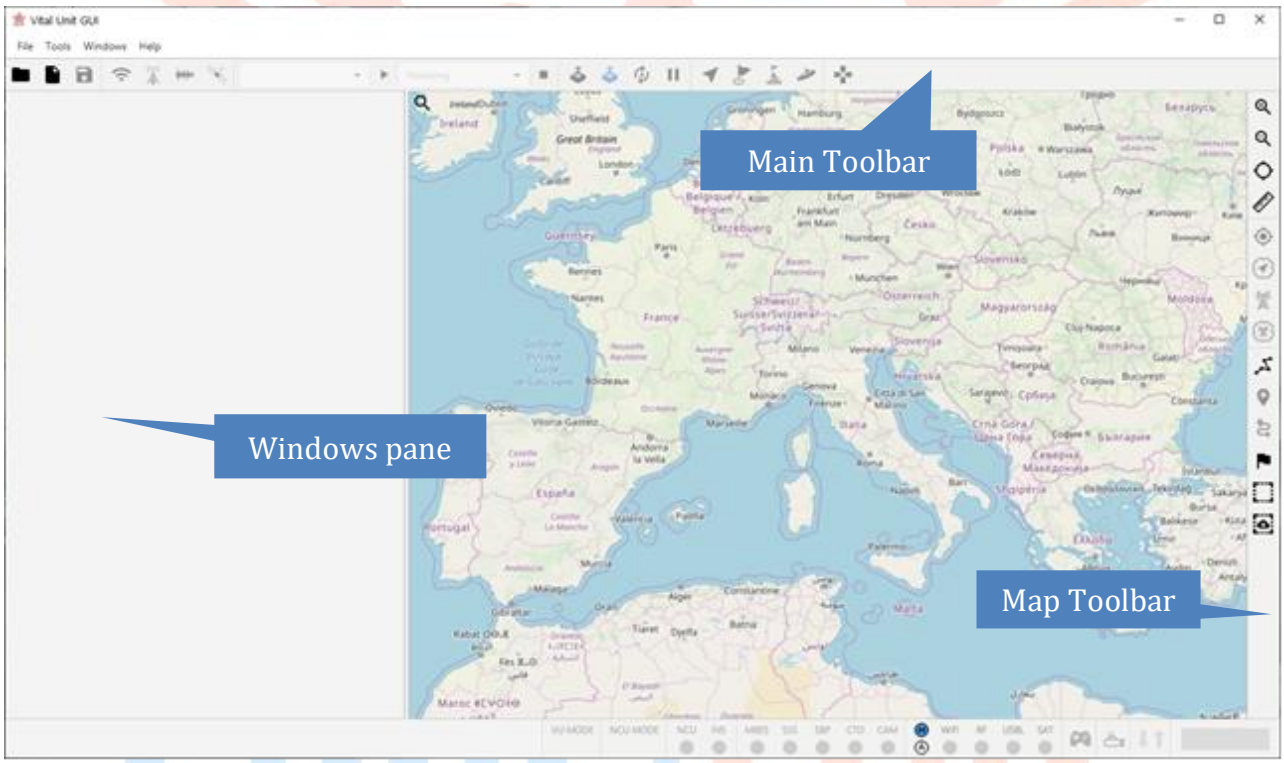
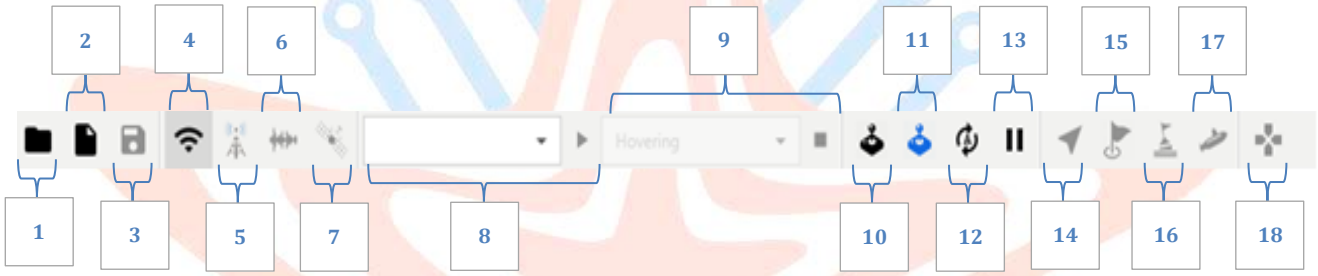


Figure 10 – VU-GUI: Main View

11.1 The Main Toolbar

The Main Toolbar allows quick access to some features of greater use (FIGURE 11 – THE MAIN TOOLBAR).



1 Open Mission | 2 New Mission | 3 Save Mission | 4 WiFi Channel | 5 RF Channel | 6 USBL Channel

7 SAT Channel | 8 Start Mission | 9 Abort Mission | 10 ROV mode | 11 ROV Direct | 12 AUV

13 Standby | 14 Gotowp | 15 Hovering | 16 Floating | 17 Surfacing | 18 Enable/Disable Gamepad

Figure 11 – The Main Toolbar

11.2 The Map

The map can be used to plan a mission, track the vehicle and ground station movements, measure distances, etc. It can be moved with a drag and drop gesture and can be zoomed in/out using the mouse wheel.

The geographic map is composed by a set of images called “tiles” placed side by side; each tile have a size of 256px * 256px and is downloaded or created only if necessary, i.e. only if the map frame contains the range of coordinates covered by the tail.

The component that takes care to load the tiles is the “Map Loader”; the default map loader used by the VU-GUI is the “Open Street Map” loader that download the tiles from the Open Street Map servers. The modular design of the VU-GUI allow a developer to implement his own loader to handle a different kind of map.

11.3 The Map Toolbar

The Map Toolbar provides the buttons to enable the tools needed to plan a mission, take measurement, track the mission, and so on (FIGURE 12 – MAP TOOLBAR).

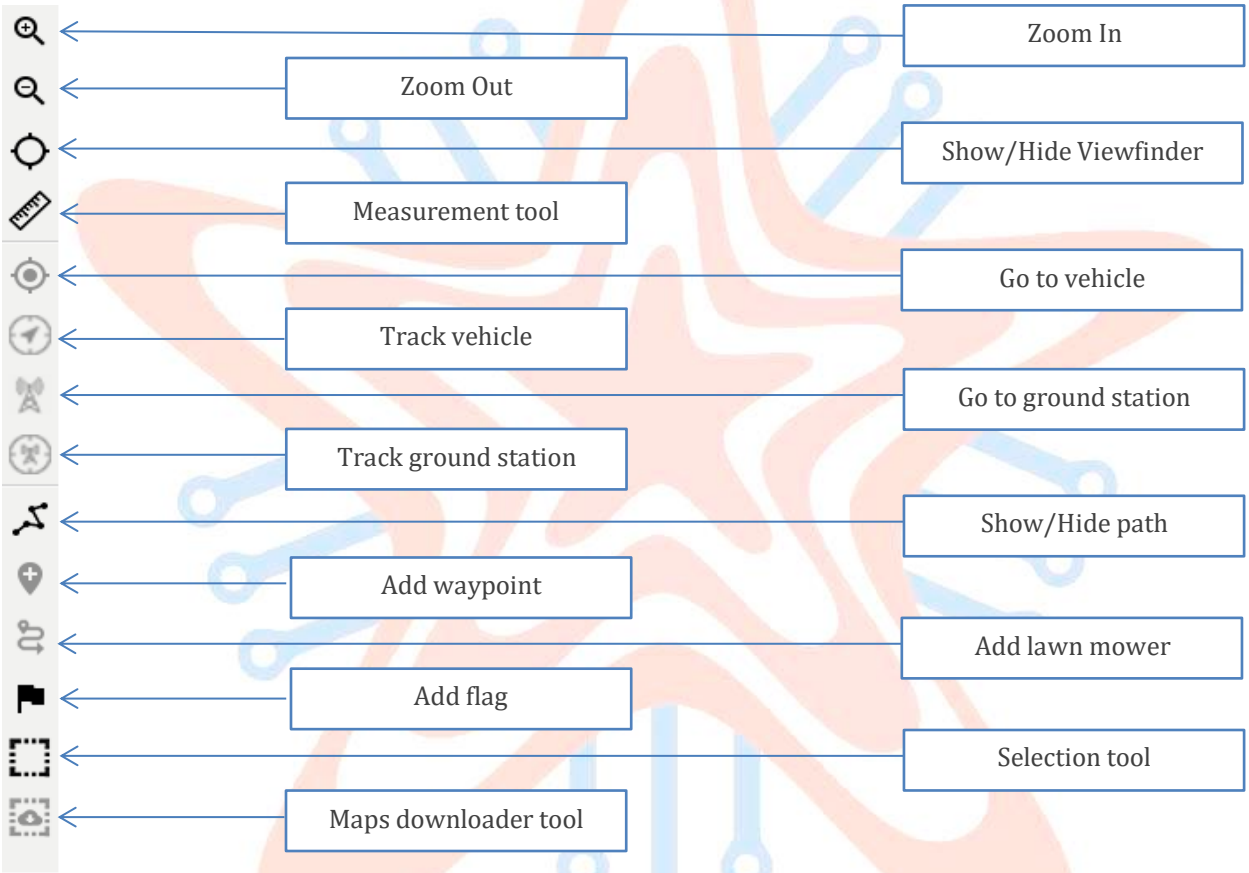


Figure 12 – Map Toolbar

11.3.1 Zoom in button

Click on the Zoom in button to zoom in the map respect to the coordinates at the center of the frame.

11.3.2 Zoom out button

Click on the Zoom out button to zoom out the map respect to the coordinates at the center of the frame.

11.3.3 Show/Hide Viewfinder

Use the Viewfinder toggle button to show/hide a viewfinder at the center of the map frame (FIGURE 13 – VIEWFINDER). This is a convenient tool to indicate the point taken as reference for the zoom in/out function.

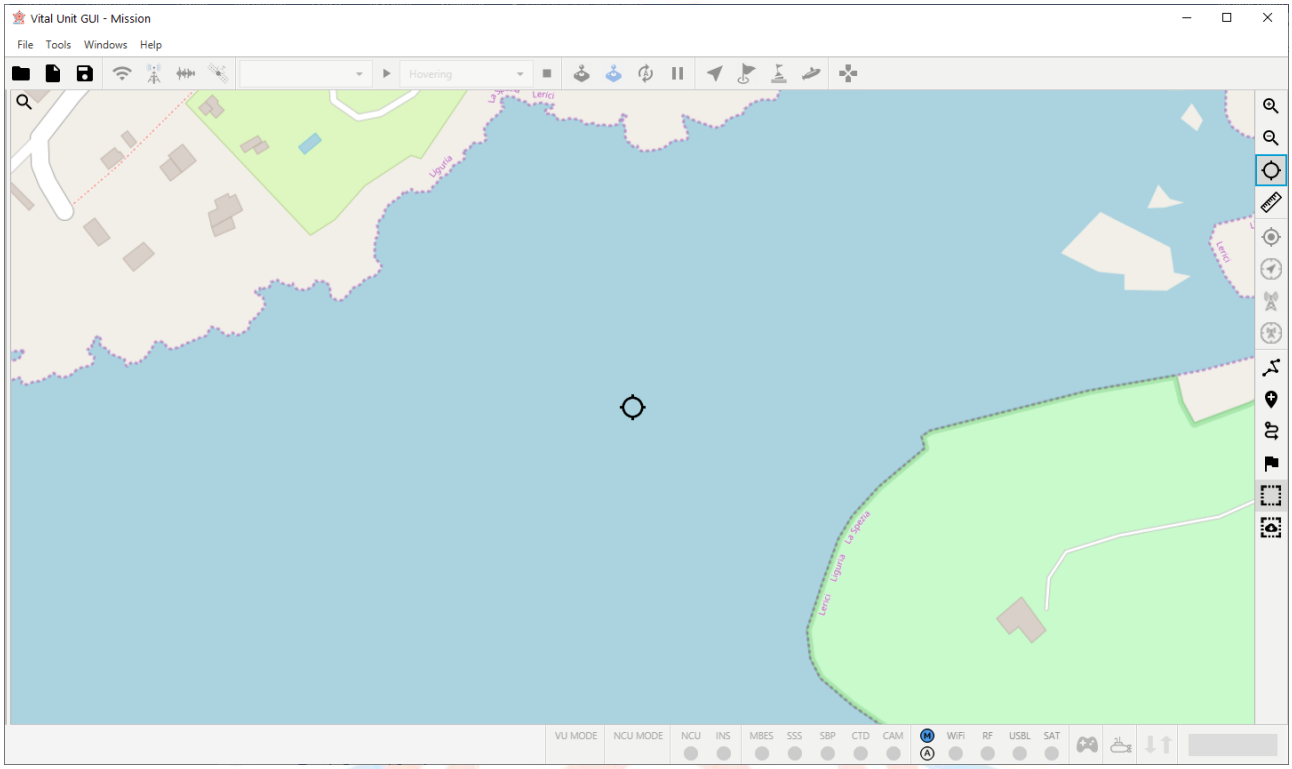


Figure 13 – Viewfinder

11.3.4 Measurement tool

The Measurement tool allows to measure the distance between two points on the map. The user clicks on the toggle button to enable the tool; clicks on the start point on the map and with a drag and drop gesture draw a line which shows a tag indicating the distance from the start to the currently selected point. When the gesture ends, the measurement line drawn is added to the map.

The endpoints of the line can be fixed to a marker, so when it is moved also the line is resized and the distance shown was updated. To fix an endpoint to a marker the user shall start or end the drawing of the line over a marker (FIGURE 14 – MEASUREMENT LINES FIXED TO WAYPOINTS).

The measurement line can be removed clicking with the right mouse button over it and selecting the remove button from the displayed tooltip.

11.3.5 Go to Vehicle

Click on the Go to Vehicle button to move the map at the vehicle position.

11.3.6 Track Vehicle

Use the Track Vehicle toggle button to enable/disable the auto tracking of the vehicle position. When the tool is enabled, the map is moved automatically to the currently position of the vehicle. Please note that if this tool is enabled the "Track Ground Station" tool cannot be enabled and vice versa.

11.3.7 Go to Ground Station

Click on the Go to Ground Station button to move the map at the ground station position.

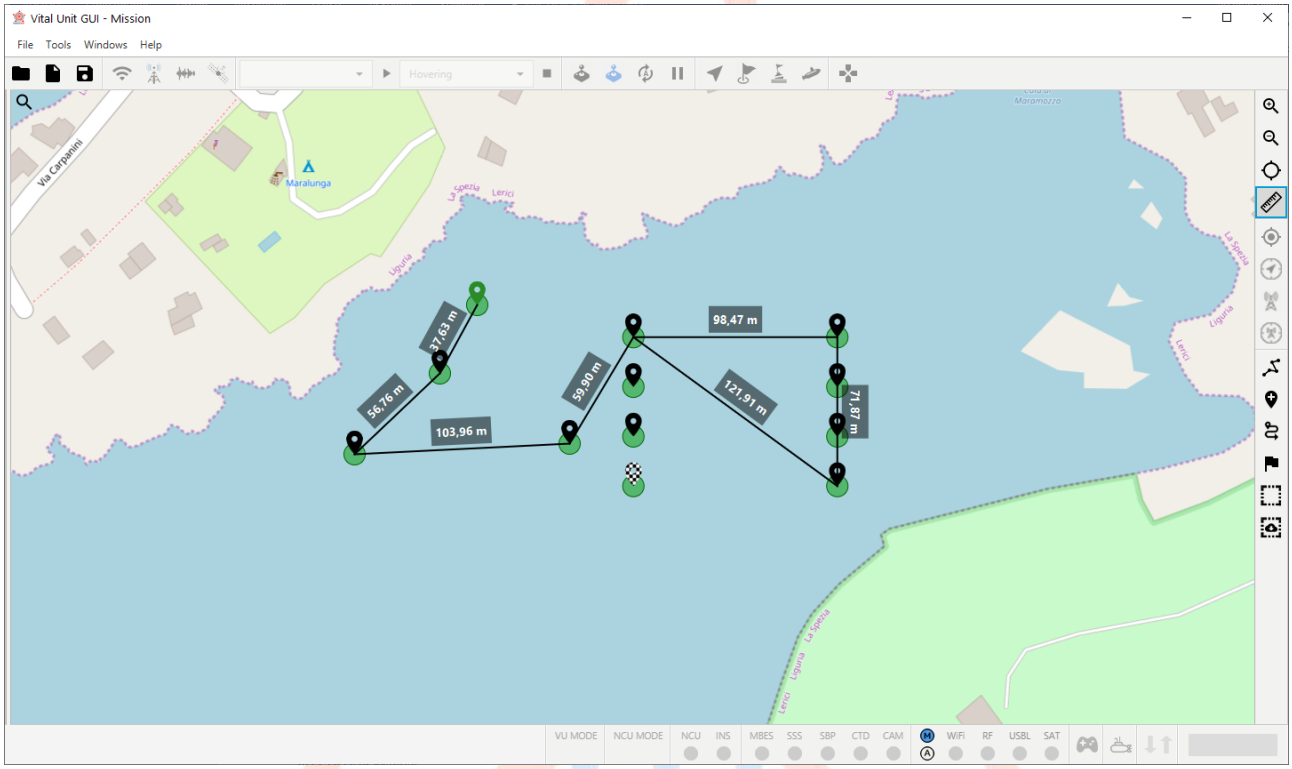


Figure 14 – Measurement lines fixed to waypoints

11.3.8 Track Ground Station

Use this tool to enable/disable the auto tracking of the ground station position. When the tool is enabled, the map is moved automatically to the currently position of the ground station. Please note that if this tool is enabled the "Track Ground Station" tool cannot be enabled and vice versa.

11.3.9 Show/Hide Path

Use the Show/Hide tool to show or hide the path of the mission (FIGURE 15 – MISSION PATH).

11.3.10 Add Waypoint

Click on the Add Waypoint toggle button to enable/disable the add waypoint function. When the tool is enabled a new waypoint can be added to the map just clicking on the desired point.

The waypoint can be moved with a drag and drop gesture. It is also possible lock its status clicking with the right mouse button on it and select “Lock” from the tooltip menu. When a waypoint is locked, cannot be moved and its data and parameters cannot be modified (FIGURE 16 – LOCKED WAYPOINT). To unlock a waypoint the user performs the previous procedure and clicks “Unlock”, while to remove it clicks on “Remove”.

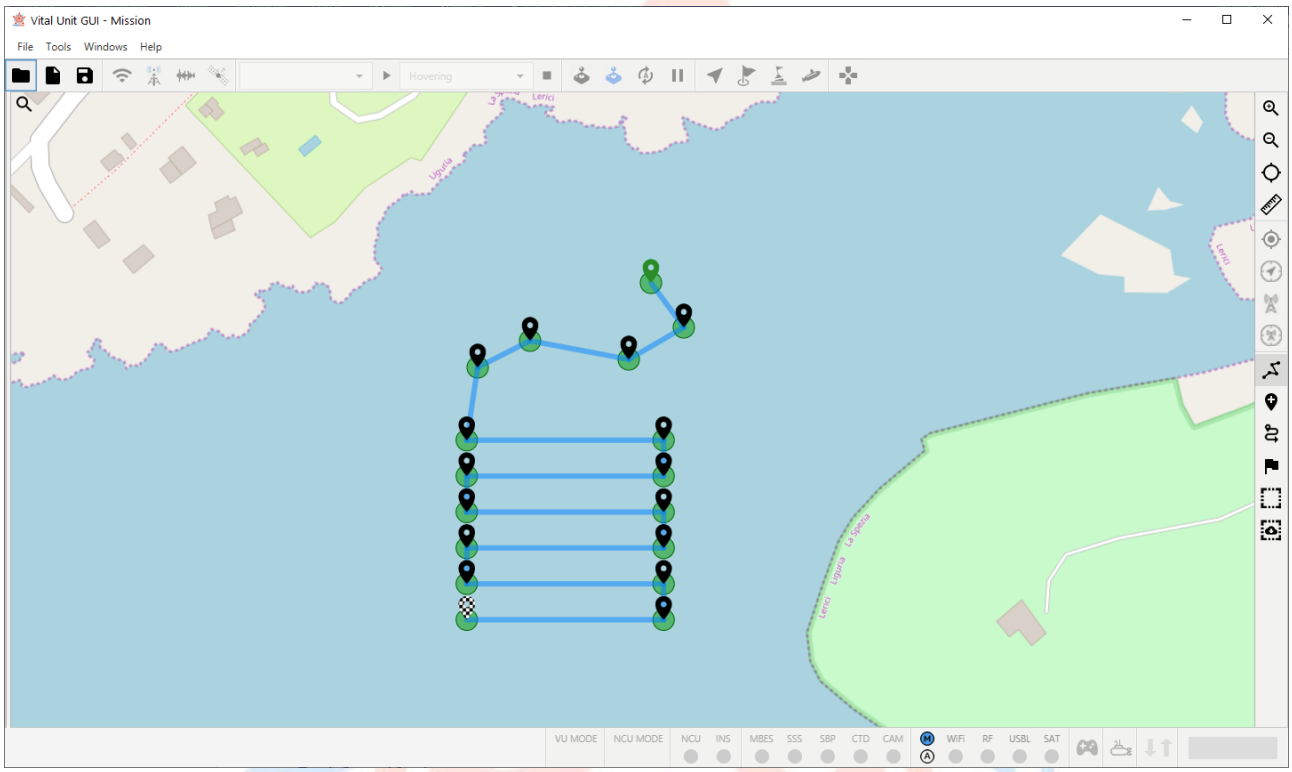


Figure 15 – Mission Path

11.3.11 Add Lawn Mower

Click on the Add Lawn Mower to enable/disable the add lawn mower function that allows adding a series of waypoints following a lawnmower pattern. The lawn mower can be added drawing a rectangle on the map with a drag and drop gesture (FIGURE 17 – LAWN MOWER). Also the lawn mower can be locked/unlocked and removed in the same way of a single waypoint and producing same effects (FIGURE 18 – LOCKED LAWN MOWER).

11.3.12 Add Flag

Click on the Add Flag button to enable/disable the add flag function that allows adding a flag on the map. The flag is a special marker that can be used to indicate the position of points of interest and it is not inserted into mission path (FIGURE 20 – FLAGS). The user can add, lock, unlock, move and remove a flag with the same modality of the waypoint.

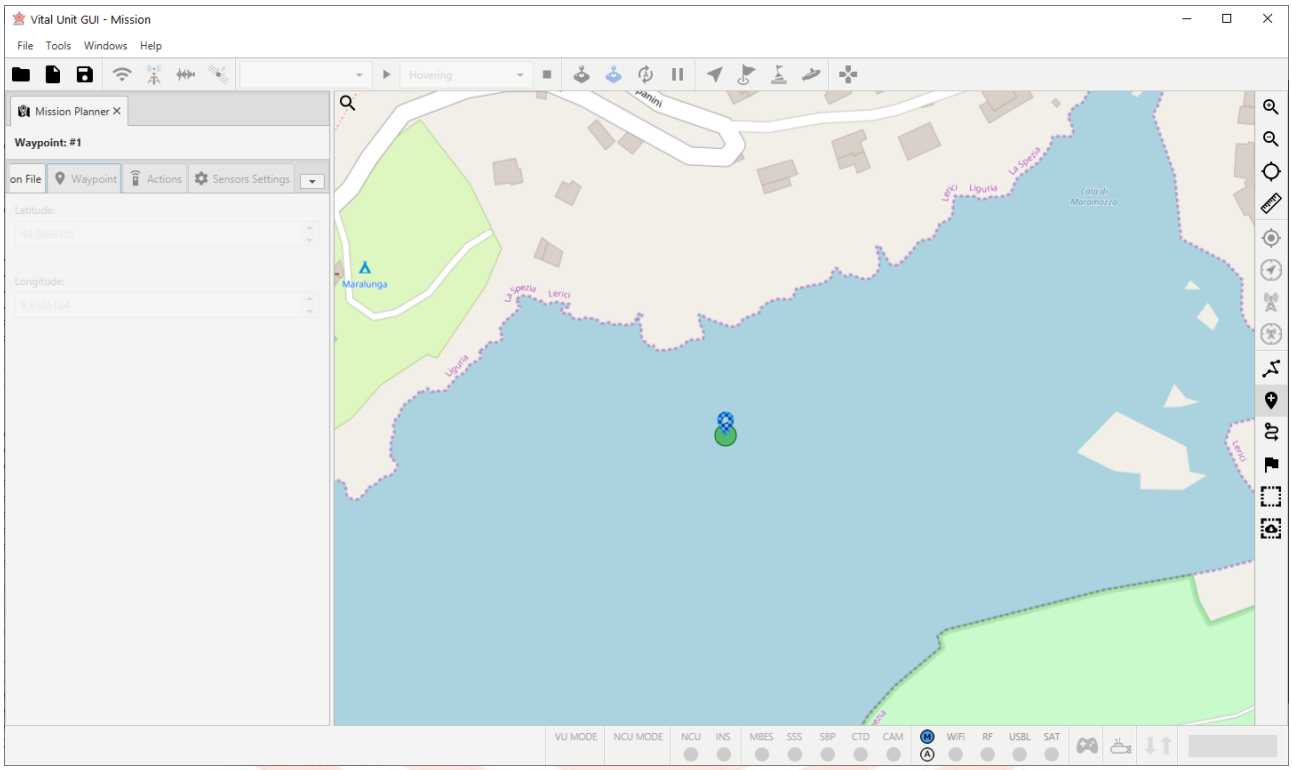


Figure 16 – Locked waypoint

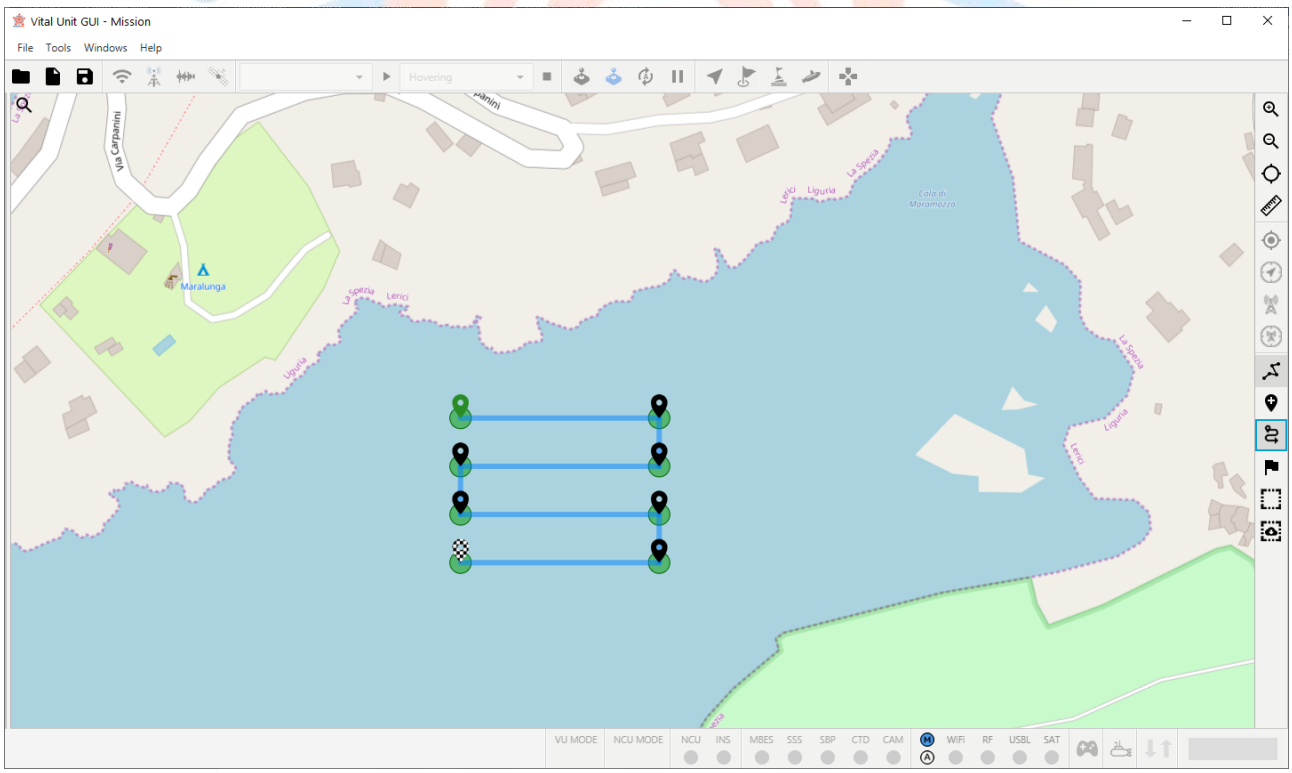


Figure 17 – Lawn mower

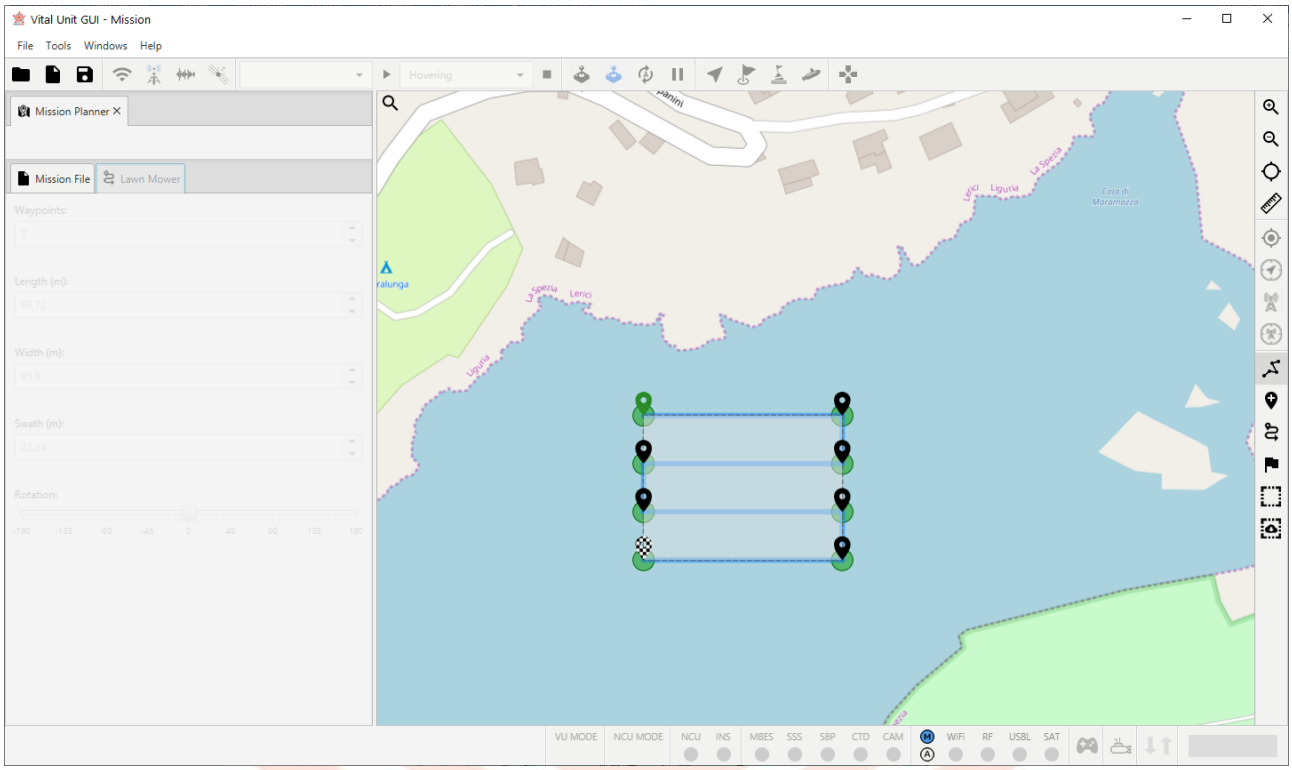


Figure 18 – Locked lawn mower

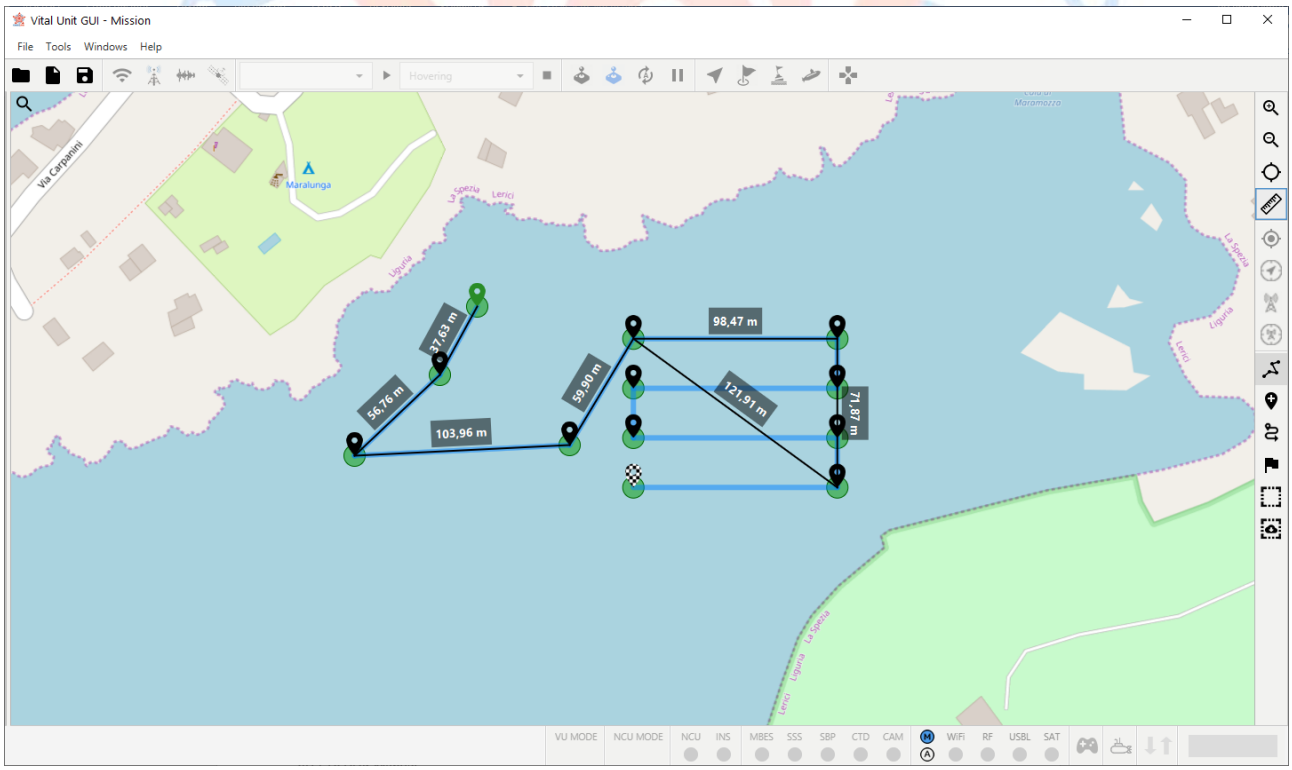


Figure 19 – Mission path combined with measurement lines

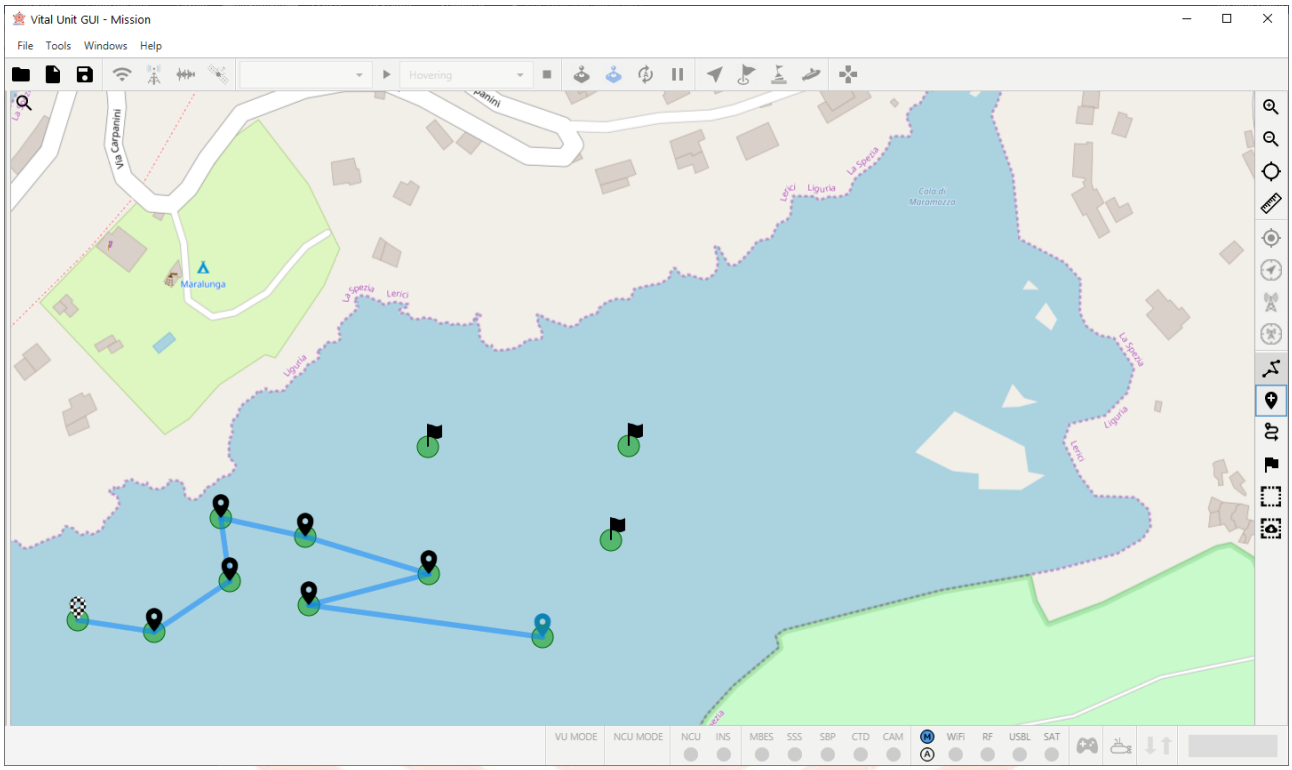


Figure 20 – Flags

11.3.13 Selection Tool

Click on the Selection Tool button to enable/disable the function that allows select multiple markers at same time (FIGURE 21 – SELECTION TOOLFigure 20 – Flags). When enabled, the operator can draw a rectangle on the map with a drag and drop gesture to select all markers contained by it.

11.3.14 Maps Downloader Tool

The Maps Downloader Tool allows the user to download the maps of a selected area (FIGURE 22 – DOWNLOADER TOOL: SELECTED AREA). When the tool is enabled, the operator can draw with a drag and drop gesture a rectangle on the map to cache all images of the area; a popup window consents to select the zoom levels to download only tails belong to the needed levels (FIGURE 23 – DOWNLOADER TOOL: DOWNLOAD DIALOG). The user can choose between "All levels", "Current zoom level" or "Custom selection". Selecting "All levels" will be downloaded all images at any zoom levels; selecting "Current zoom level" will be downloaded only the images that belong to the current zoom level; selecting "Custom selection" will be downloaded images that belongs to the provided levels (FIGURE 24 – DOWNLOADER TOOL: DOWNLOAD IN PROGRESS).

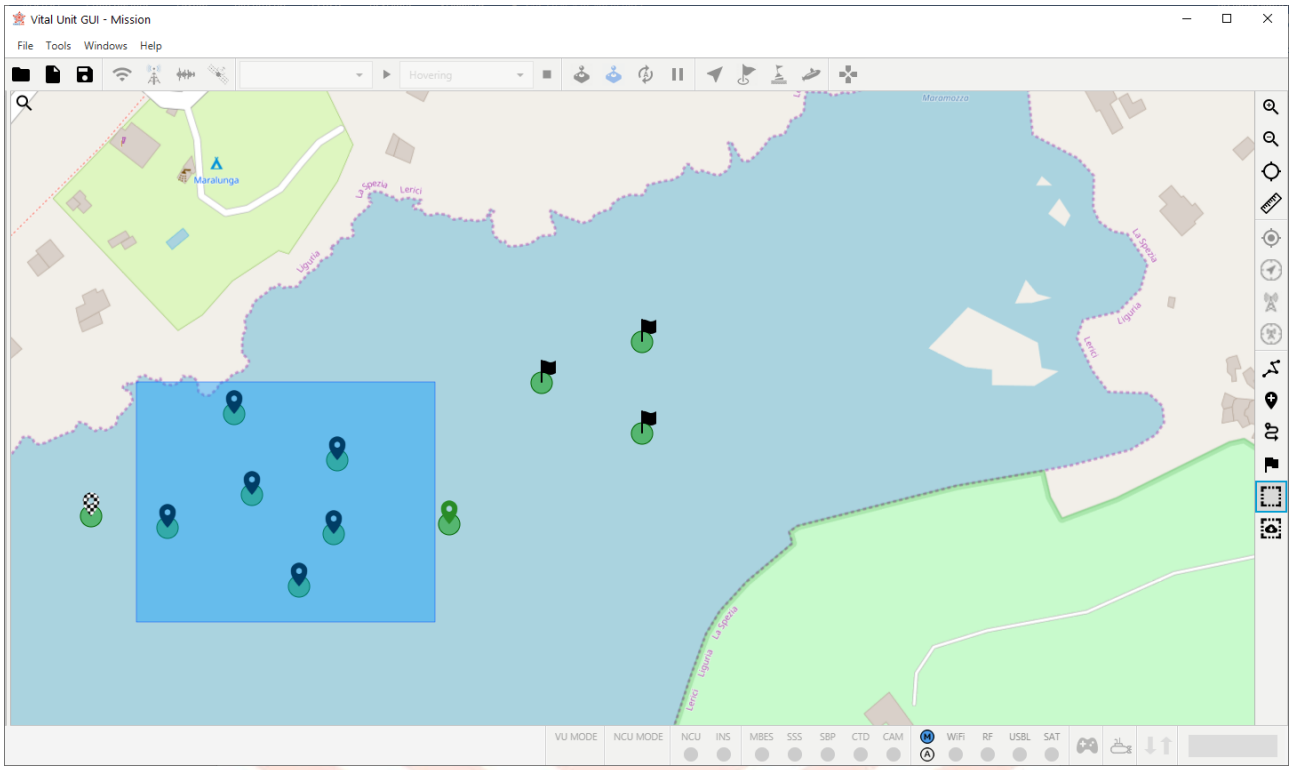


Figure 21 – Selection Tool

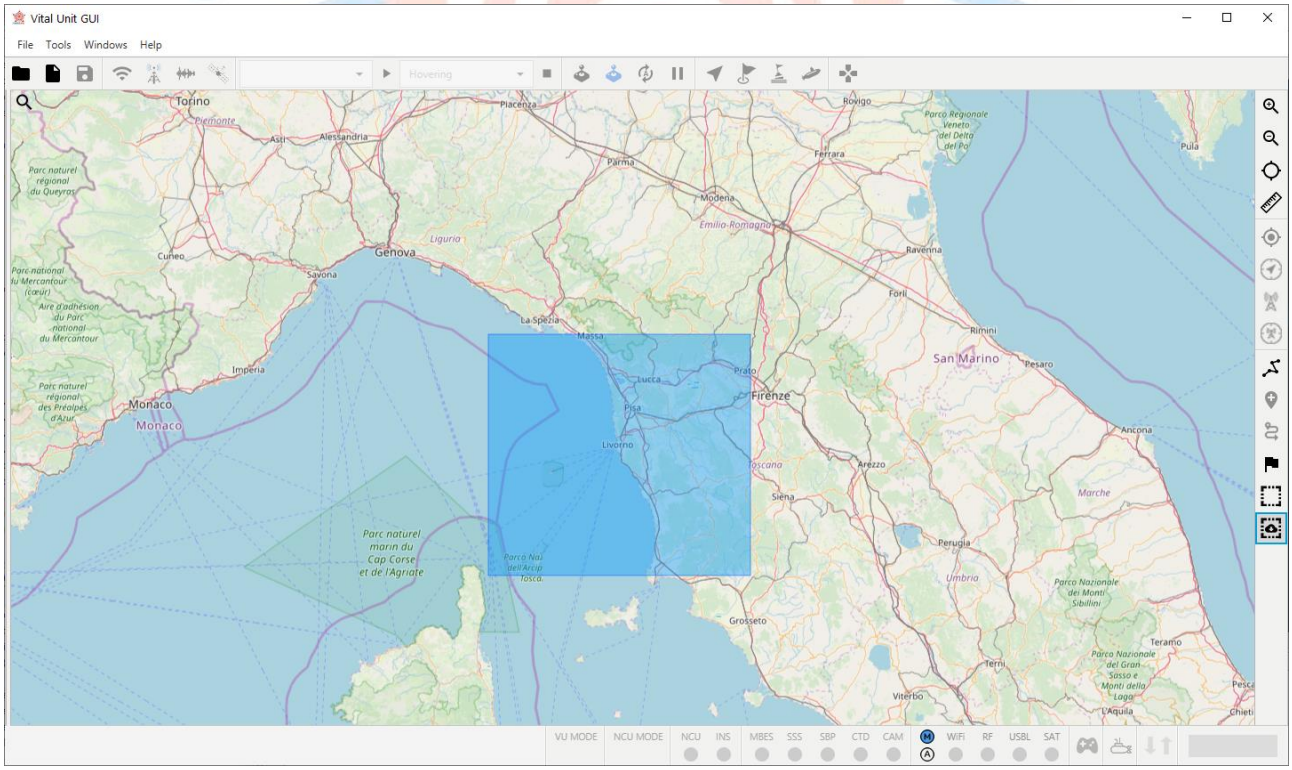


Figure 22 – Downloader Tool: selected area

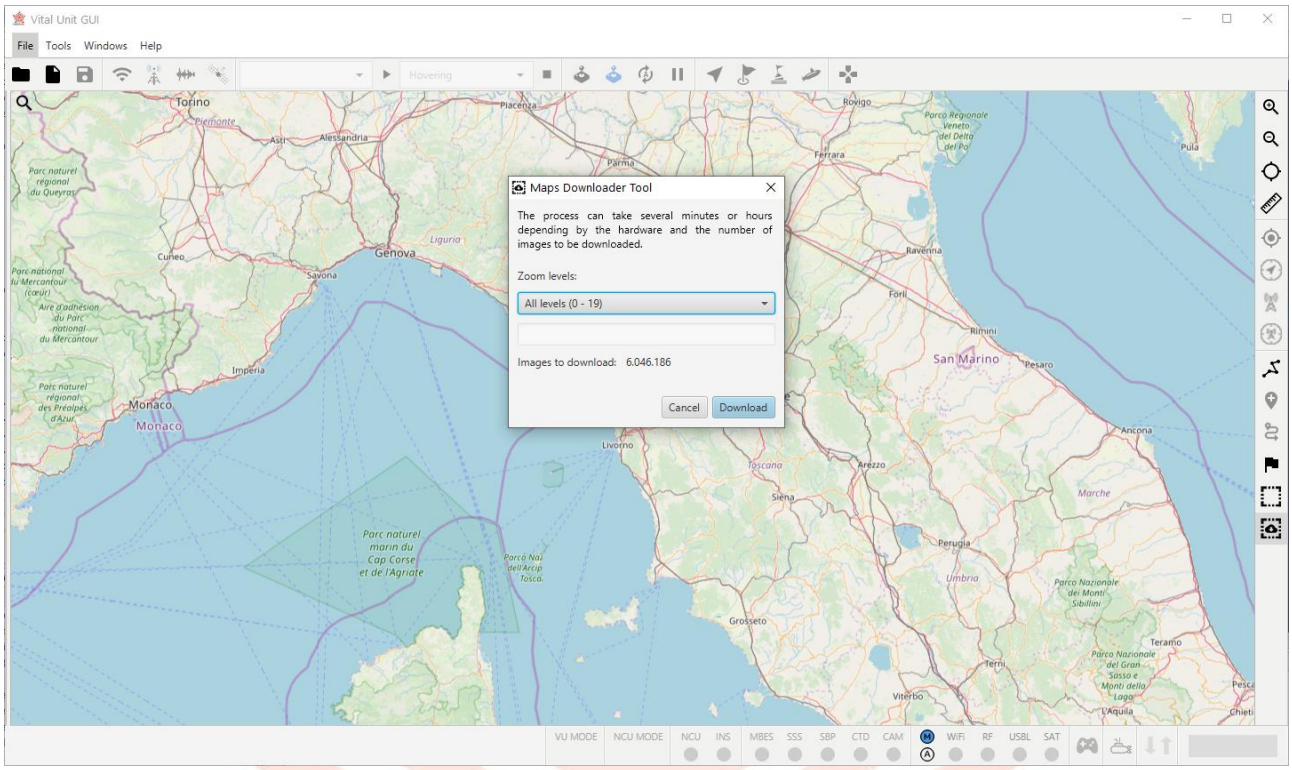


Figure 23 – Downloader Tool: download dialog

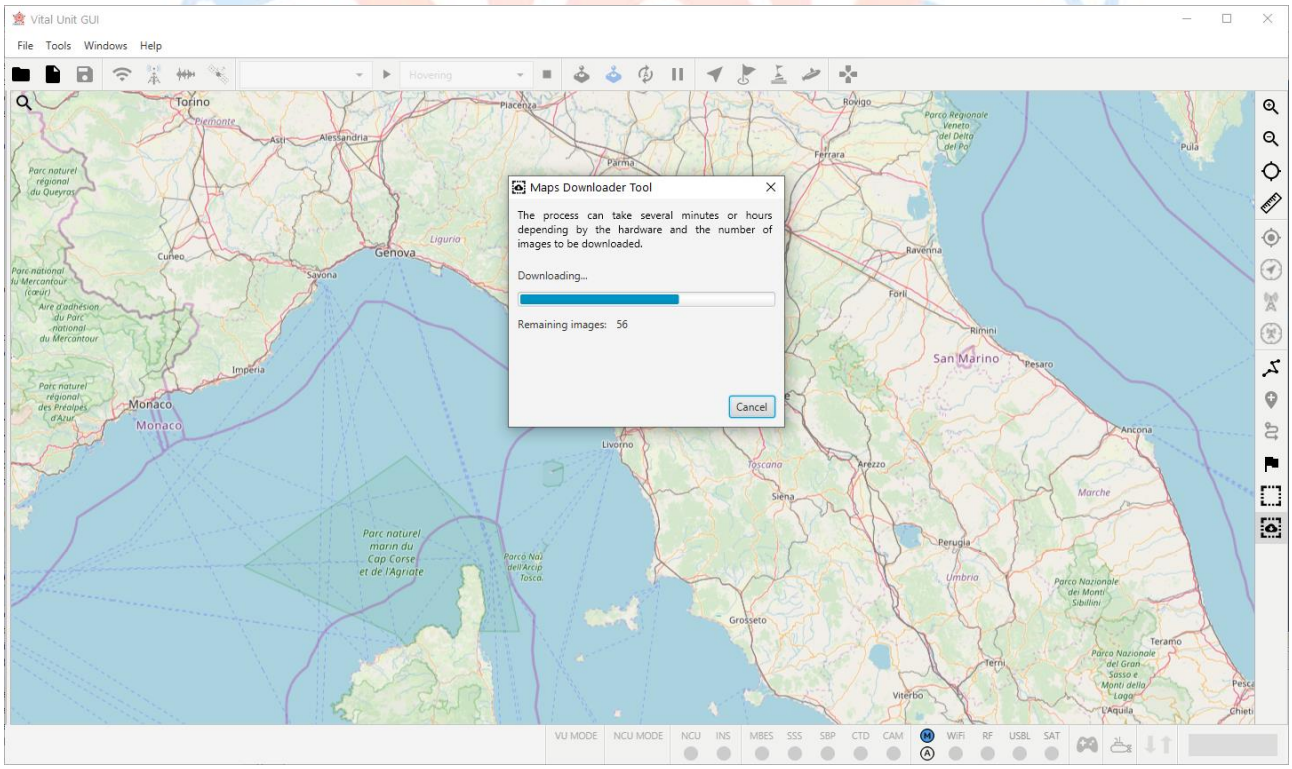


Figure 24 – Downloader Tool: download in progress

11.4 The Windows Pane

The Windows Pane is a tabbed pane component that organizes all the features offered by the system in tabs (FIGURE 25 – THE WINDOWS PANE). The VU-GUI architecture is modular, so if a developer wants to add extra features to the system, shall extends a set of Java classes needed to build his custom module and the piece of user interface that will be showed inside a tab of the Windows Pane.

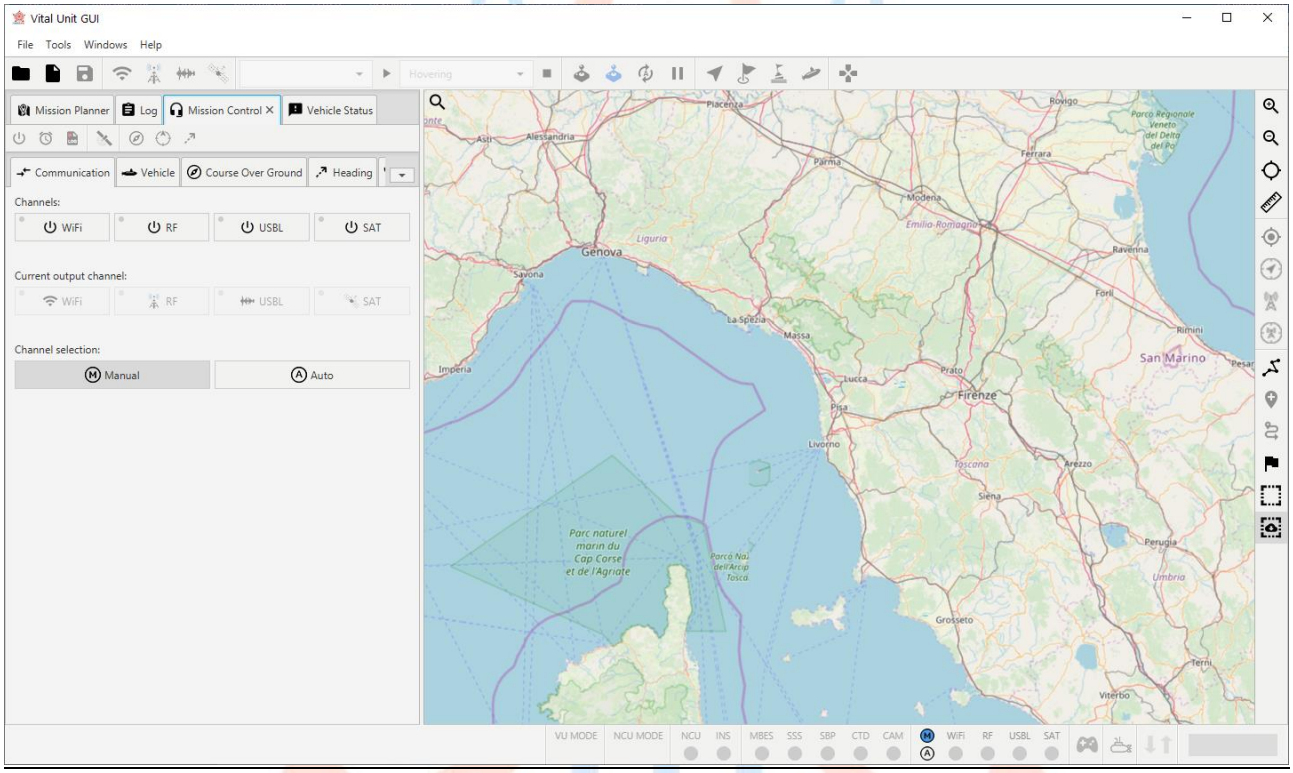


Figure 25 – The Windows Pane

The Window can be closed, opened (FIGURE 26 – WINDOW OPENING, FIGURE 27 – WINDOW OPENED) or transferred to a new window (FIGURE 28 – MISSION CONTROL TRANSFERRED IN A NEW WINDOW).

To transfer a Window in a new window, the user shall click with the mouse right button on its tab and select "Open in new window" from the tooltip menu displayed.

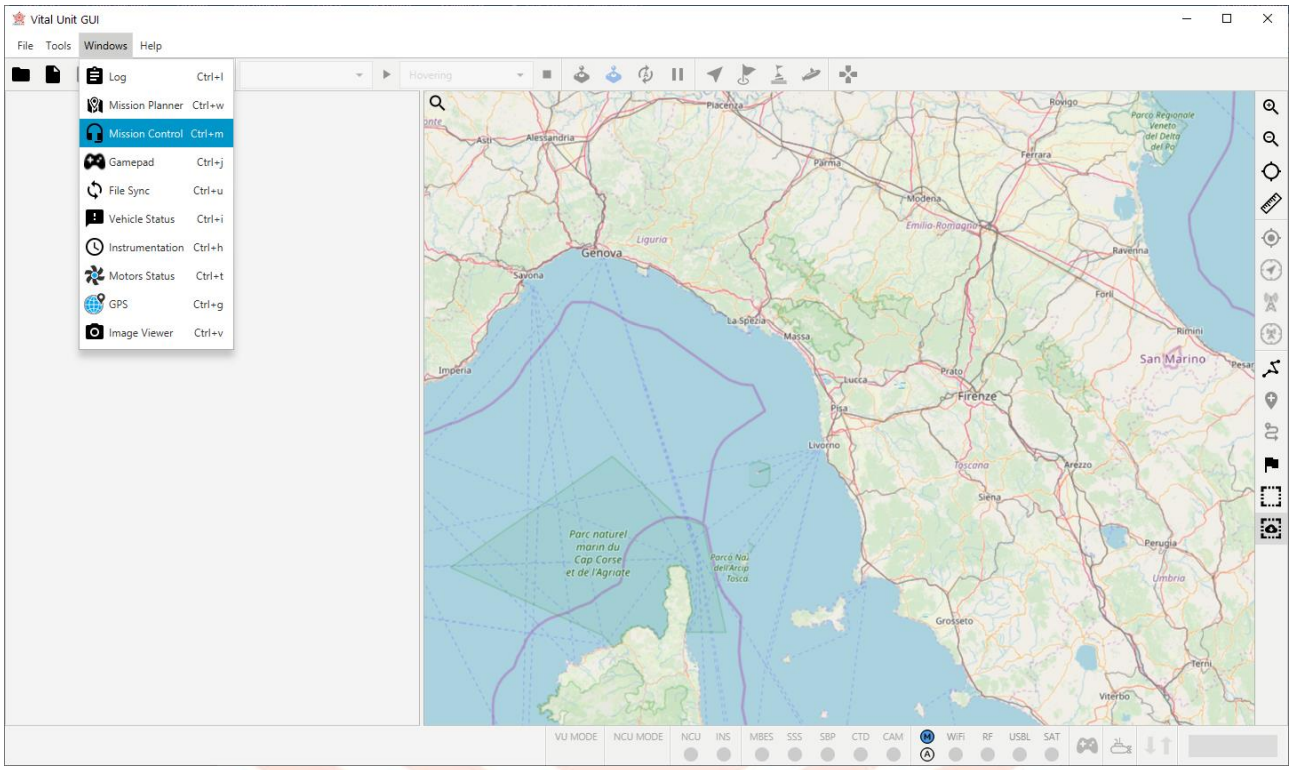


Figure 26 – Window opening

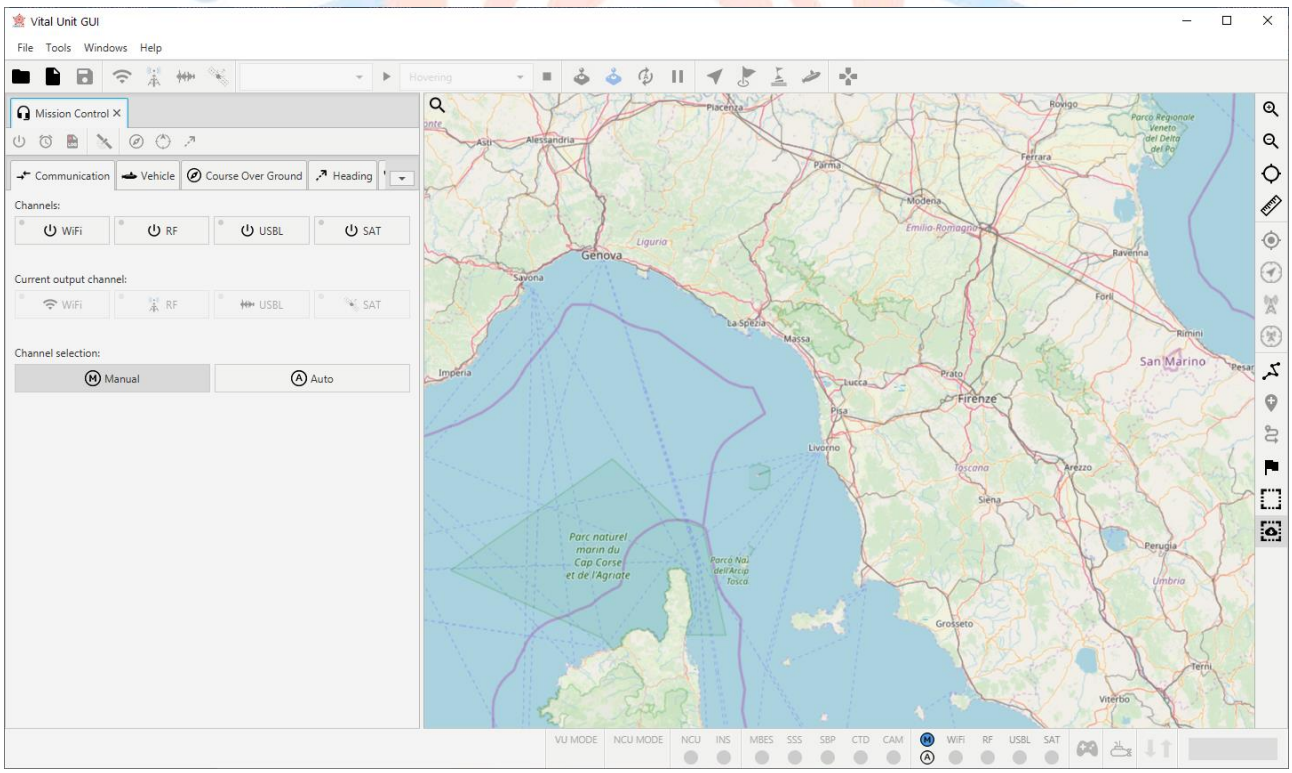


Figure 27 – Window opened

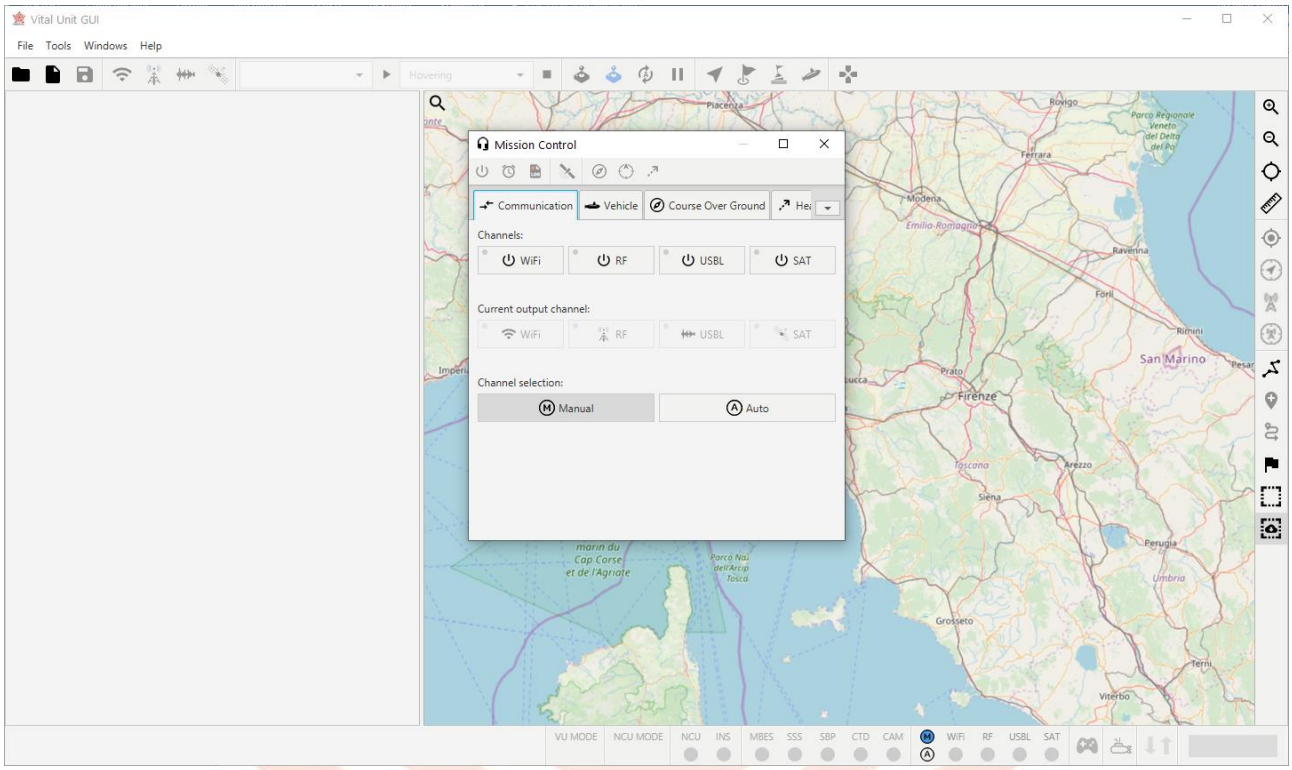


Figure 28 – Mission Control transferred in a new window

12 The Setting View

The Setting View allows an operator to adjust configurable parameters of the system or of an extra module installed on the VU-GUI. The Setting View can be displayed clicking on the menu Tools > Settings… from the Menu Bar (10.1 THE MENU BAR).
The parameters are grouped in a tree with the root node indicating the name of the category of membership and the child nodes indicating a more specialized name for the type of settings that can be configured. Clicking on a child node will displayed its configuration pane with the list of all parameter that the operator can set.

12.1 General

The General category provides settings that affect the entire system.

12.1.1 Logging

The Logging configuration pane allows to enable/disable the debug mode of the system (FIGURE 29 – SETTINGS: GENERAL > LOGGING).

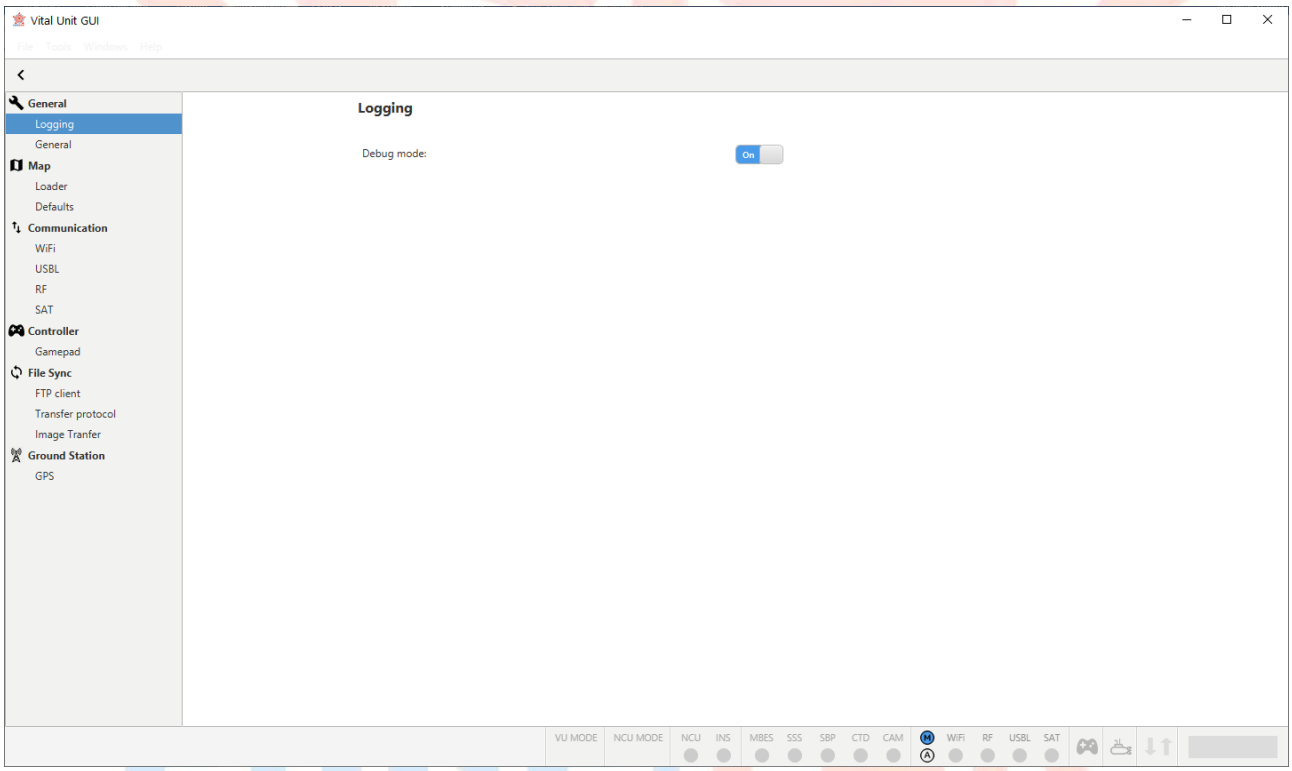


Figure 29 – Settings: General > Logging

To enable/disable the debug mode, the user shall click on the switch button with the label "Debug mode". A dialog informs the user that the application should be restarted to make changes effective; clicking on the "yes" button the VU-GUI will be restarted automatically, otherwise the user shall take care to restart the application manually.

When the debug mode is enabled, the system logs any kinds of messages and creates a log file where store them (2 SOFTWARE OUTPUT).

12.1.2 General

The General configuration pane allows to enable/disable the hardware acceleration and sound alerts (FIGURE 30 – SETTINGS: GENERAL > GENERAL).

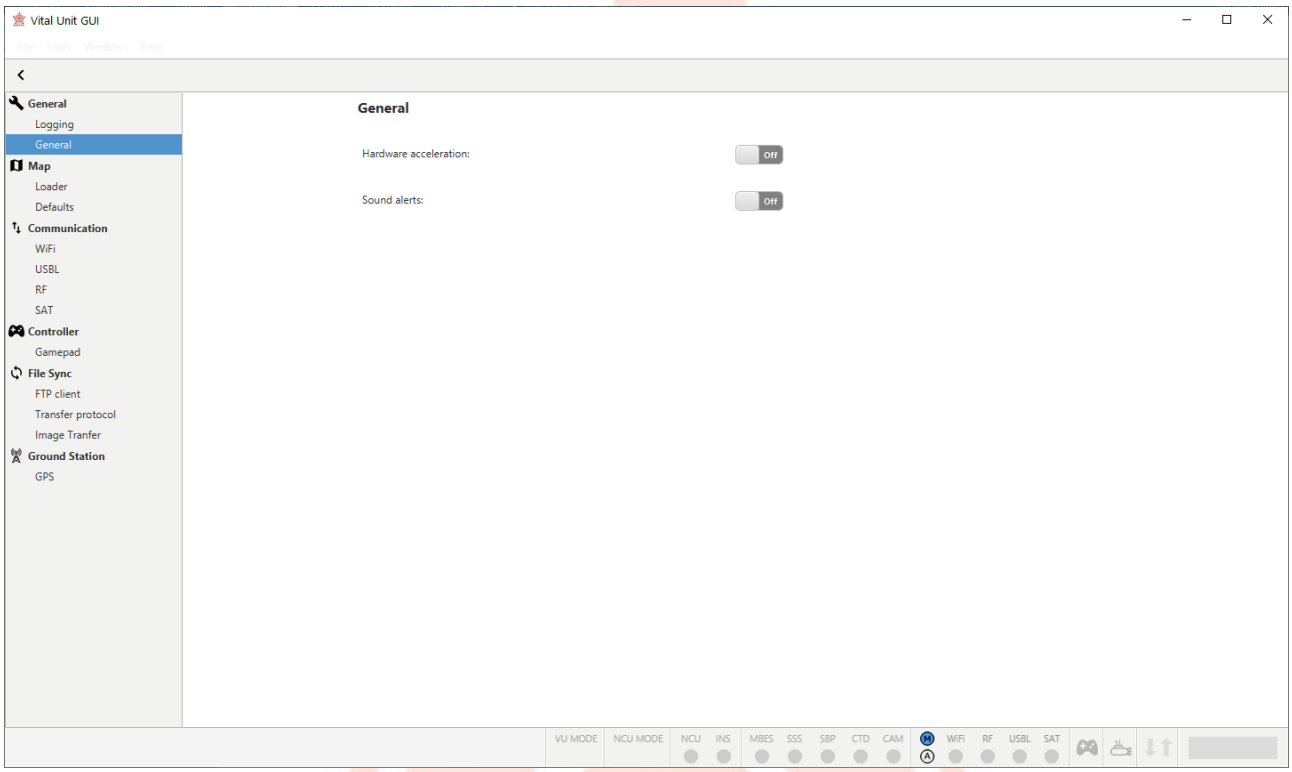


Figure 30 – Settings: General > General

The operator can enable the hardware acceleration to improve the system's graphics performance; it is recommended to disable this feature if you notice graphical glitches.
Enabling the “Sound alerts”, the system will produce sound alerts when the vehicle could be in a potential danger situation.

12.2 Map

The Map category provides settings that allow to configure several map aspects.

12.2.1 Loader

The Loader configuration pane allows the operator to configure the software component used to load the maps. The default loaded of the system is the “Open Street Map” loader that uses the Open Street Map servers to download the maps (FIGURE 31 – SETTINGS: MAP > Loader).

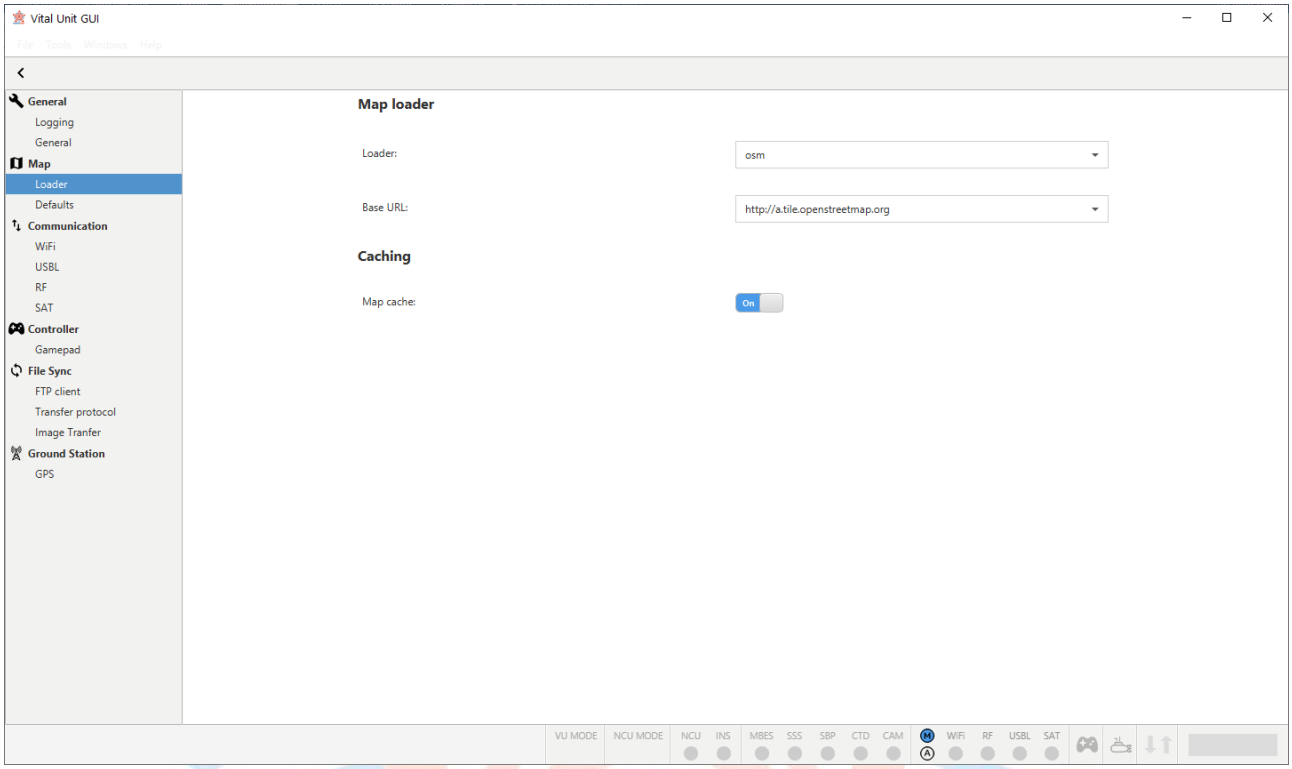


Figure 31 – Settings: Map > Loader

The operator can select the base URL used to download the maps between those provided by the choice box with the label "Base URL".

Moving the "Map cache" switch to the "On" position, all maps downloaded will be stored on the local disk in the workspace directory.

12.2.2 Defaults

The Defaults configuration pane contains the settings used to set the initial position of the map when is loaded for the first time, e.g. when the application is started or a new mission is created (FIGURE 32 – SETTINGS: MAP > DEFAULTS).

The operator can set the default latitude, longitude and zoom level; so, when the application is started or a new mission is created, the map will be displayed with that zoom level and at that location.

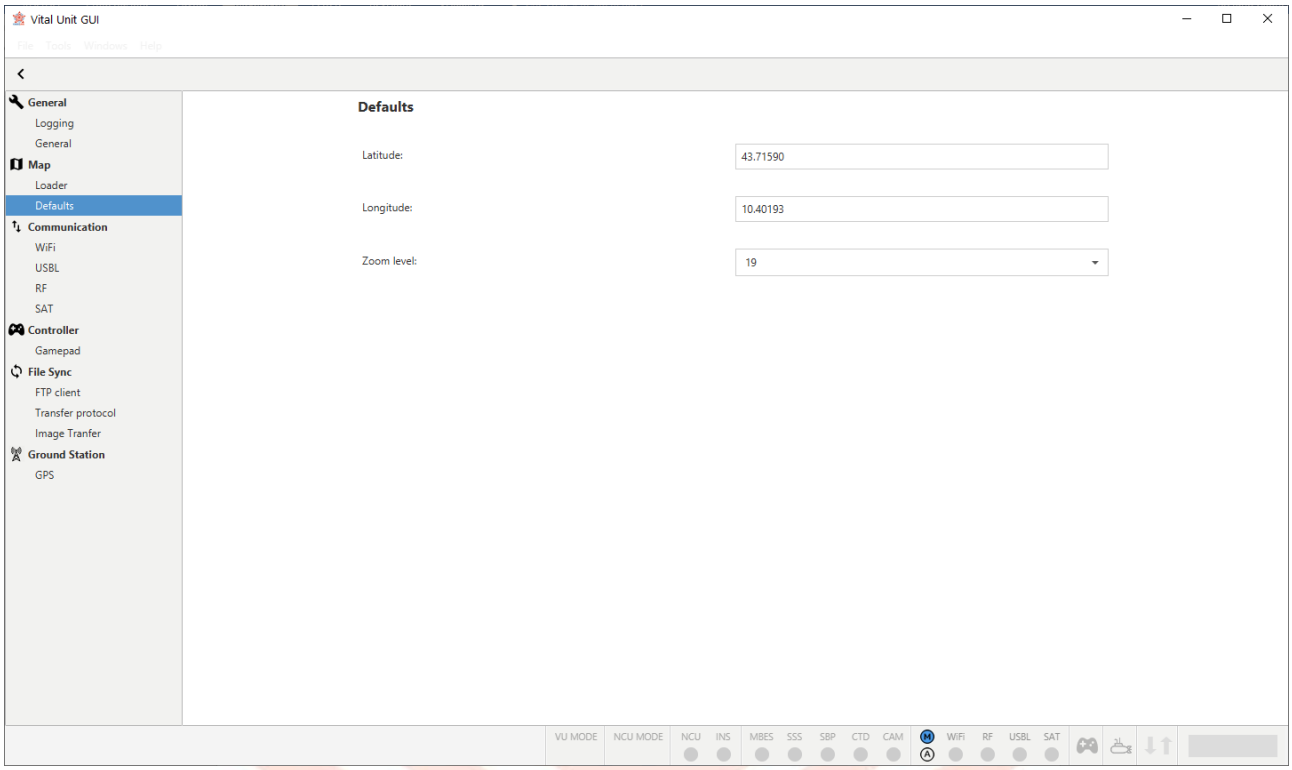


Figure 32 – Settings: Map > Defaults

12.3 Communication

The Communication category provides settings that affect the communication channels.

12.3.1 WiFi

The operator uses the WiFi configuration pane to set up the WiFi communication channel (FIGURE 33 – SETTINGS: COMMUNICATION > WIFI).

The "Local host" section gives information about the local host name and IP address and contains the field where the user can set the local port used to receive messages from the vehicle.

The "Vital Unit" section provides the fields where the user can set the remote IP address and port to send messages to the vehicle.

In the "Timing" section, the user can set:

Timeout: the maximum waiting time for receiving a reply message from the vehicle.
Retries: the maximum number of attempts to send a message to the vehicle.
Polling rate: defines how often the VU-GUI polls the status information of the vehicle.

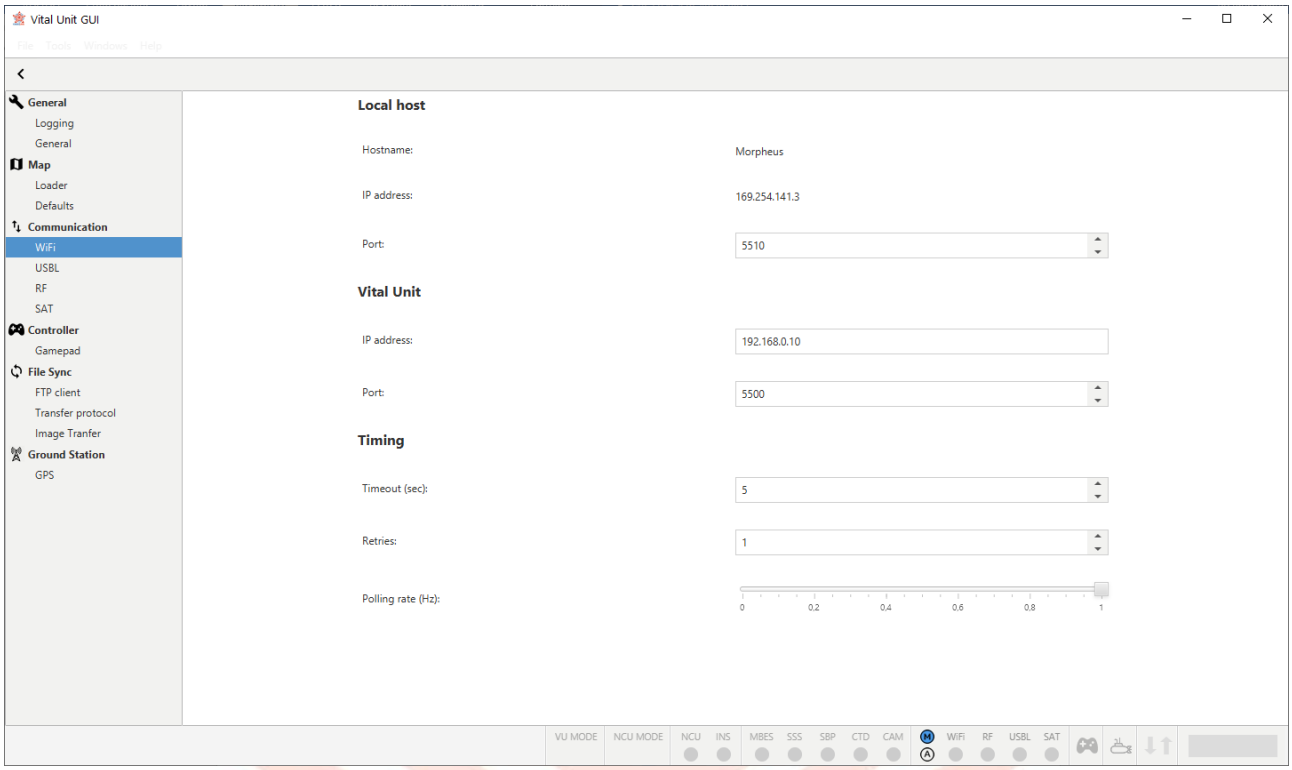


Figure 33 – Settings: Communication > WiFi

12.3.2 USBL

The operator uses the USBL configuration pane to set up the USBL communication channel (FIGURE 34 – SETTINGS: COMMUNICATION > USBL).

The "Local host" section gives information about the local host name and IP address and contains the field where the user can set the local port used to receive messages from the vehicle.

The "Vital Unit" section provides the fields where the user can set the remote IP address and port to send messages to the vehicle.

In the "Timing" section, the user can set:

Timeout: the maximum waiting time for receiving a reply message from the vehicle.
Retries: the maximum number of attempts to send a message to the vehicle.
Polling rate: defines how often the VU-GUI polls the status information of the vehicle.

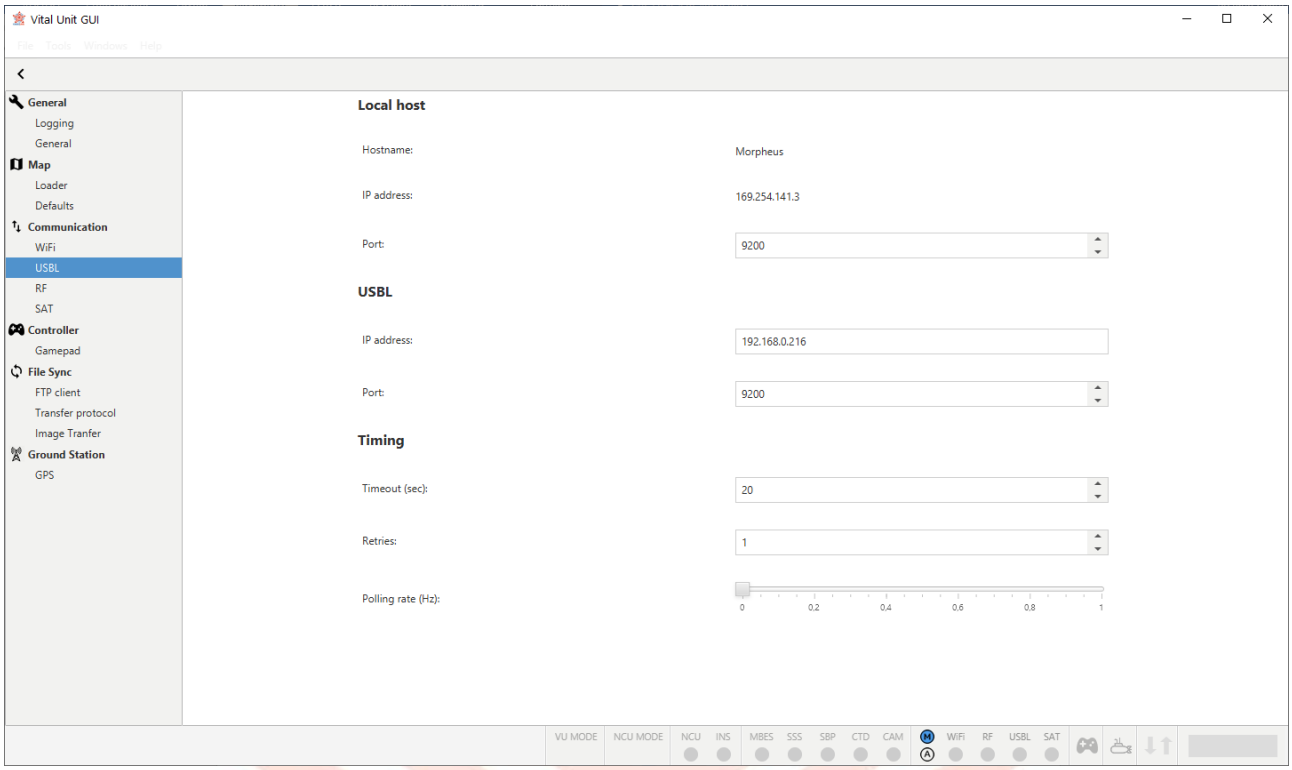


Figure 34 – Settings: Communication > USBL

12.3.3 RF

The operator uses the RF configuration pane to set up the RF communication channel (FIGURE 35 – SETTINGS: COMMUNICATION > RF).

The "Serial Port" section contains the fields where user can set the serial port parameters.
A valid configuration for the Digi XTEND module is:

Port: the name of the serial port where the module is connected, e.g. *COM1*
Baud rate: 9600
Data bits: 8
Parity: none
Stop bits: 1
Flow control: none

In the "Timing" section, the user can set:

Timeout: the maximum waiting time for receiving a reply message from the vehicle.
Retries: the maximum number of attempts to send a message to the vehicle.
Polling rate: defines how often the VU-GUI polls the status information of the vehicle.

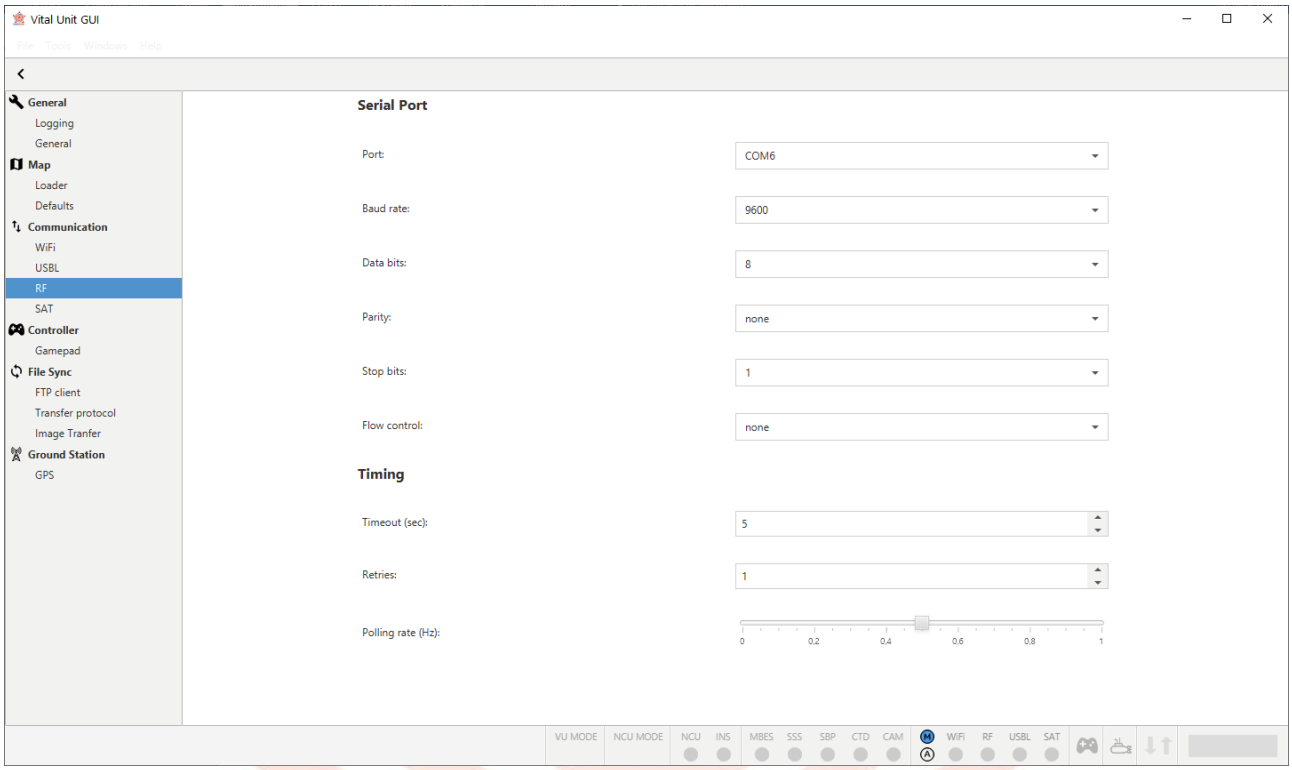


Figure 35 – Settings: Communication > RF

12.3.4 SAT

The operator uses the SAT configuration pane to set up the SAT communication channel (FIGURE 36 – SETTINGS: COMMUNICATION > SATFigure 35 – Settings: Communication > RF).

The "Serial Port" section contains the fields where user can set the serial port parameters.
A valid configuration for the RockBLOCK module is:

Port: the name of the serial port where the module is connected, e.g. *COM1*
Baud rate: 19200
Data bits: 8
Parity: none
Stop bits: 1
Flow control: none

The "RockBLOCK module" section contains the status led that give a visual feedback of the correct functioning of the module when it is enabled.

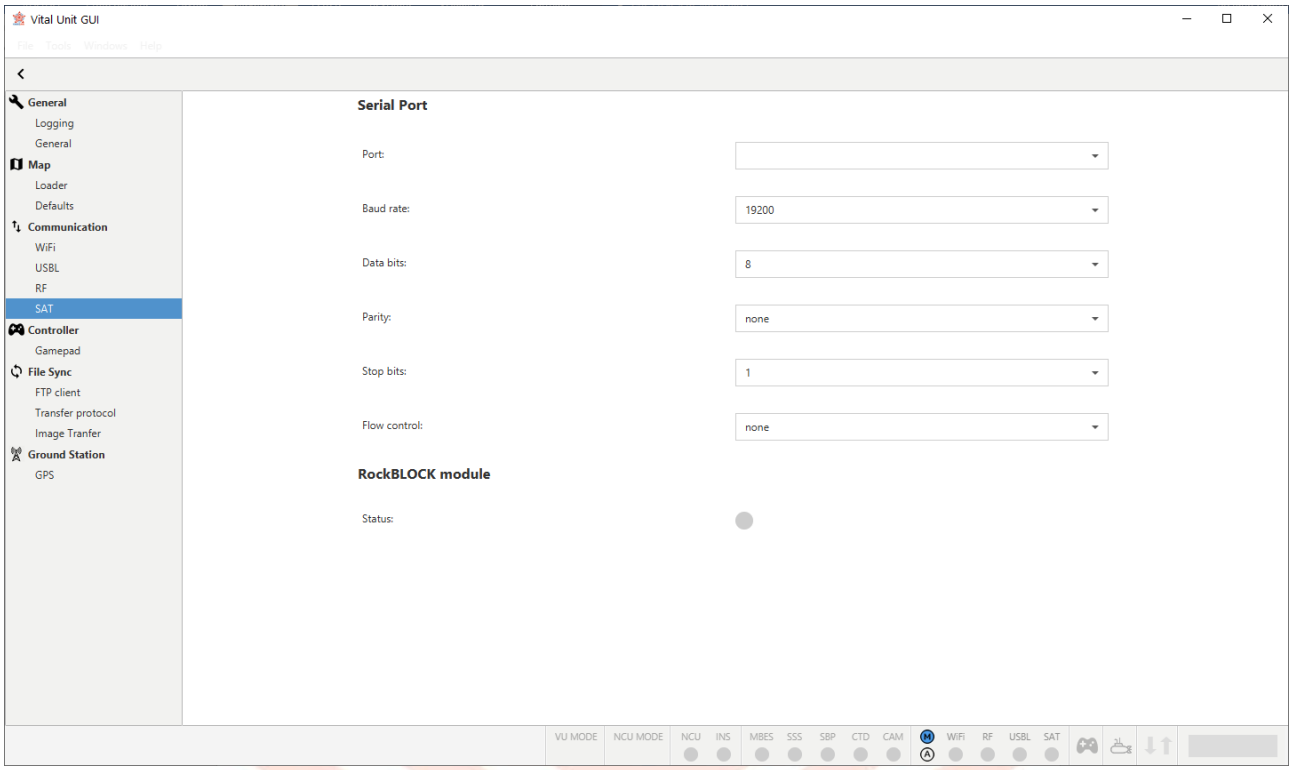


Figure 36 – Settings: Communication > SAT

12.4 Controller

The Controller category provides settings that affect the controller used to control the vehicle movements.

12.4.1 Gamepad

The operator accesses the Gamepad configuration pane to set up the controller (FIGURE 37 – SETTINGS: CONTROLLER > GAMEPADFigure 35 – Settings: Communication > RF).

The controller shall be selected between those provided by the choice box. Please note that controller shall be installed and activated before to run the VU-GUI.

The "Polling rate" slider allows the user to set the rate at which the gamepad commands are sent to the vehicle.

The user can use the "Force feedback" switch to enable/disable the gamepad force feedback; if it is enabled, the gamepad will begin to vibrate when the motors of the vehicle are active. The vibration intensity increases with the rotation of the motors.

The user can use the “Invert Axis x” switch to invert the Axis x of the gamepad. Invert means you press the stick in the opposite direction that you want to move the vehicle; so, left is right and right is left.

The user can use the “Invert Axis y” switch to invert the Axis y of the gamepad. Invert means you press the stick in the opposite direction that you want to move the vehicle; so, up is down and down is up.

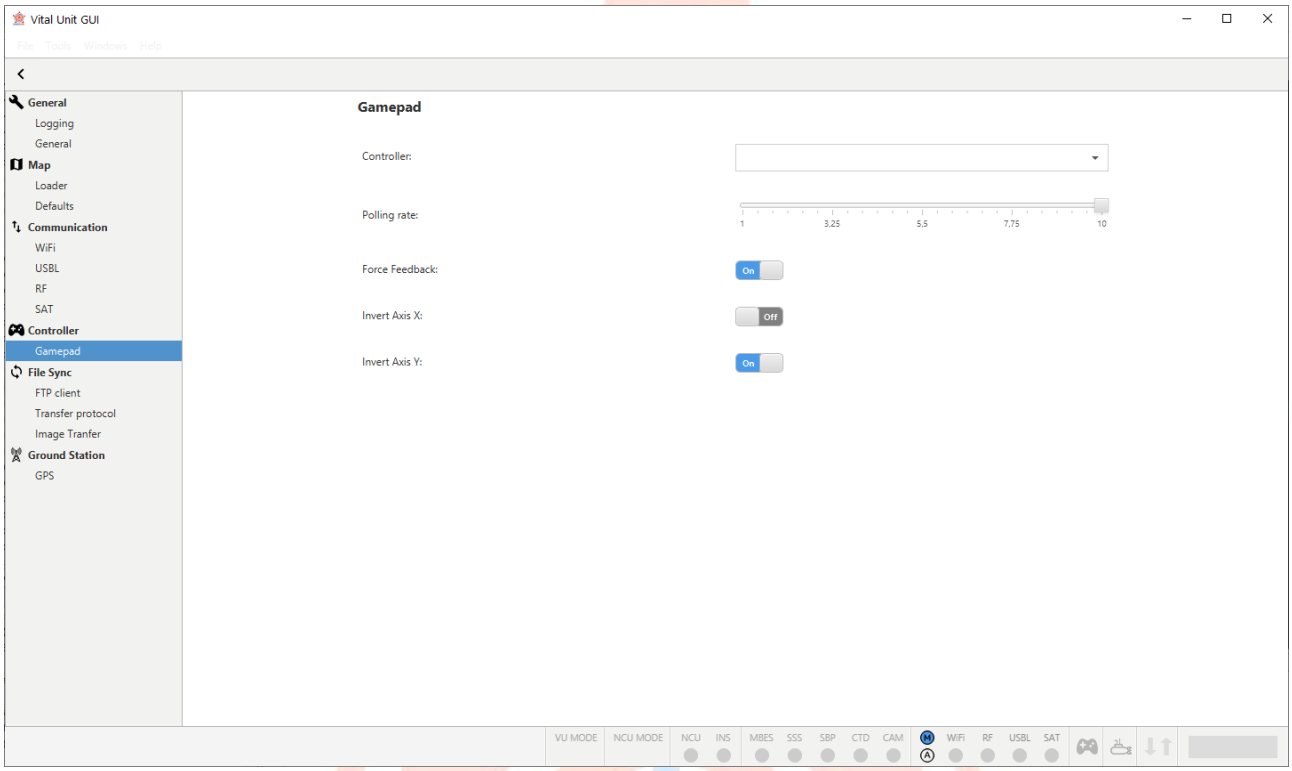


Figure 37 – Settings: Controller > Gamepad

12.5 File Sync

The File Sync category provides settings that affect the file transfer.

12.5.1 FTP client

The operator accesses the FTP client configuration pane to set up the FTP connection (FIGURE 38 – SETTINGS: FILE SYNC > FTP CLIENTFigure 35 – Settings: Communication > RF). Please note that the FTP communication is allowed only on WiFi channel.

The operator can set the hostname of the remote host with which establish a FTP connection and the usernames and passwords to access the missions and logs directories on the vehicle.

The default configuration is:

Hostname: 192.168.1.10

Mission directory
Name: auvguimission
Password: guiauv

Log Directory
Name: auvguilog
Password: guiauv

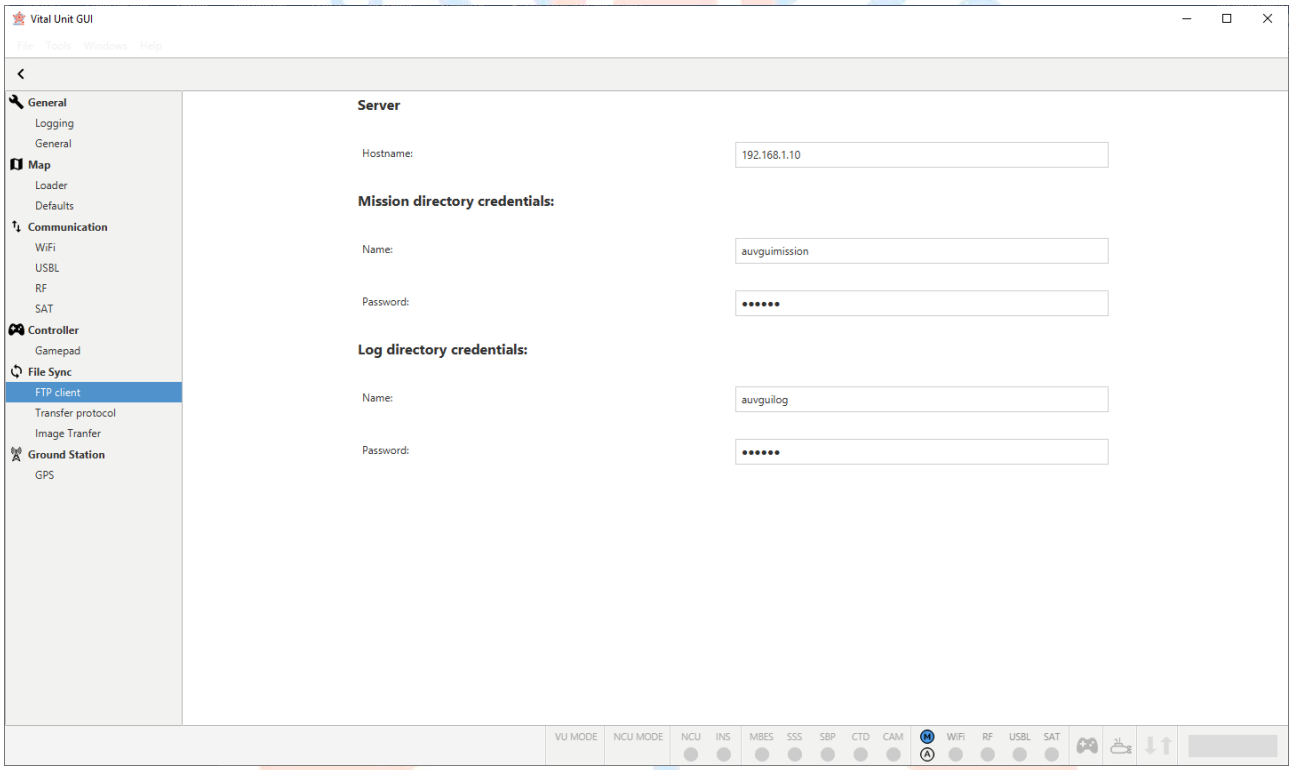


Figure 38 – Settings: File Sync > FTP client

12.5.2 Transfer protocol

The operator accesses the Transfer protocol configuration pane to set up the file transfer protocol (FIGURE 39 – SETTINGS: FILE SYNC > TRANSFER PROTOCOLFigure 35 – Settings: Communication > RF). Please note that this kind of protocol is used only to transfer files over RF and USBL channels.

The operator can set the Maximum Transmission Unit and the number of retries of the RF and USBL channel.

The first parameter indicates the maximum dimension of a packet sent over the channel.

The second parameter indicates the maximum number of retries performed by the transfer protocol to receive a valid frame over the channel.

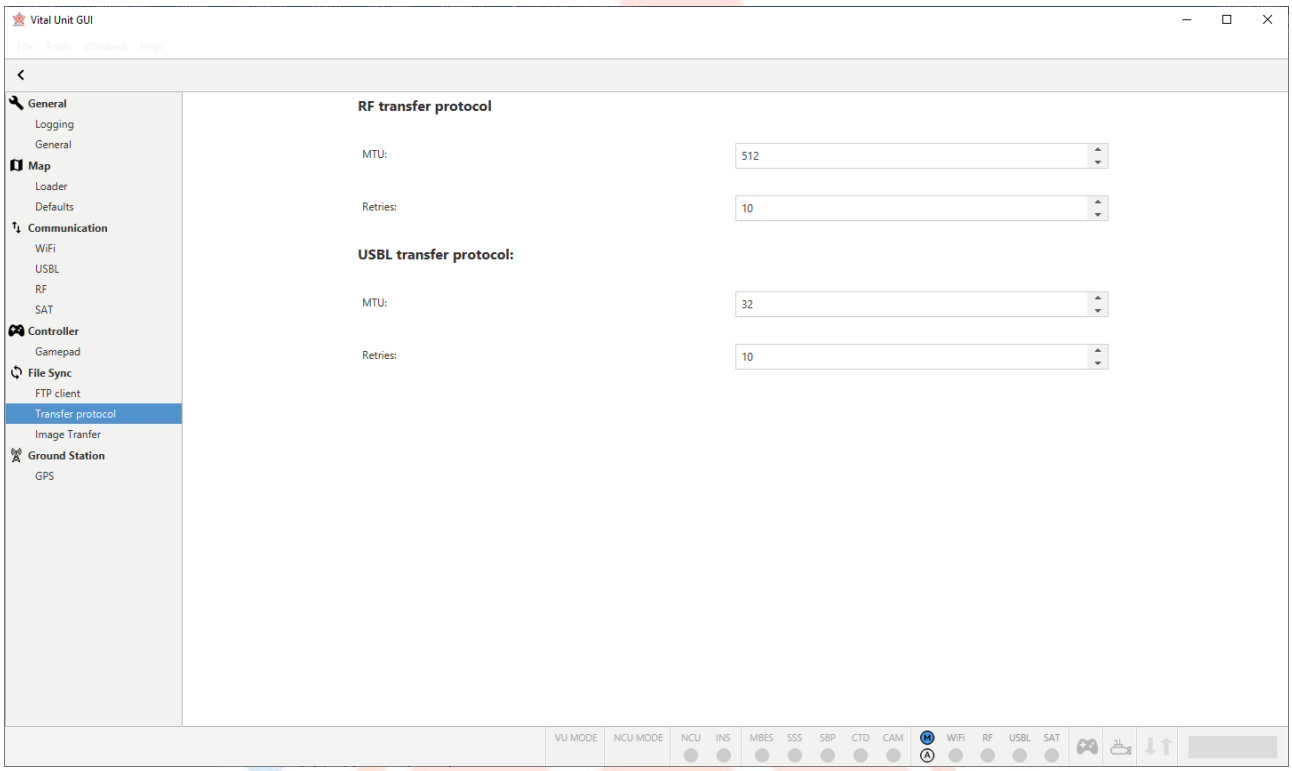


Figure 39 – Settings: File Sync > Transfer protocol

12.5.3 Image transfer

The operator accesses the Image Transfer protocol configuration pane to set up the image transfer protocol (FIGURE 40 – SETTINGS: FILE SYNC > IMAGE TRANSFERFigure 35 – Settings: Communication > RF). Please note that this kind of protocol is used only to transfer image over the USBL channel.

The operator can set:

- The *local port* to witch the image transfer service is connected to receive the image;
- The *remote IP* address and *port* used to establish the connection with the remote process that takes care to transfer the image.
- The *MTU* of the packet sent over the channel.

The default configuration is:

Local Host

Port: 9300

USBL
IP address: 192.168.0.216
Port: 9203
MTU: 128

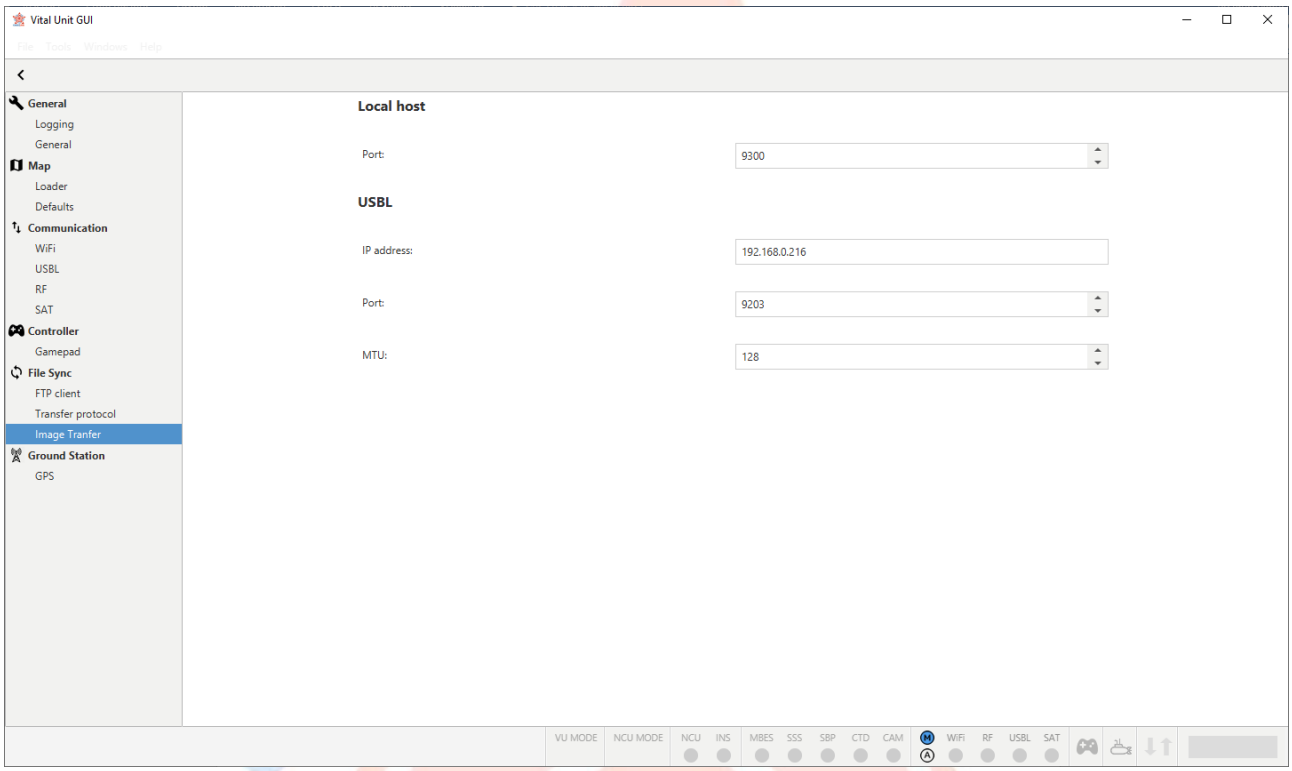


Figure 40 – Settings: File Sync > Image Transfer

12.6 Ground station

The File Sync category provides settings that affect the Ground Station.

12.6.1 GPS

The operator accesses the GPS configuration pane to set up the communication with the GPS module (FIGURE 41 – SETTINGS: GROUND STATION > GPSFigure 35 – Settings: Communication > RF).

The "Serial Port" section contains the fields where user can set the serial port parameters.
A valid configuration for the GPS module is:

Port: the name of the serial port where the module is connected, e.g. *COM1*
Baud rate: 19200
Data bits: 8

Parity: none
Stop bits: 1
Flow control: none

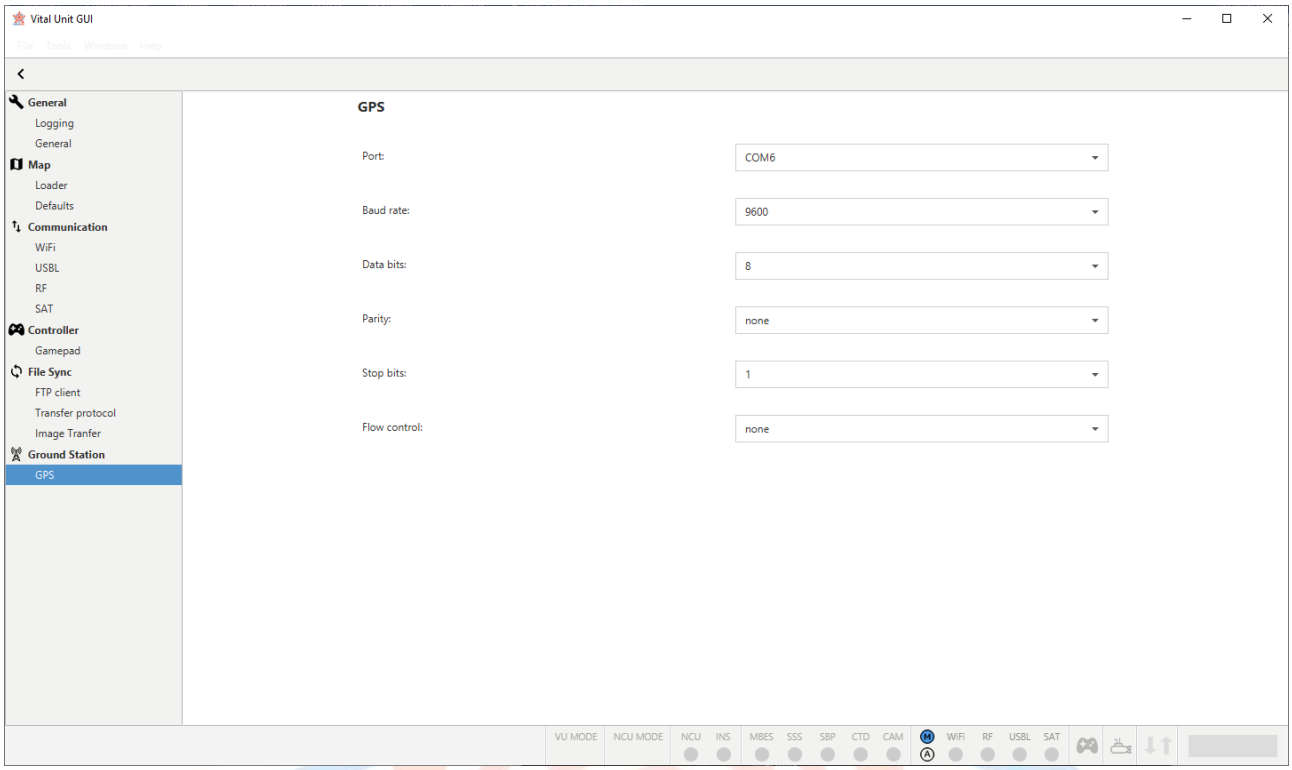


Figure 41 – Settings: Ground Station > GPS

13 Windows

The features of the VU-GUI are organized in windows contained by the Windows Pane (11.4 THE WINDOWS PANE). Each window extends the system adding its own user interface that can be used to perform specific functions. The scope of this chapter is to give a detailed description of the VU-GUI windows and their functions, what there are for and how use them.

13.1 Mission Planner

The Mission Planner windows provides tools need to plan a mission. The interface is a tabbed pane that contains a tab for each configurable element of a mission. There are five different tabs that become available when a mission file is created or at least a waypoint or a lawn mower is selected.

13.1.1 Mission file tab

This tab is available as soon as a mission file is created. It shows informations about the name of the mission, the time zone, the number of waypoints and the lawn mowers present in the mission (FIGURE 42 – MISSION PLANNER: MISSION FILE TAB).

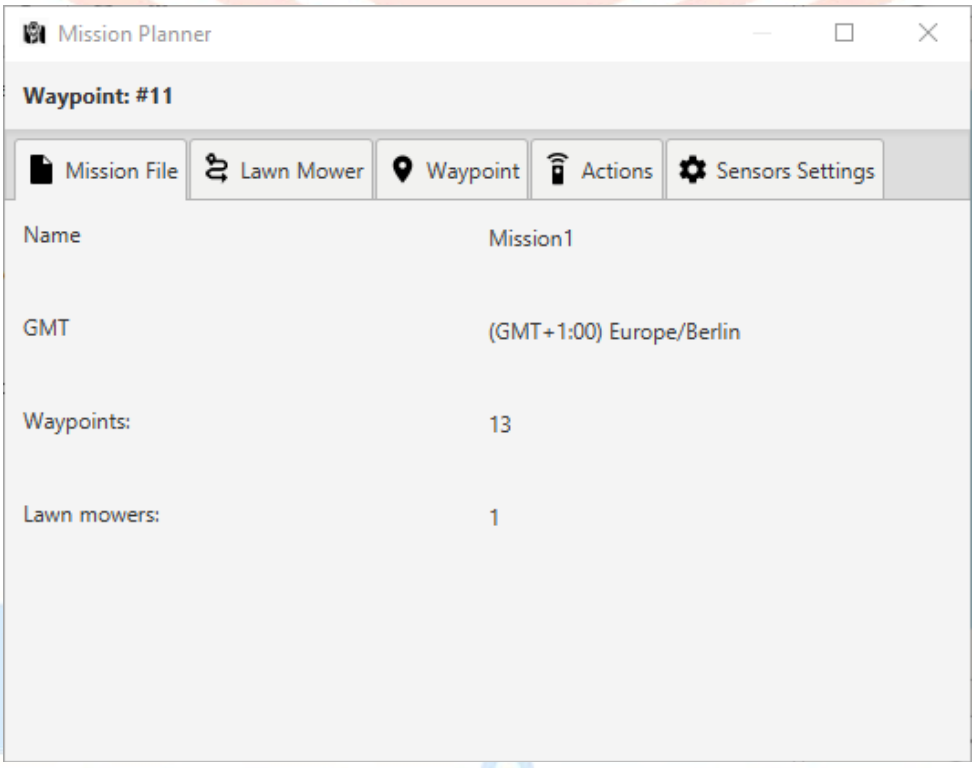


Figure 42 – Mission Planner: Mission file tab

13.1.2 Lawn Mower tab

The Lawn Mower tab is available only when only one lawn mower is selected on the map. The tab provides tools to modify its number of waypoints, the width, the swath, the length and rotation (FIGURE 43 – MISSION PLANNER: LAWN MOWER).

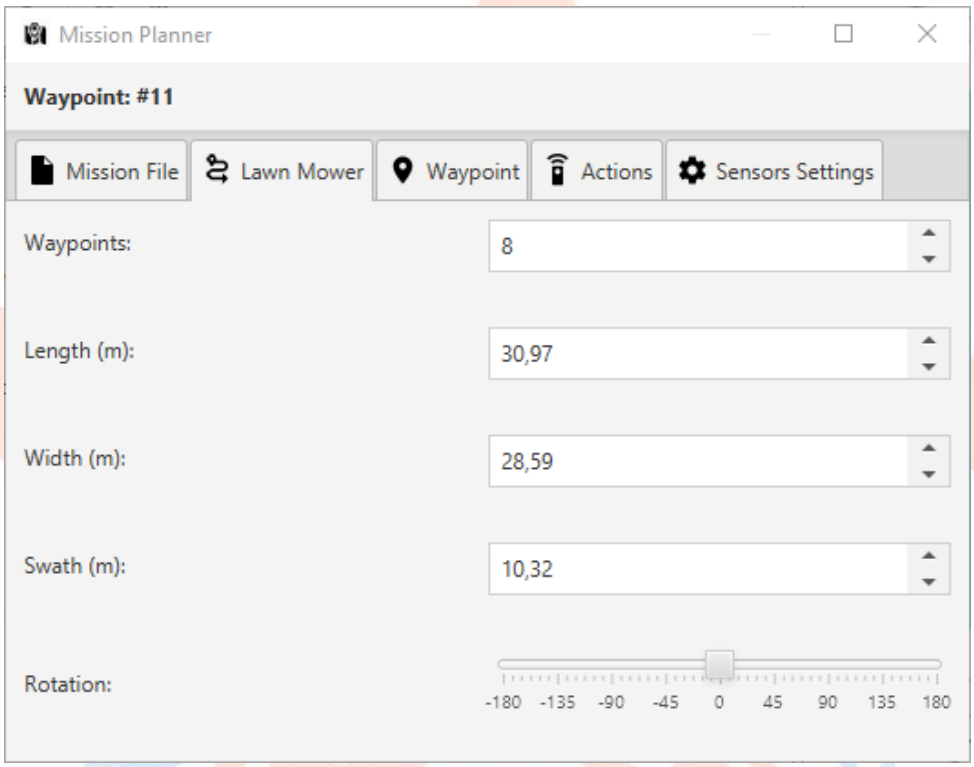


Figure 43 – Mission Planner: Lawn mower

13.1.3 Waypoint tab

The Waypoint tab is available only when a waypoint on the map is selected. Using the provided spinner the operator can adjust the latitude and longitude of the waypoint (FIGURE 44 – MISSION PLANNER: WAYPOINT).

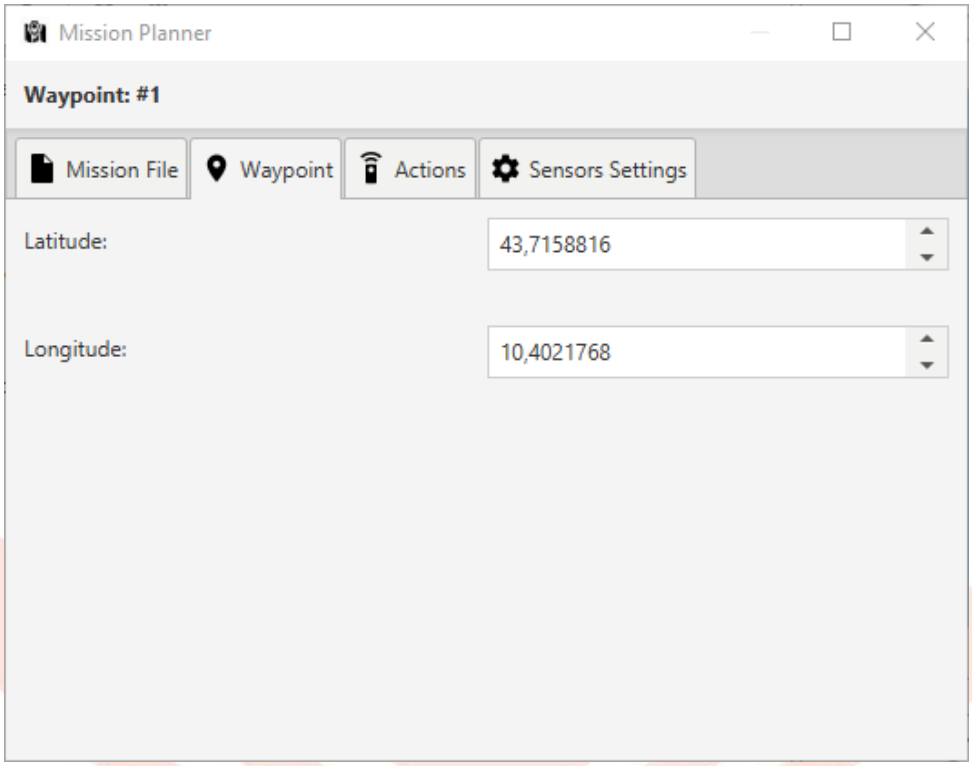


Figure 44 – Mission Planner: Waypoint

13.1.4 Actions tab

The Actions tab provides the tools to plan the actions that the vehicle must performs to reach or after it has reached the selected waypoint. The operator can use the buttons of the toolbar to add a new *Hovering*, *Floating* or *Surfacing* action that will be executed in sequence by the vehicle; the *Gotowp* action is available for all waypoints, while the *Endmission* action only for the last waypoint. In user interface terms, the actions are displayed as items, called titled panes, of an accordion component; when a titled pane is clicked, expands its content providing so the fields that can be configured for the specific action (FIGURE 45 – MISSION PLANNER: ACTIONS). An action previously added can be removed just clicking on the trash button of the titled pane.

Using the selection tool (FIGURE 21 – SELECTION TOOL) it is also possible to configure the actions of multiple waypoints at the same time (FIGURE 46 – MISSION PLANNER: MULTIPLE CONFIGURATION).

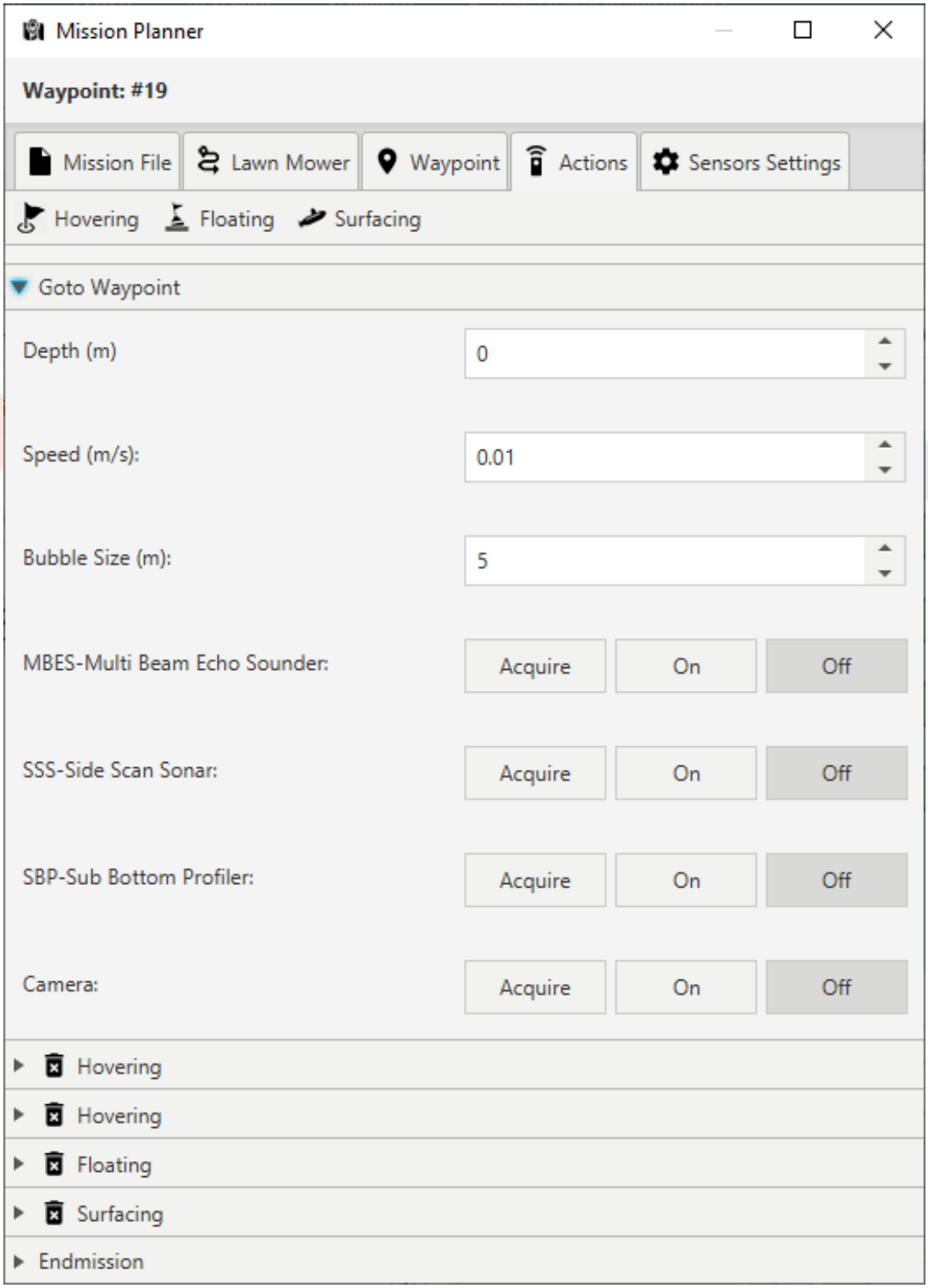


Figure 45 – Mission Planner: Actions

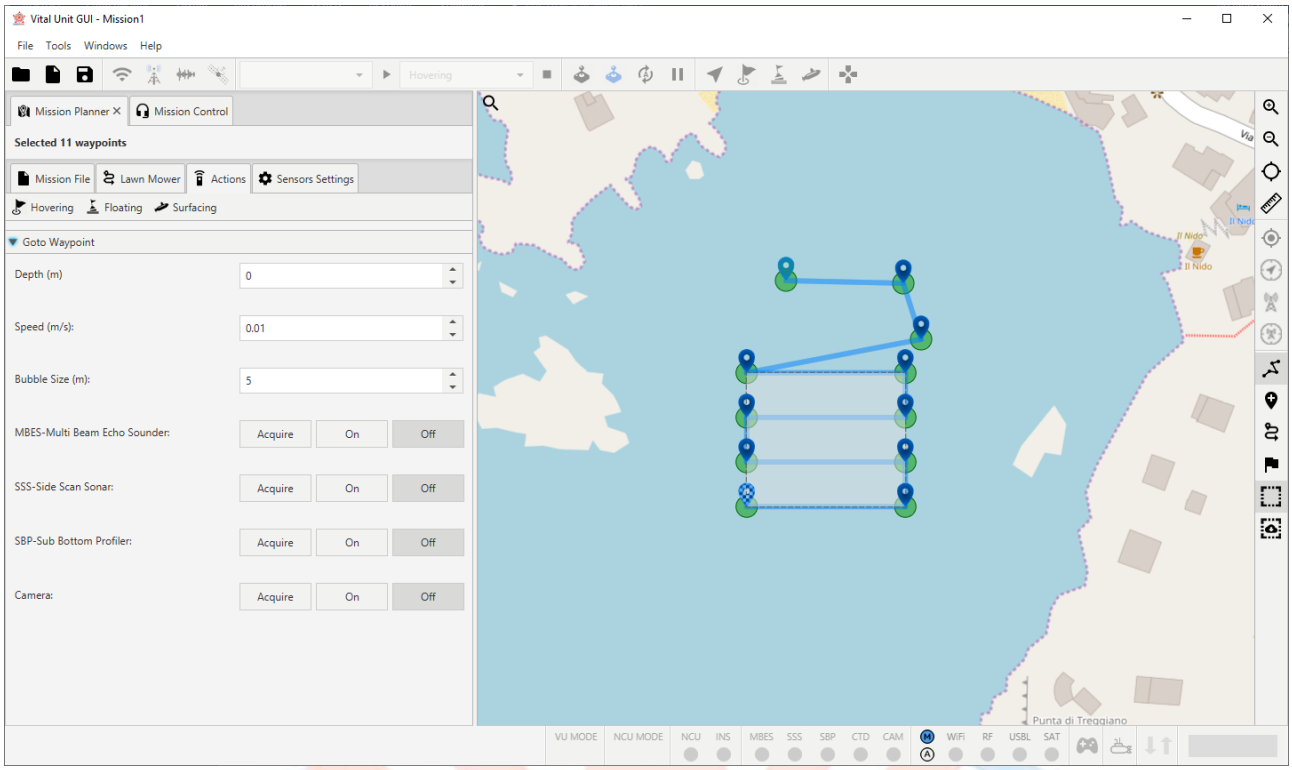


Figure 46 – Mission Planner: multiple configuration

13.1.4.1 Gotowp action

This action is used to command the vehicle to move towards the selected waypoint (FIGURE 45 – MISSION PLANNER: ACTIONS).

The operator can set:

- the depth or altitude of the vehicle in meters, depends on the value provided: negative value for depth reference, positive value for altitude reference;
- the speed that the vehicle must have to reach the selected waypoint;
- the imaginary spherical area surrounding the waypoint that is used as tolerance to reach it, i.e. as long as the vehicle enters this area the waypoint has been reached. On the map this area is shown as a green circle with the marker of the waypoint in the middle;
- the sensors operational status: Acquire, On or Off.

13.1.4.2 Hovering, Floating and Surfacing actions.

These actions are commands that the vehicle performs after the waypoint is reached, i.e. after the Gotowp action (FIGURE 48 - HOVERING, FLOATING, SURFACING AND ENDMISSIONFigure 48 - Hovering, Floating, Surfacing.

The operator can set:

- the execution time of the command (except for Surfacing action);

- the sensors operational status: Acquire, On or Off.

13.1.4.3 Endmission action

This is the last action performed when a mission ends (FIGURE 48 - HOVERING, FLOATING, SURFACING AND ENDMISSIONFigure 48 - Hovering, Floating, Surfacing).

The operator can set:

- the type of end, i.e. the last action of the mission;
- the sensors operational status: Acquire, On or Off.

13.1.5 Sensors Settings tab

The Sensors Settings tab provides the tools to set the configurations that the sensors must have to reach the selected waypoint. The user interface is similar to that of the Actions tab described in the previous paragraph (FIGURE 47 - MISSION PLANNER: SENSORS). In the same way as the actions, using the selection tool it is also possible configure the sensors of multiple waypoints at the same time.

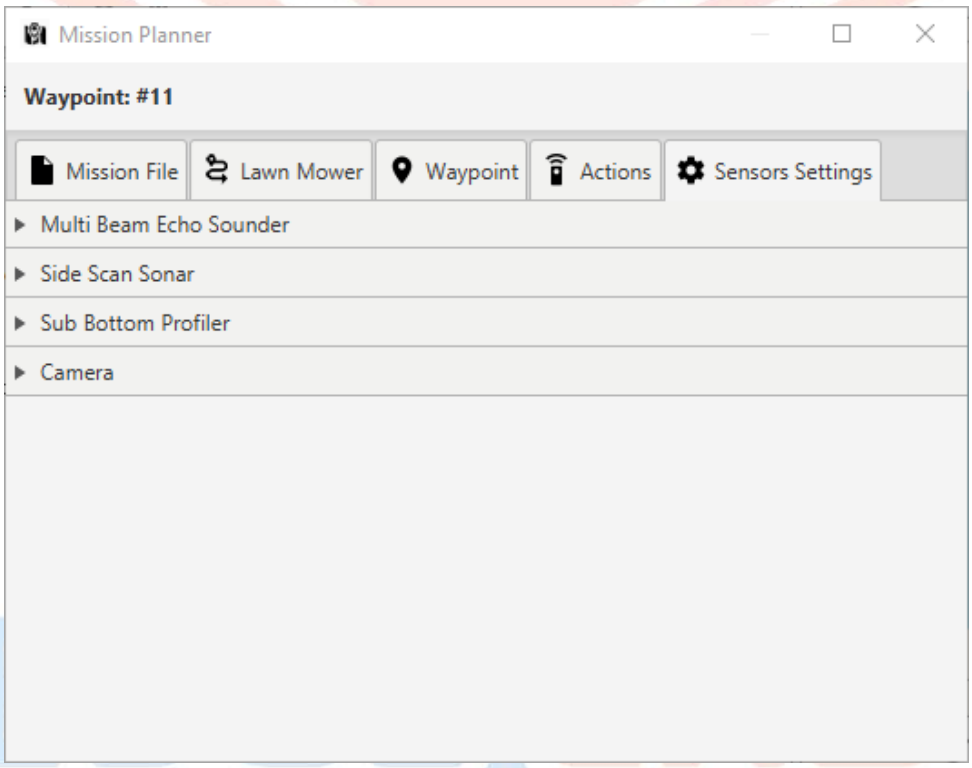


Figure 47 - Mission Planner: Sensors

13.1.5.1 Multi Beam Echo Sounder

Provides the input controls to configure the MBES sensors (FIGURE 49 – MBS, SSS, SBP AND CAMERA).

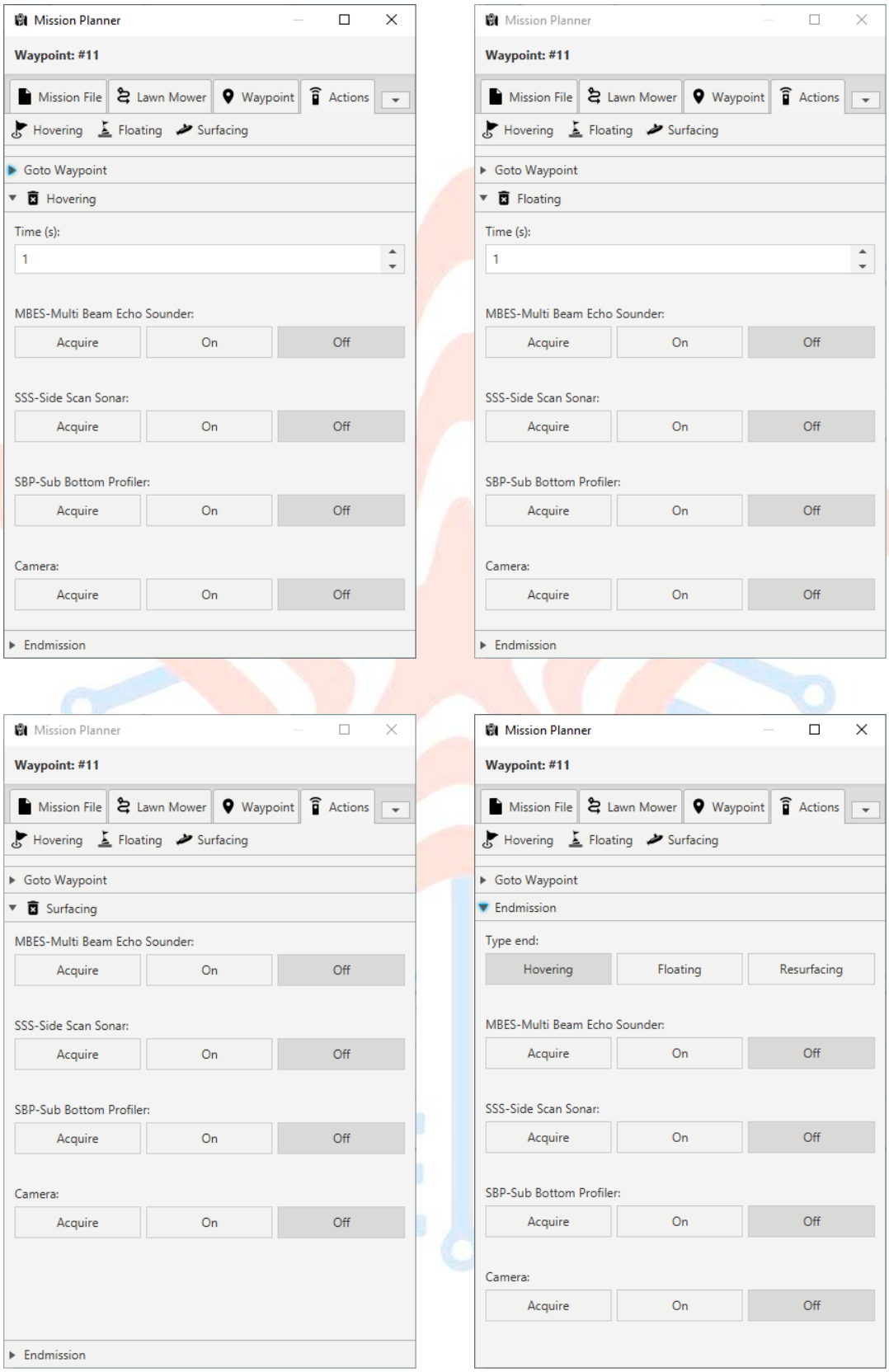


Figure 48 - Hovering, Floating, Surfacing and Endmission

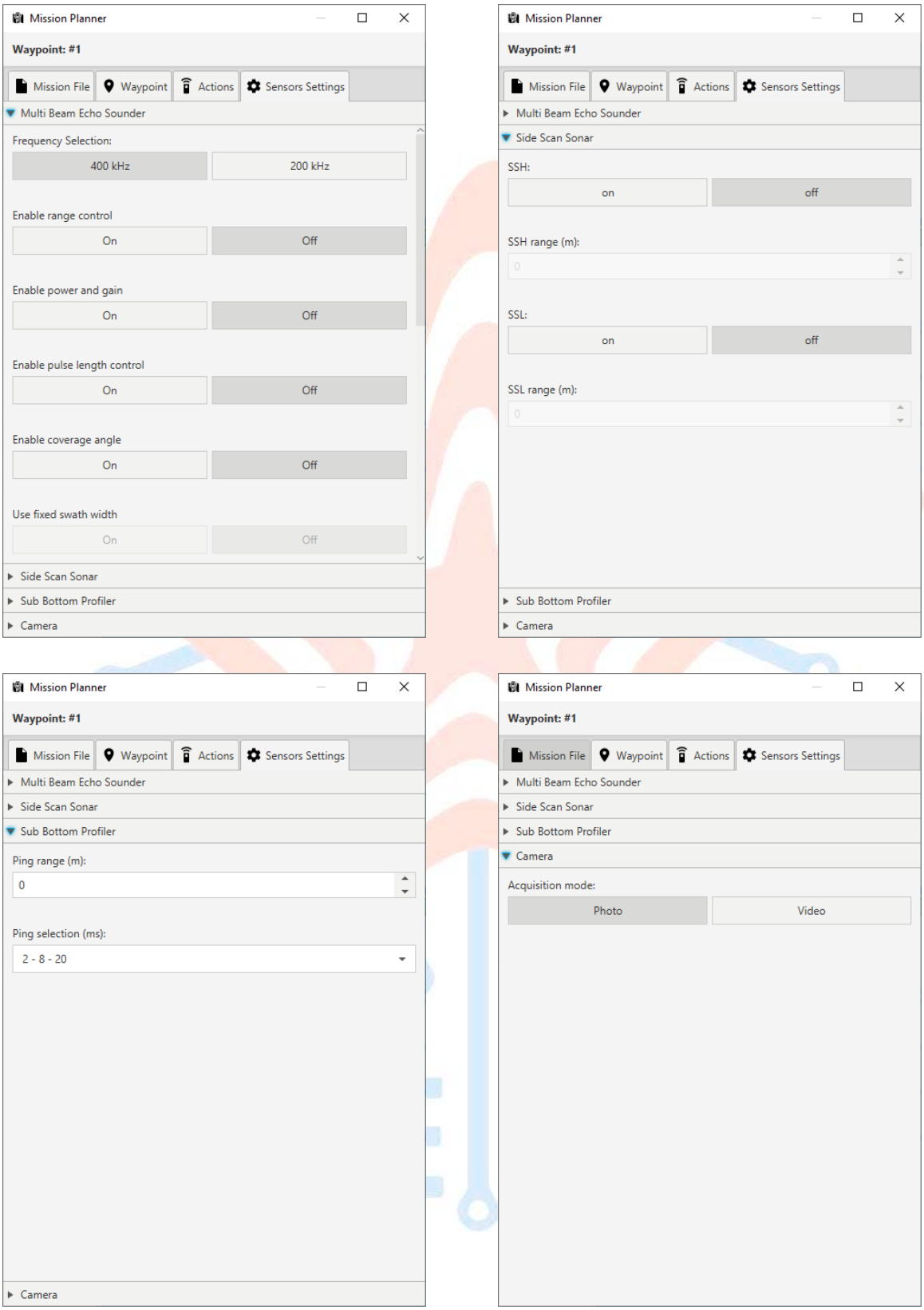


Figure 49 – MBS, SSS, SBP and Camera

13.1.5.2 Side Scan Sonar

Provides the input controls to configure the SSS sensors (FIGURE 49 – MBS, SSS, SBP AND CAMERA).

13.1.5.3 Sub Bottom Profiler

Provides the input controls to configure the SBP sensors (FIGURE 49 – MBS, SSS, SBP AND CAMERA).

13.1.5.4 Camera

Provides the input controls to configure the acquiring mode of the camera (FIGURE 49 – MBS, SSS, SBP AND CAMERA).

13.2 Mission Control

The Mission Control window is the interface that the operator can use to control all vehicle features. It is organized in the following tabs: *Communication, Vehicle, Course Over Ground, Heading, Gotowp* and *Maintenance*; its toolbar provides buttons to send commands to the vehicle or to enable/disable some features that give to operator a visual feedback of the command on the map (FIGURE 50 – MISSION CONTROL: TOOLBAR).

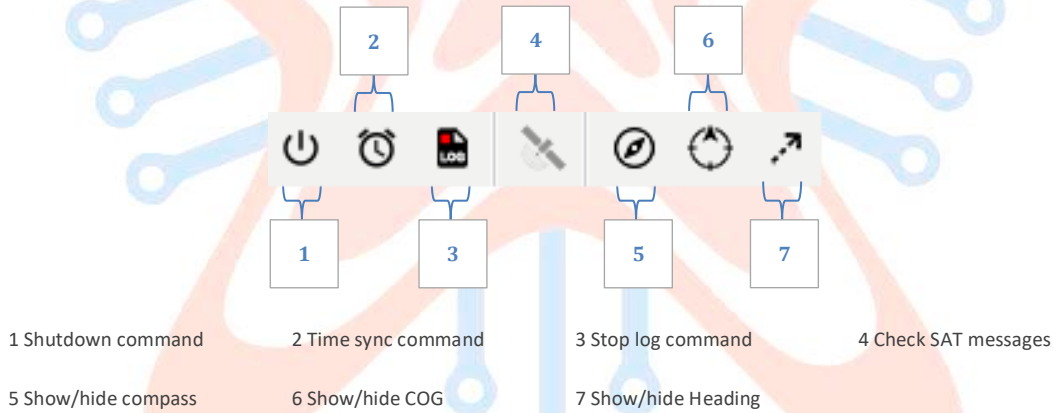


Figure 50 – Mission Control: Toolbar

13.2.1 The Mission Control Toolbar

Shutdown

Clicking on the Shutdown button will be send to the vehicle the command to power off all CPUs and sensors (Figure 50 – Mission Control: Toolbar).

Time Sync

Clicking on the Time Synch button (Figure 50 – Mission Control: Toolbar) will be send to the vehicle the command to synchronize the time of all CPUs.

Stop Log

Clicking on the Stop Log button (Figure 50 – Mission Control: Toolbar) will be send to the vehicle the command to stop the creation of the mission logs.

Check Sat Messages

Clicking on the Check SAT Messages button (Figure 50 – Mission Control: Toolbar) will be forced the SAT module to check for incoming messages.

Show/Hide Compass

Clicking on the Show/Hide Compass (Figure 50 – Mission Control: Toolbar) will be shown/hidden on the map a compass surrounding the vehicle (FIGURE 51 – MISSION CONTROL: COMPASS).

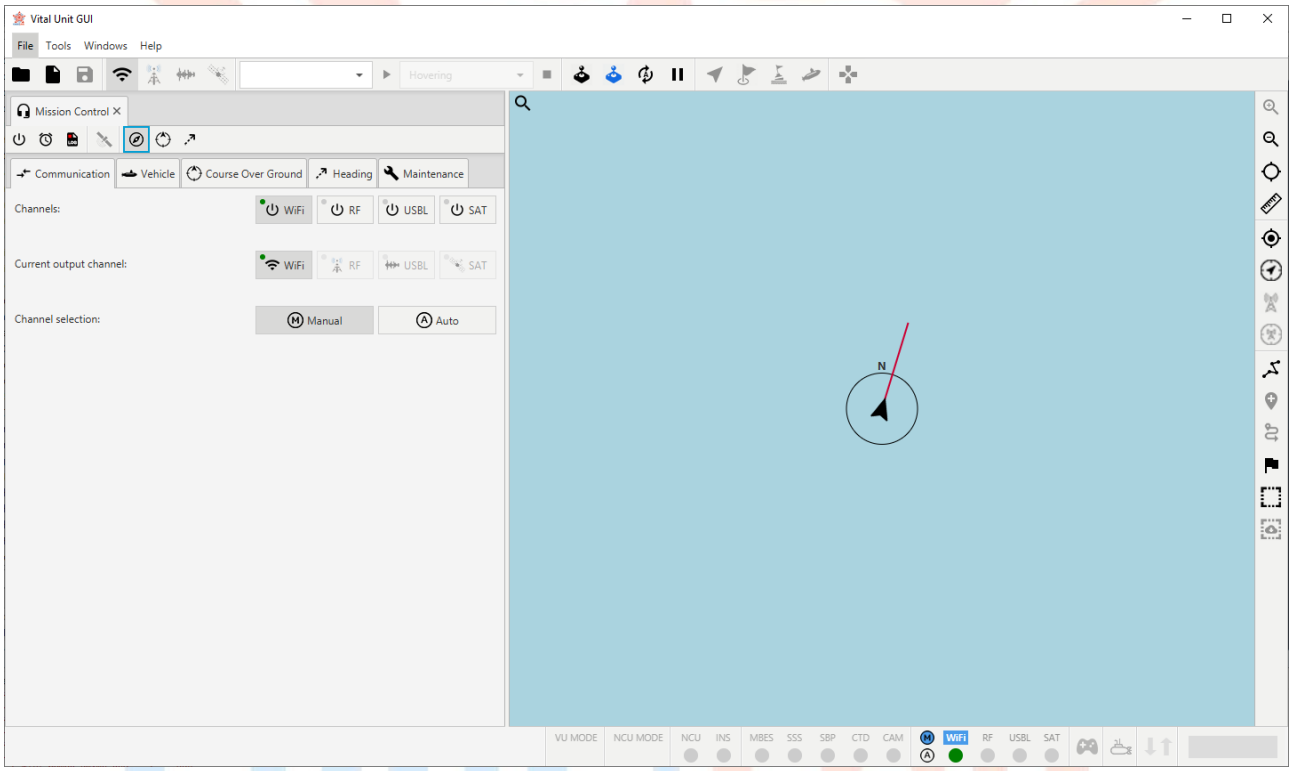


Figure 51 – Mission Control: Compass

Show/Hide COG

Clicking on the Show/Hide COG (Figure 50 – Mission Control: Toolbar) will be shown/hidden the direction of the course over ground on the map. (FIGURE 52 – MISSION CONTROL: COG DIRECTION).

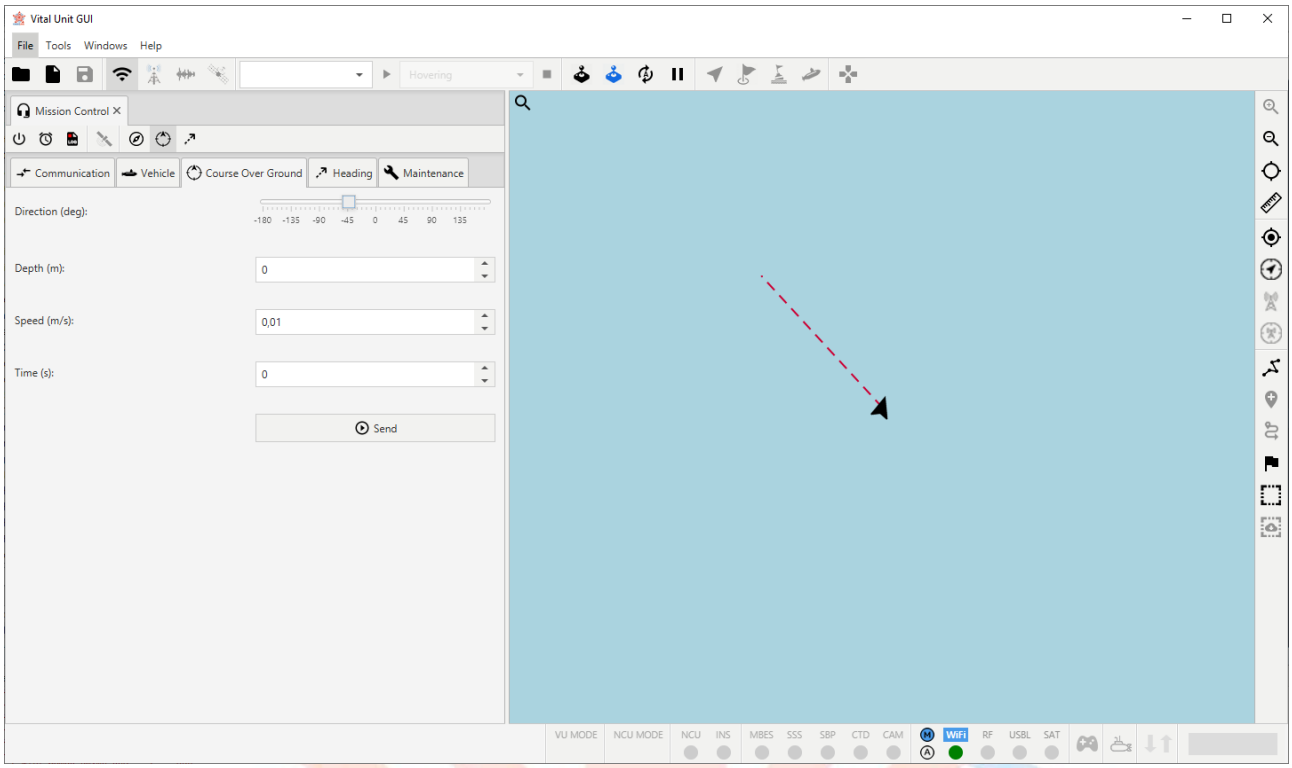


Figure 52 – Mission Control: COG direction

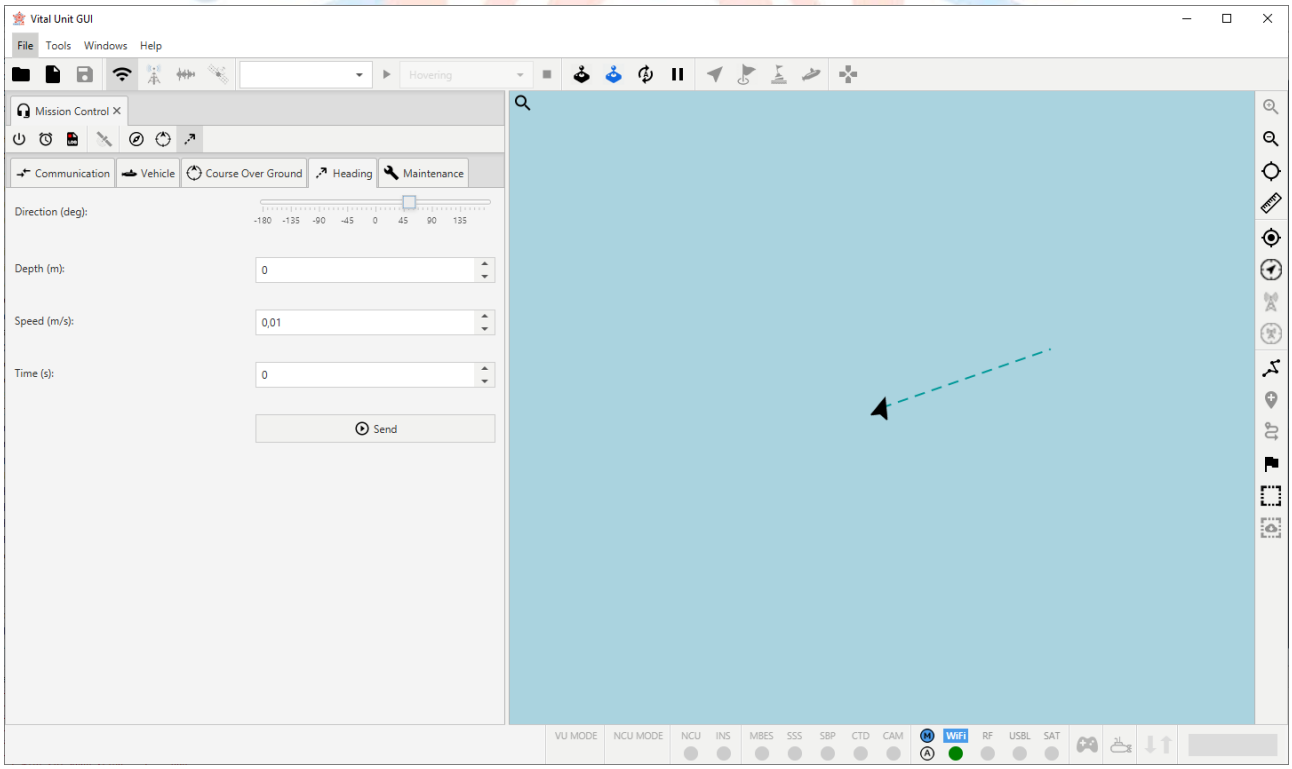


Figure 53 – Mission Control: Heading direction

Show/Hide Heading

Clicking on the Show/Hide Heading (Figure 50 – Mission Control: Toolbar) will be shown/hidden the direction of the heading on the map. (FIGURE 52 – MISSION CONTROL: COG DIRECTION).

13.2.2 Communication tab

The Communication tab provides tools to select the communication channels, both in manual and automatic mode (FIGURE 54 – MISSION CONTROL: COMMUNICATION TAB). By selecting the manual mode, it is possible to activate the channel to receive messages from the vehicle, which will only be activated if communication of that type is possible. Once one of the input channels is active, it will be possible to select the desired output channel by clicking on the relative button. When the automatic mode is enabled, the system scans the channels to find the first one where it is possible to establish a connection.

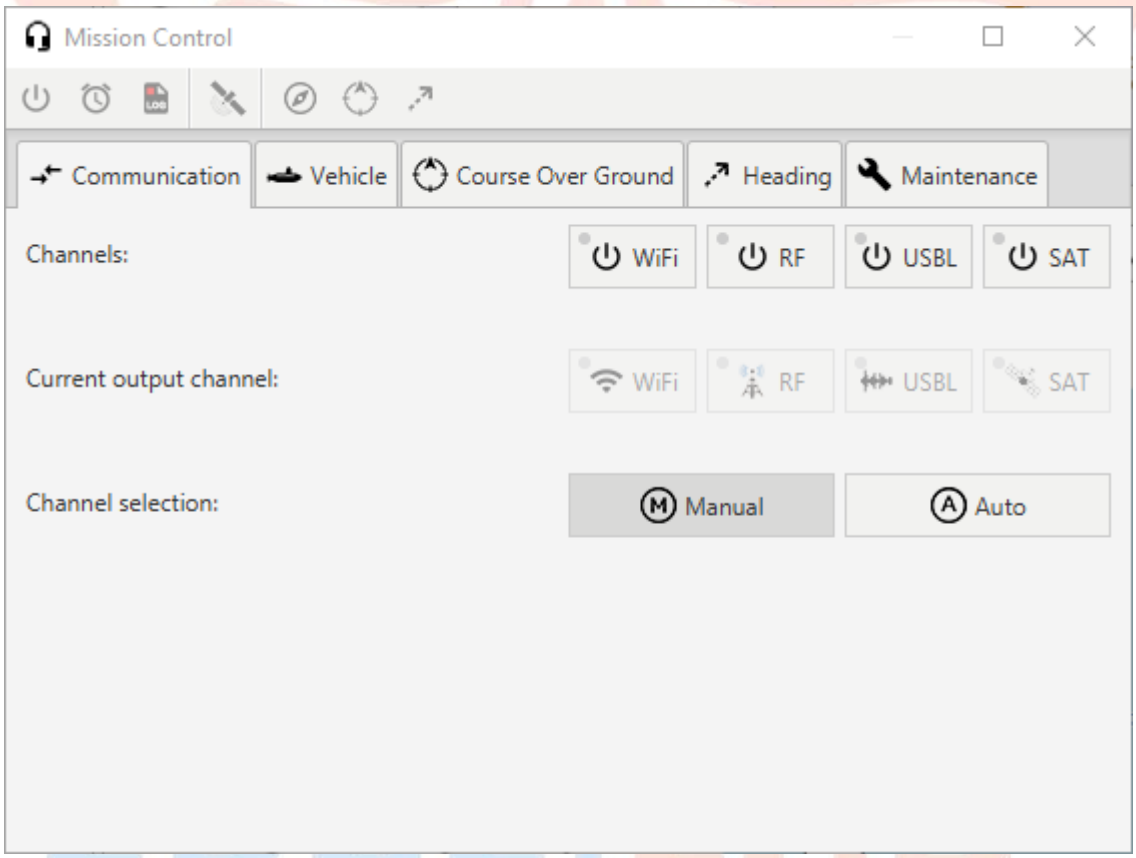


Figure 54 – Mission Control: Communication tab

13.2.3 Vehicle tab

The Vehicle tab interface (FIGURE 55 – MISSION CONTROL: THE VEHICLE TAB) contains controls that allow the operator:

- to select the mission to be started;
- abort a mission;
- select the navigation modality;
- send the action commands;
- request data over the SAT channel.

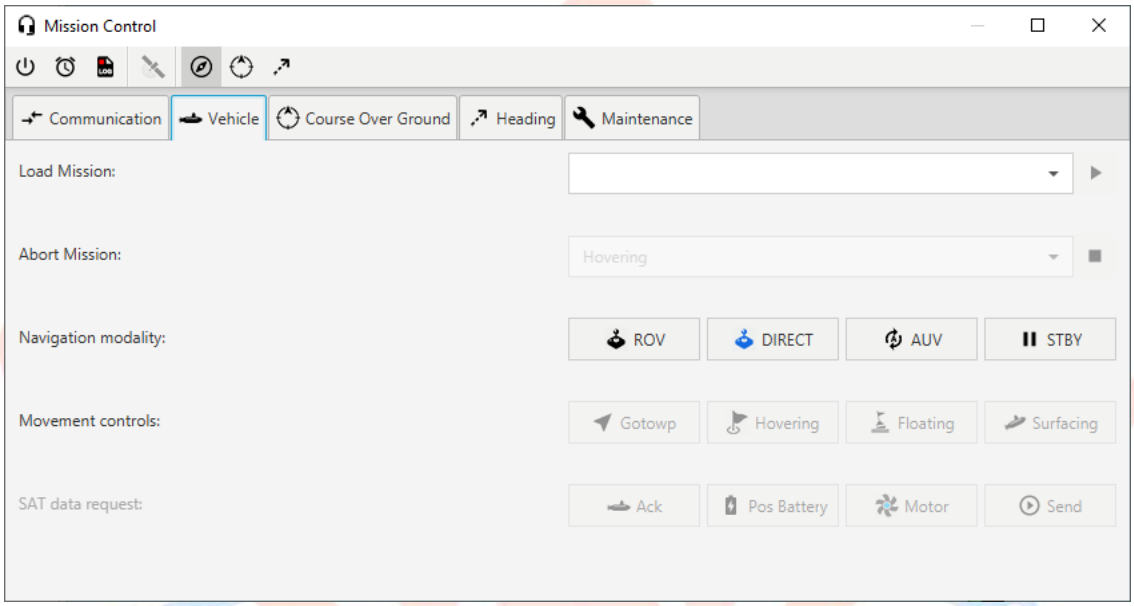


Figure 55 – Mission Control: The Vehicle tab

Select and start a mission

The operator selects the mission to be started between those that are already uploaded to the vehicle. When a mission is selected the operator can start it pressing the play button.

Abort a mission

The operator selects the type of abort and then presses the stop button.
An abort command can be sent only when a mission is already started.

Select a navigation modality

The operator can select a navigation modality pressing one of the provided buttons: *ROV*, *DIRECT*, *AUV* or *STBY*.

Send an action command

The operator can send an action command pressing one of the provided buttons: *Gotowp*, *Hovering*, *Floating* or *Surfacing*.
The Gotowp action command can be sent only if the operator have already select a flag on the map; the flag indicates the position that the vehicle has to move to.

Request data over the SAT channel

The operator can request the specific data selecting one of more types of data to be requested (*Ack, Pos Battery,* or *Motor*) and then press the *Send* button.

Requesting the Ack data type, the vehicle responds with a messages containing information about the vehicle position, CPUs status and battery charge; with the Pos Battery data type, the vehicle responds providing information about the position and battery; finally, with Motor data type the vehicle responds sending information about the motors status.

13.2.4 Course Over Ground tab

The Course Over Ground tab provides controls to set the COG navigation (FIGURE 56 – MISSION CONTROL: COURSE OVER GROUND). The operator sets the direction, the depth, the speed, the maximum time of execution and finally presses the Send button to send the command.

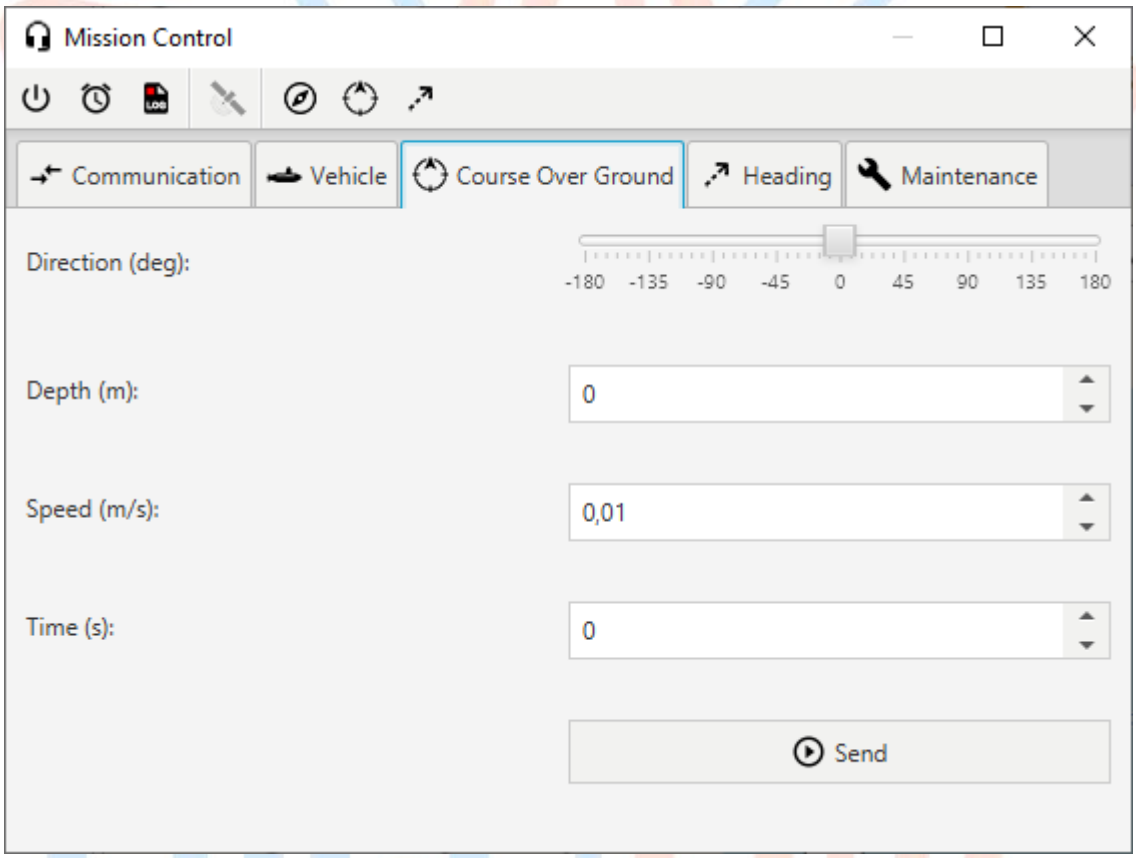


Figure 56 – Mission Control: Course Over Ground

13.2.5 Heading tab

The heading tab provides input controls to set the Heading navigation (FIGURE 57 – MISSION CONTROL: HEADING). The interface is just like the COG described above and is used in the same way.

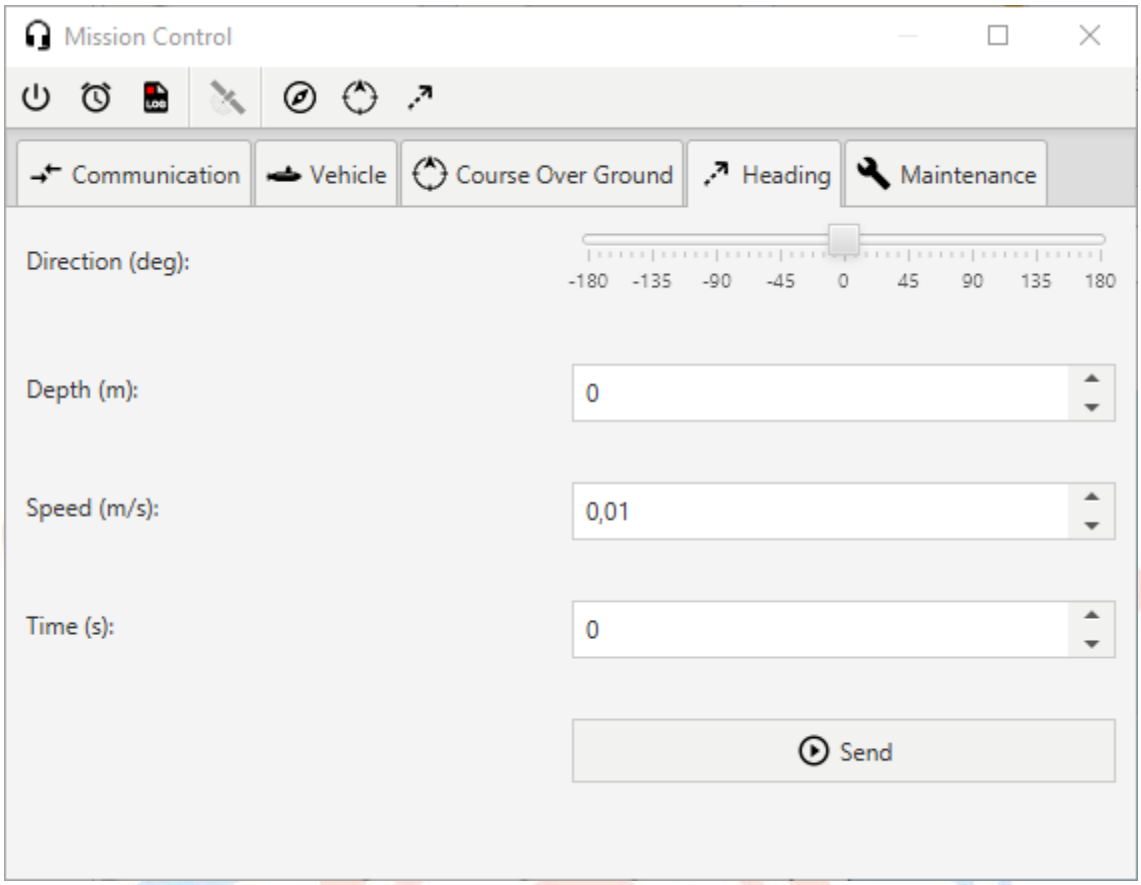


Figure 57 – Mission Control: Heading

13.2.6 Maintenance tab

The Maintenance tab provides controls that the operator can use to send a special command to the vehicle (FIGURE 58 – MISSION CONTROL: MAINTENANCE TAB).

The operator can:

- command the vehicle to perform autotest;
- release/hung up the weight;
- release/ hung up the nose;
- set the battery security level;
- set the emergency timeout.

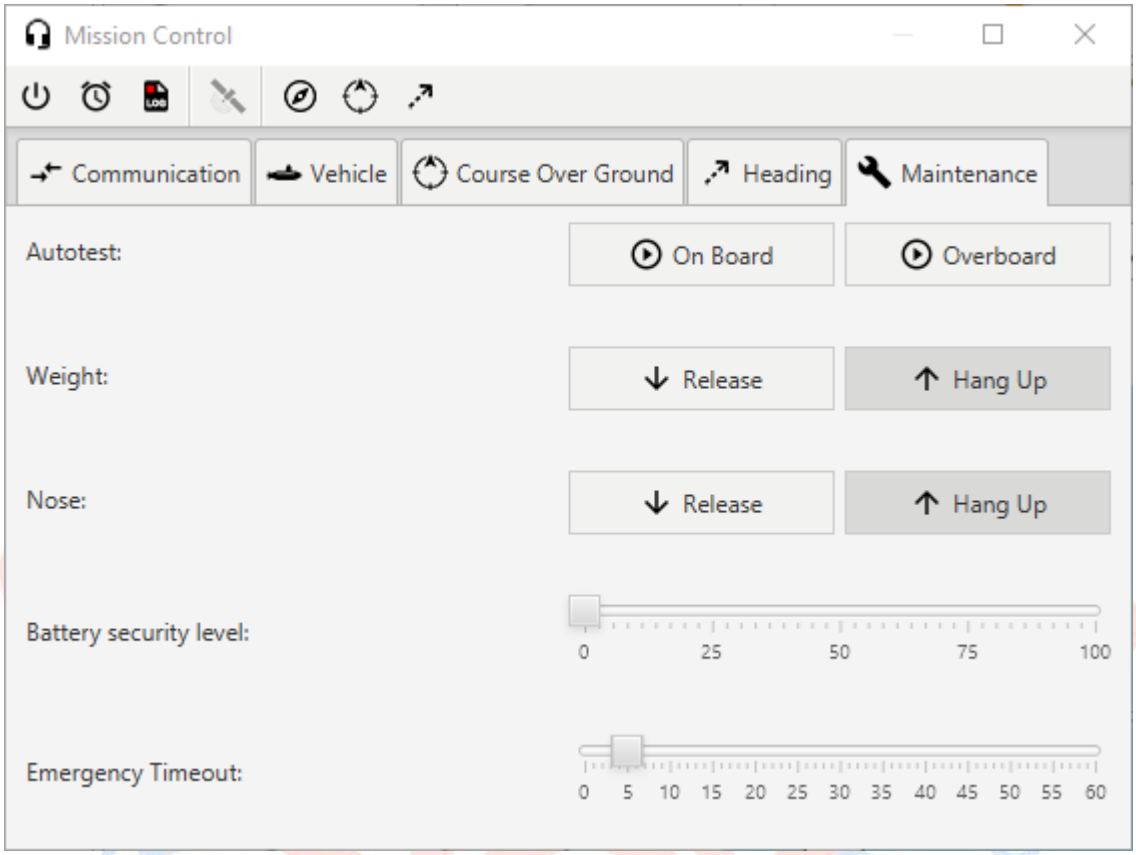


Figure 58 – Mission Control: Maintenance tab

13.2.7 Gotowp tab

The Gotowp tab provides input controls to set the go to waypoint command (FIGURE 59 – MISSION CONTROL: GOTOWP TAB). The tab is associated to a flag and is only available when it is selected (11.3.12 ADD FLAG).

The operator can set:

- the depth or altitude of the vehicle in meters, depends on the value provided: negative value for depth reference, positive value for altitude reference;
- the speed that the vehicle must have to reach the selected waypoint;
- the imaginary spherical area surrounding the waypoint that is used as tolerance to reach it, i.e. as long as the vehicle enters this area the waypoint has been reached. On the map this area is shown as a green circle with the marker of the waypoint in the middle.

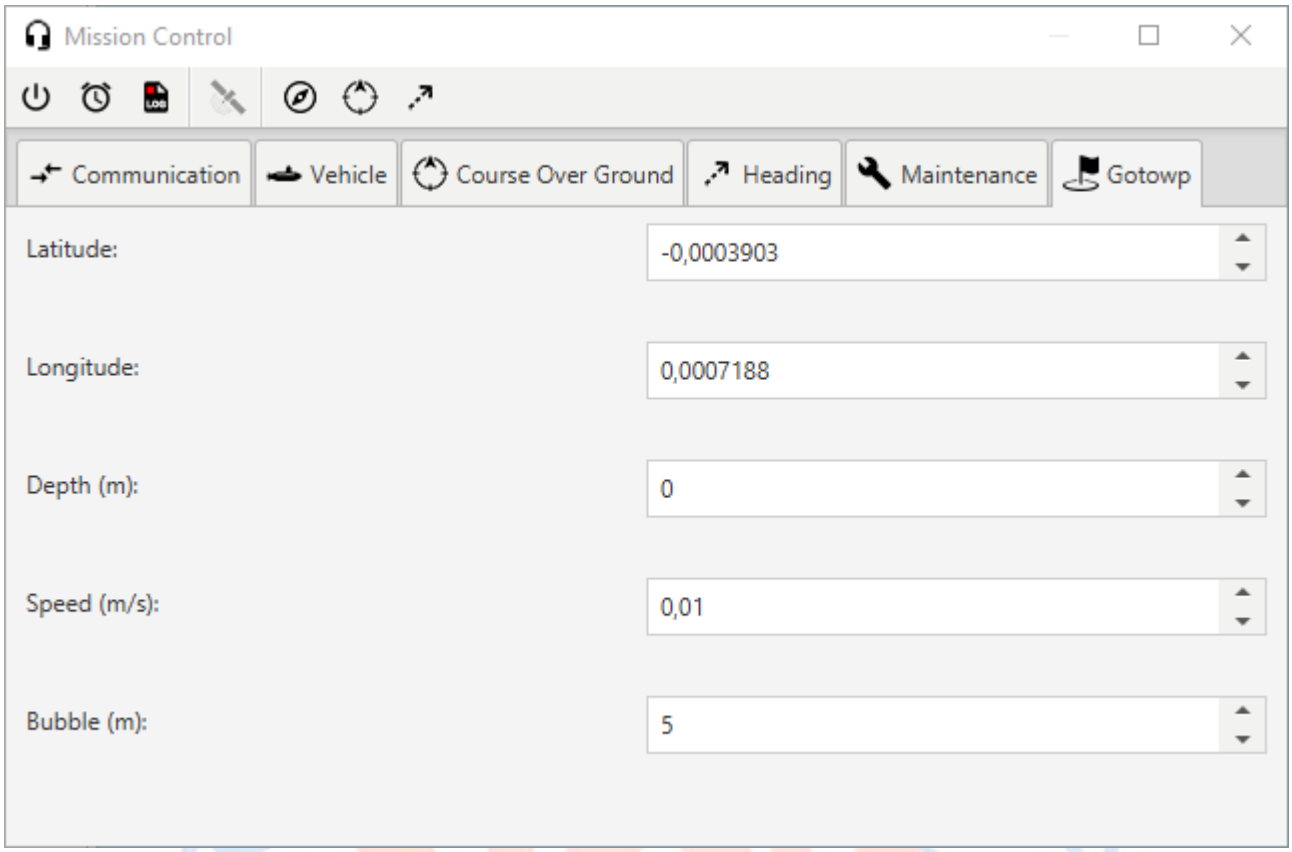
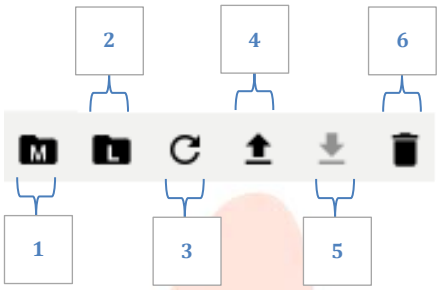


Figure 59 – Mission Control: Gotowp tab

13.3 File Sync

Through the File Sync window, the operator can upload, download or handle missions and log files. The user interface can be different depending on which channel is currently selected. This because some operations can be performed over the WiFi channel only, when the FTP server can be used. In simple terms, over RF and USBL channels is allowed only upload a mission file, while over WiFi channel can be performed the other operations such as download mission log, delete local or remote missions and logs.



1 Connect to Mission directory | 2 Connect to Log directory | 3 Refresh files list

4 Upload selected files | 5 Download selected files | 6 Delete selected

Figure 60 – File Transfer toolbar

The user interface used on WiFi channel consists of two views, one relative to the remote directory (on vehicle) and the other relative to the local directory (FIGURE 61 – FILE TRANSFER: WIFI INTERFACE); the toolbar on the top contains the commands necessary for connecting, transferring and deleting files from the folders (FIGURE 60 – FILE TRANSFER TOOLBAR). The operator can also download or upload a file with a double click on its name; it is also allowed the multiple selection of elements holding down "Ctrl" or "Shift" + click (FIGURE 62 – FILE TRANSFER: WIFI INTERFACE MULTIPLE SELECTION). The selected items can be downloaded, uploaded and deleted all with one shot.
Finally, the files lists can be ordered in ascending or descending order by name, size or last modified date clicking on the relative column title.

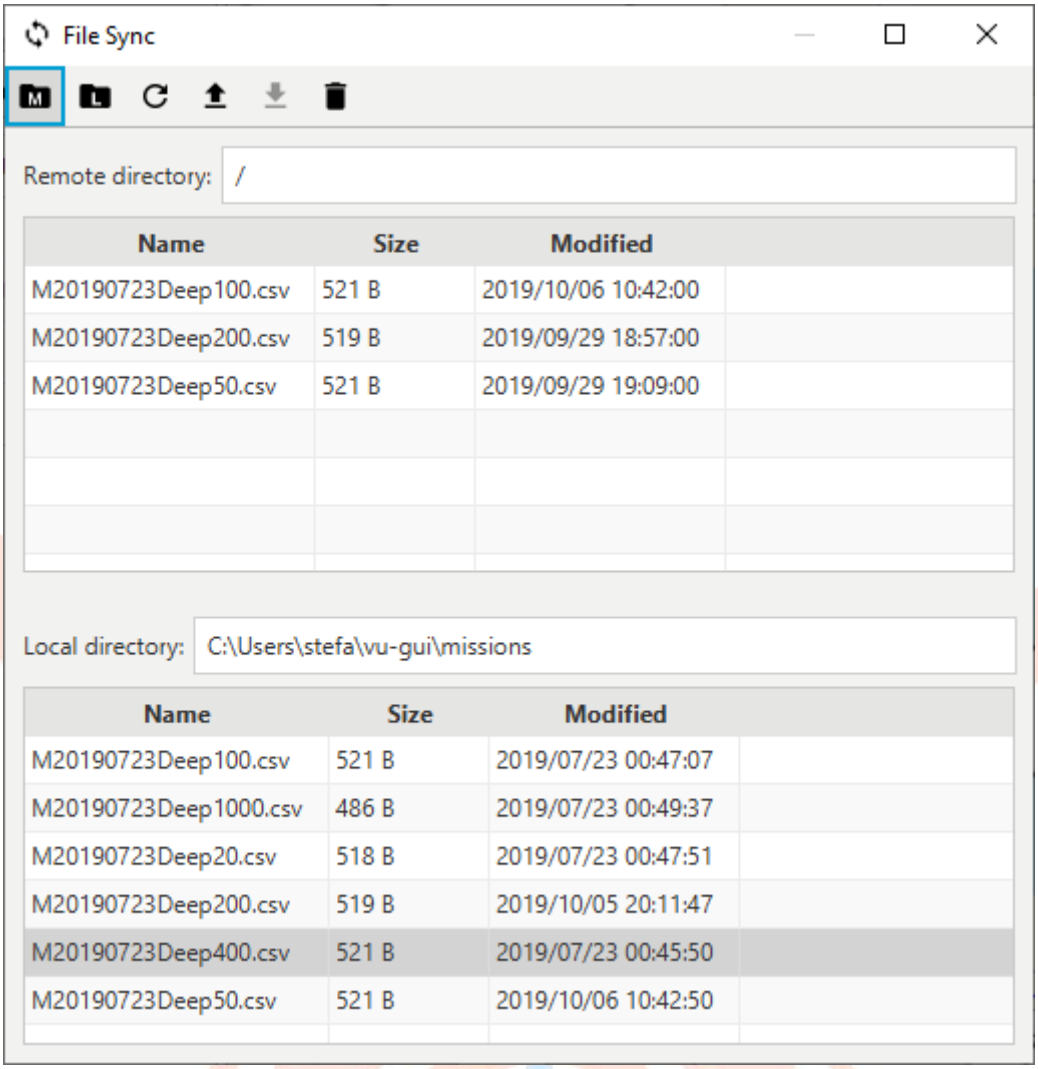


Figure 61 – File Transfer: WiFi interface

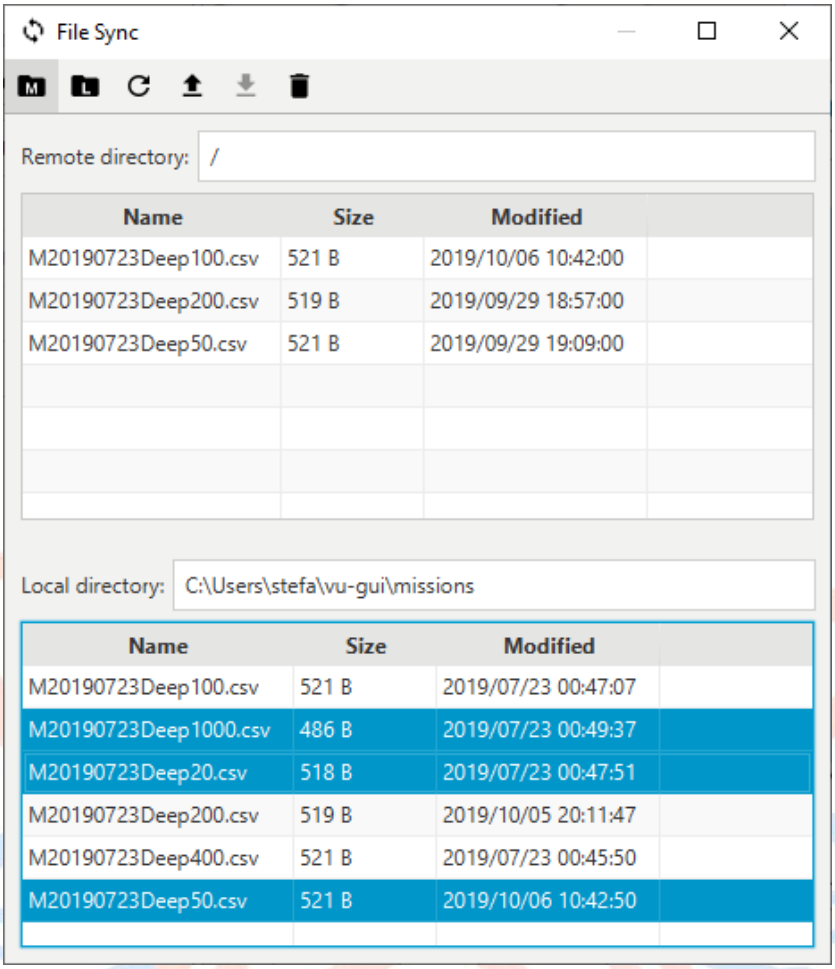


Figure 62 – File Transfer: WiFi interface multiple selection

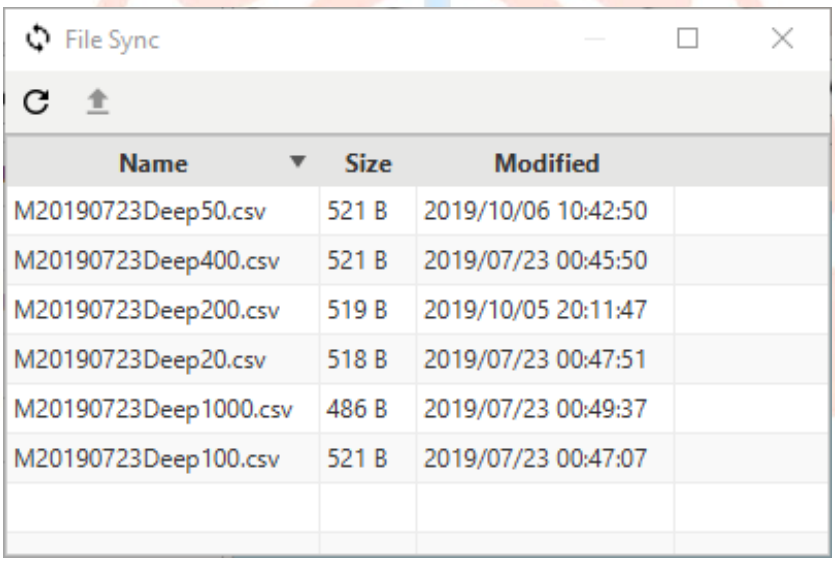


Figure 63 – FileSync: RF interface

The user interface used on RF channel shows only the list of the local files and a toolbar with only the refresh and the upload button (FIGURE 63 – FILESYNC: RF INTERFACE). Please note that is allowed upload just a single file at time over RF channel.

13.4 Vehicle Status

The Vehicle Status window provides real time information about the status of the vehicle (FIGURE 64 – VEHICLE STATUS).

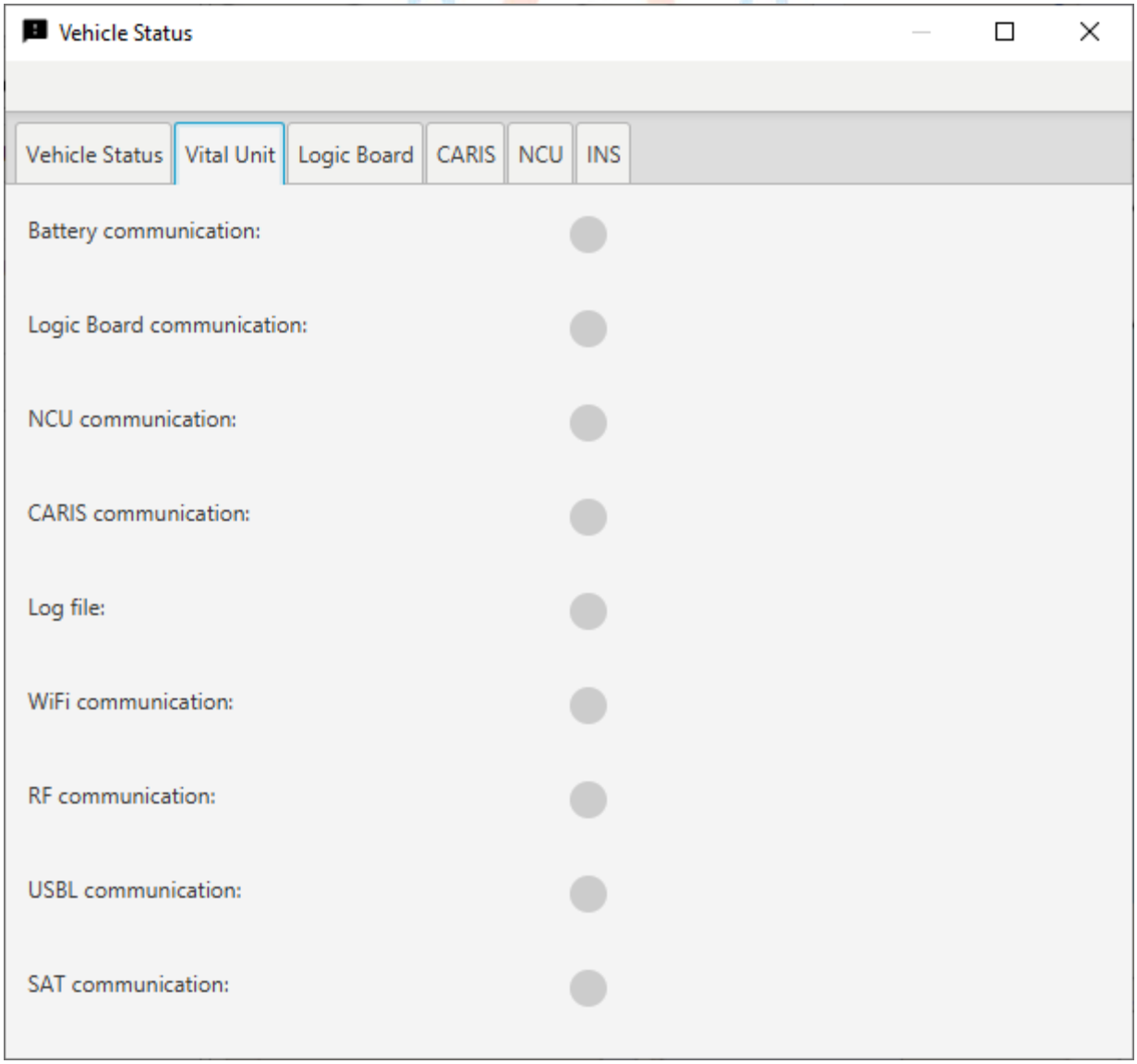


Figure 64 – Vehicle Status

The information are displayed as text or using a RGB LED providing the following indications:

Led Color	Indication
	Off
	Startup action / Warning status
	On / OK status
	Acquire
	Error status

13.5 Log

The Log window display notifications and error messages about the system (FIGURE 65 – LOG). The number and the types of messages shown depends on activation of the debug mode flag in Setting View (12.1.1 LOGGING).

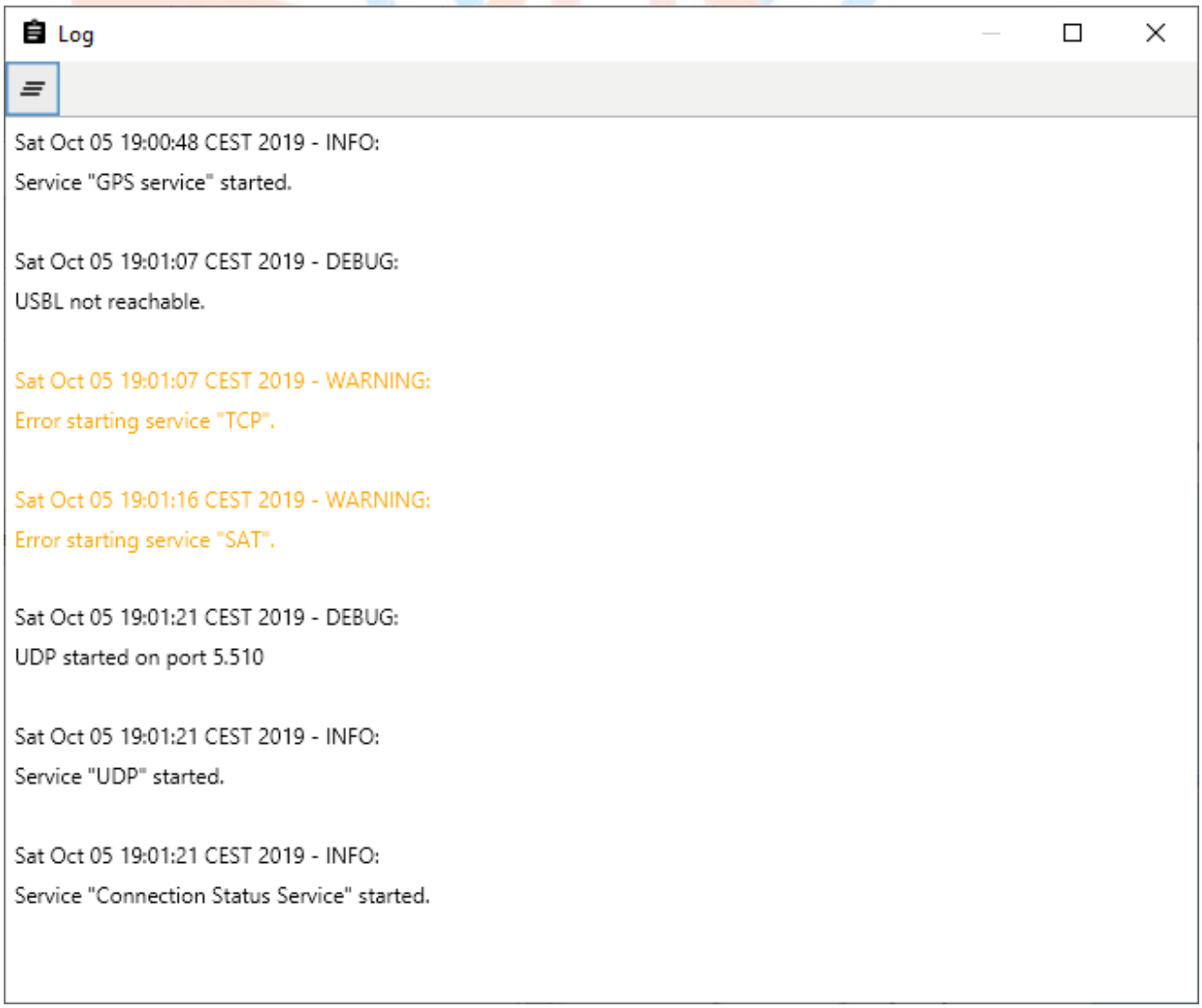


Figure 65 – Log

13.6 Instrumentation

The instrumentation window provides a set of instruments useful to get at runtime some of the principal data coming from the vehicle such as attitude, depth, speed and battery voltage (FIGURE 66 – INSTRUMENTATION).

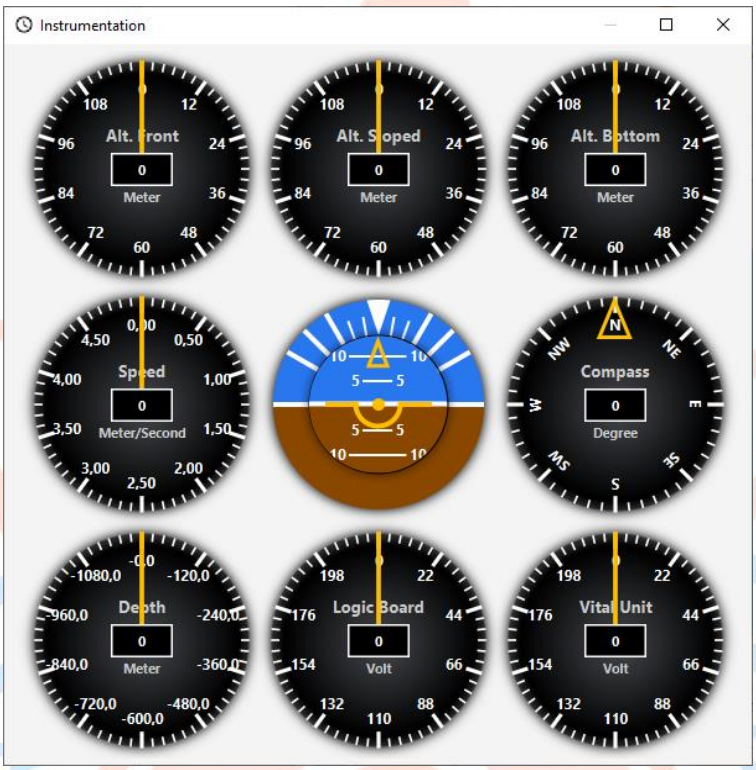


Figure 66 – Instrumentation

13.7 Motors Status

The Motors Status window can be used to get information about motors. The motors parameters are displayed inside instrument panels organized in the following tabs:

All: displays any parameters of any motors (FIGURE 67 – MOTORS STATUS).
RPM: displays only the RPM values.
Volt: displays only the Volt values.
Current: displays only the Current values.
Temp: displays only the Temperature values.
BSX: displays any parameters of the back sx motor.
BDX: displays any parameters of the back dx motor.
BSide: displays any parameters of the back side motor.
FSide: displays any parameters of the front side motor.
BTop: displays any parameters of the back top motor.

FTop: displays any parameters of the front top motor.

Each tab can be displayed in a new window clicking with the mouse right button on the tab and select “Open in new window” from the tooltip menu.

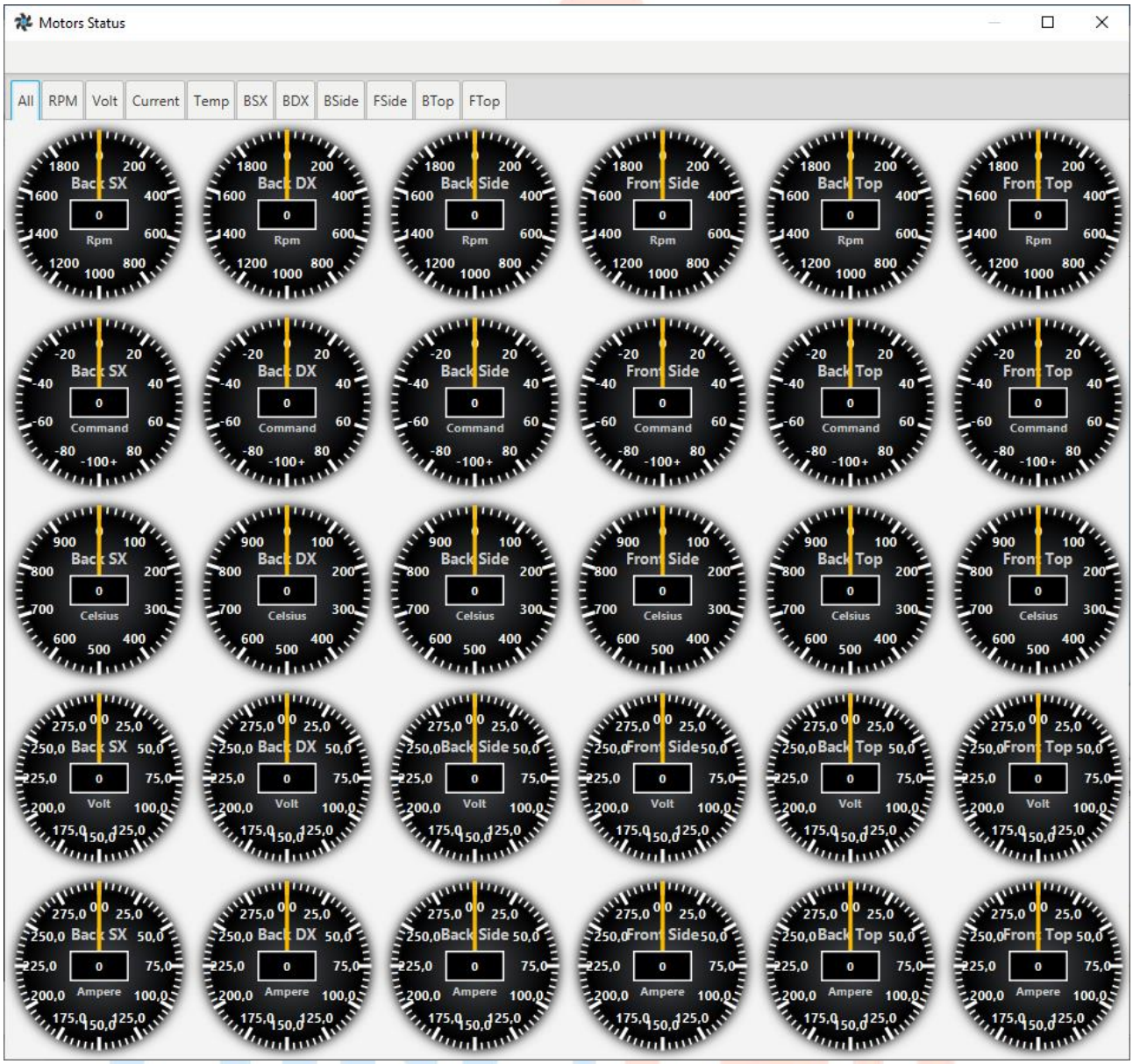


Figure 67 – Motors Status

13.8 GPS

The GPS window provides information about the ground station position (FIGURE 68 – GPS DATA). When the GPS module is correctly connected and the fix is acquired, a position marker

is displayed on the map to give a visual representation of the actual position of the ground station (FIGURE 69 – GROUND STATION POSITION MARKER).

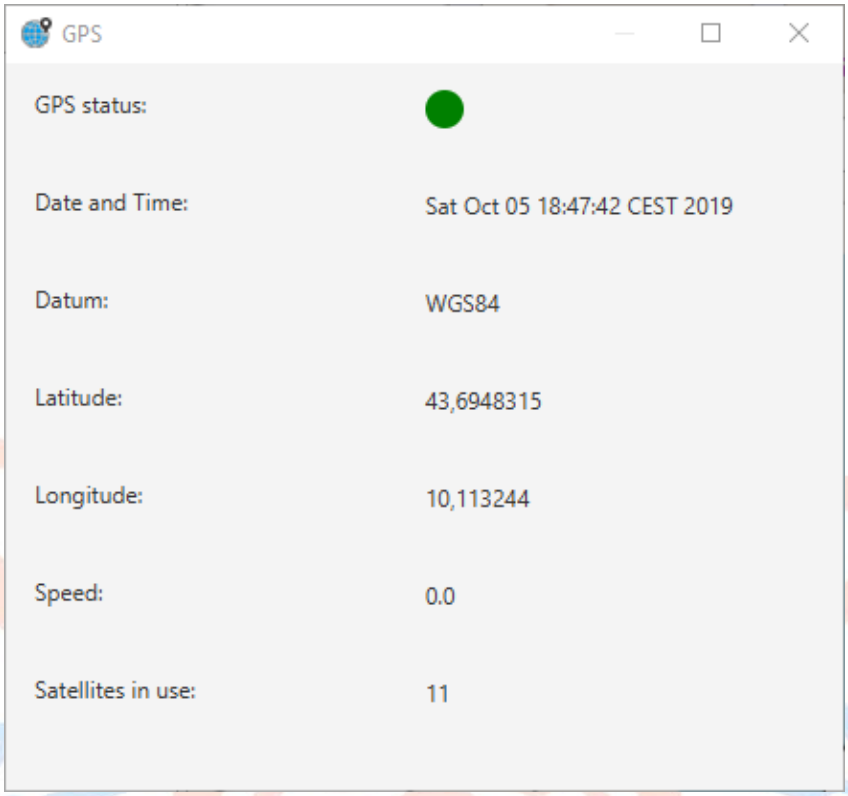


Figure 68 – GPS data

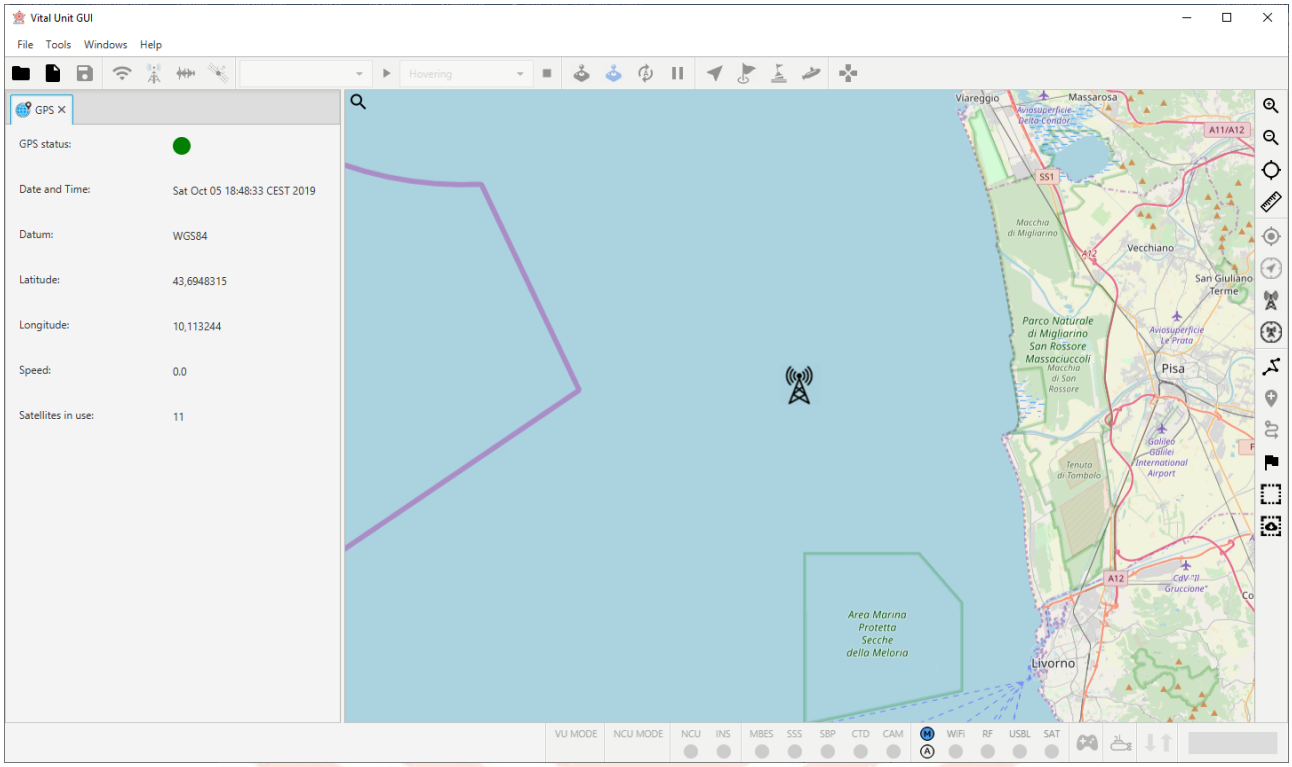


Figure 69 – Ground Station position marker

13.9 Gamepad

The Gamepad window provides a visual feedback of the commands values which are sent to the vehicle using the gamepad and can also be used as reminder for the operator.
A commands map indicating which sticks or buttons have to be moved or pressed to send a specific command, is shown for each of two manual control modes: *ROV* (FIGURE 70 – GAMEPAD: MANUAL MAPPING) and *ROV DRIECT* (FIGURE 71 – GAMEPAD: DIRECT MAPPING). The only button provided by the toolbar allows to enable or disable the gamepad.

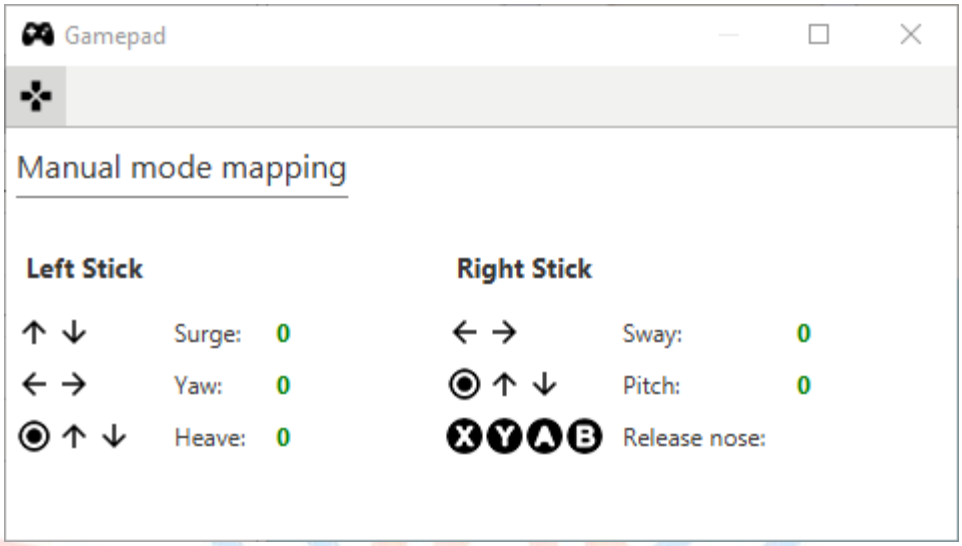


Figure 70 – Gamepad: Manual mapping

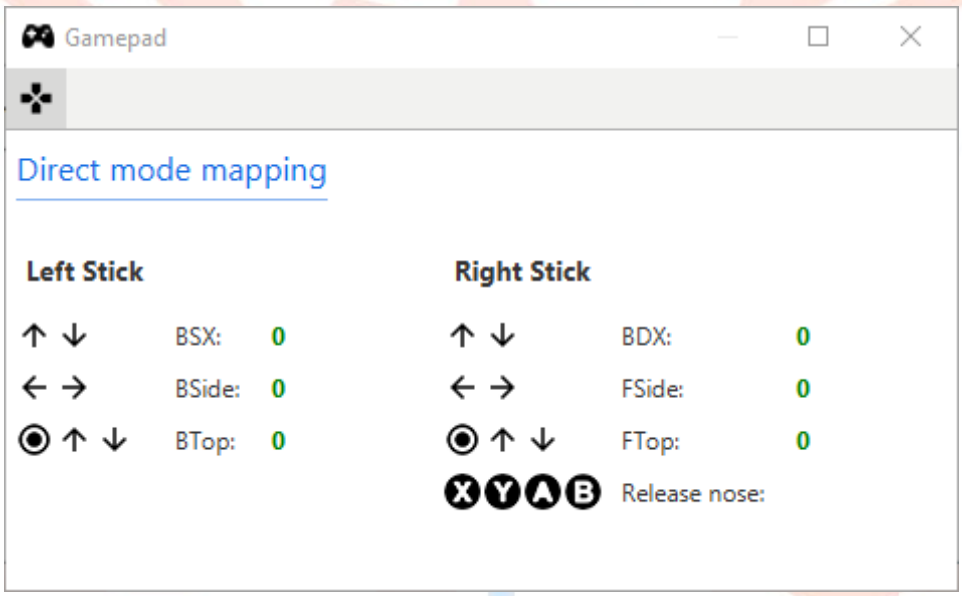


Figure 71 – Gamepad: Direct mapping

13.10 Image Viewer

The Image Viewer is the window that provides the tools to load the images produced by sensors of the vehicle (FIGURE 72 – IMAGE VIEWER).

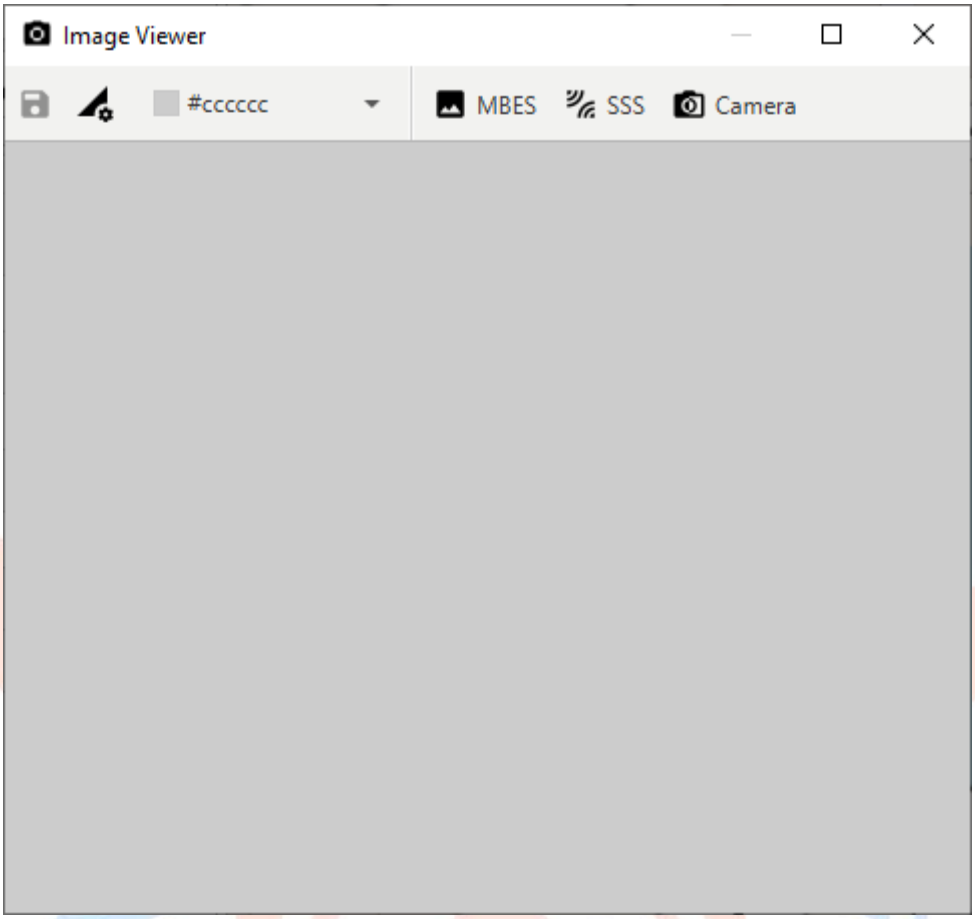


Figure 72 – Image Viewer

The operator can click on *MBES*, *SSS* or *Camera* button to load respectively the last image of the Multibeam Echosounder, Side Scan Sonar or camera (FIGURE 73 – IMAGE VIEWER TOOLBAR).

To speed up the download process is possible to adjust some image parameters such as the maximum width, maximum height and the quality of the image; the parameters can be set clicking on the *Settings* button of the toolbar (FIGURE 74 – IMAGE VIEWER SETTINGS).

When the download process starts, a progress bar will shows the percentage of the completion of the transfer process. The operator can abort the process at any time.

Once the image has been downloaded it can be saved clicking on the *Save* button.

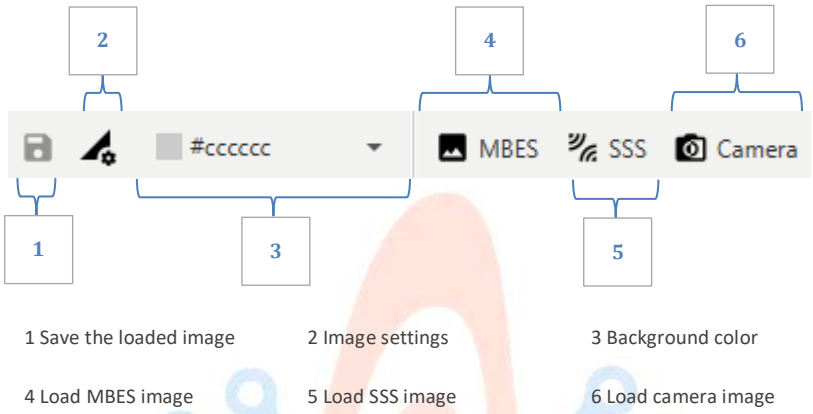


Figure 73 – Image Viewer toolbar

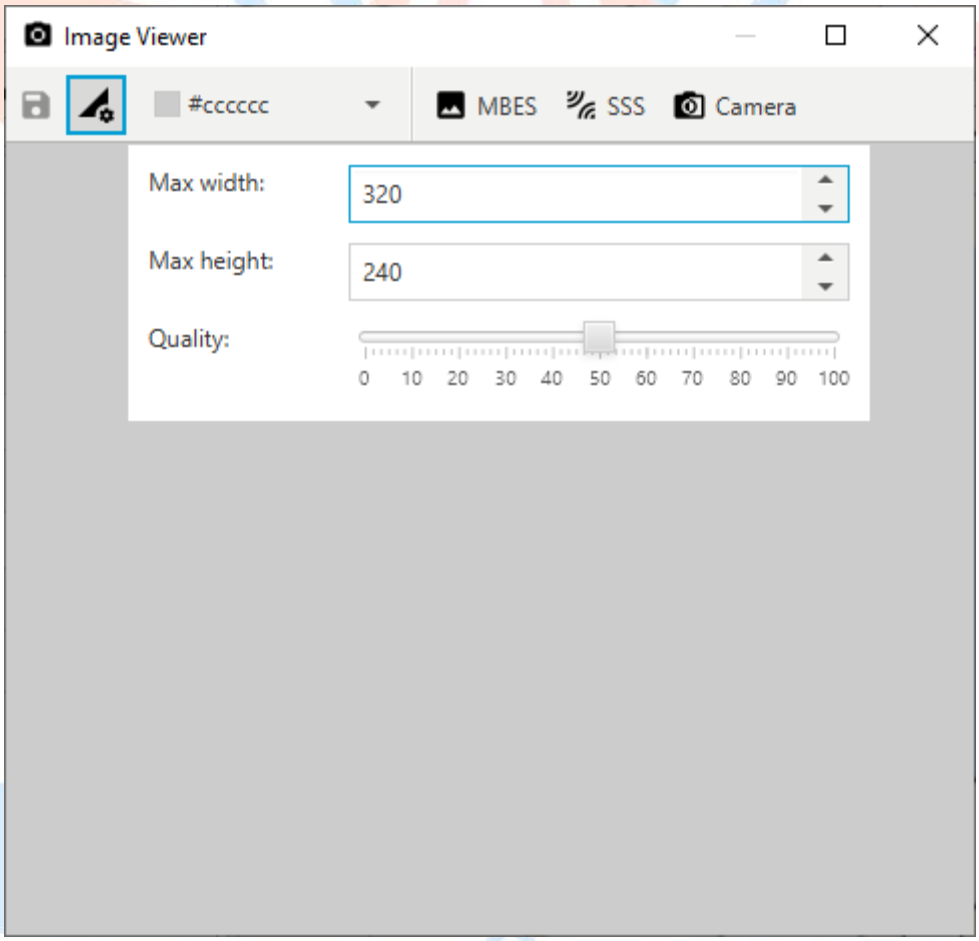


Figure 74 – Image Viewer settings

14 Definitions, Acronyms and Abbreviations

AUV	– Autonomous underwater vehicle, Amogh.
Bubble size	– The area of an imaginary sphere that surrounds the waypoint, when the vehicle enters this area the waypoint is considered reached.
CAM	– Camera.
CARIS	– The scientific board that takes care to communicate with sensors and get their data.
Flag	– A marker used to indicate the position of a point of interest.
Floating	– Means that the vehicle should drift.
GOTOWP	– The go to waypoint command used to direct the vehicle to a waypoint.
Ground station	– The computer where the VU-GUI is installed and executed.
Hovering	– Means that the vehicle should maintain the current position.
INS	– Inertial Navigation System
LB	– Logic Board
MBES	– Multi Beam Echo Sounder.
MTU	– Maximum Transmission Unit indicating the maximum dimension of a packet sent over a communication channel.
NUC	– The Navigation Control Unit that takes care of the navigation.
Operator	– The person who controls the AUV using the VU-GUI.
Resurfacing	– see surfacing.
SBP	– Sub Bottom Profiler
SSS	– Side Scan Sonar
Surfacing	– Means that the vehicle should resurface.
Vehicle	– Amogh.
VU	– Vital Unit, the board installed on the vehicle that communicates with VU-GUI.
VU-GUI	– Vital Unit – Graphical User Interface.
Lawn mower	– The positioning style of a group of waypoints arranged in parallel lines with a defined swath and width.
Swath	– The distance between two parallel lines of waypoints.
Local host	– See Ground station.
SAT	– Satellite
USBL	– USBL (ultra-short baseline) is a method of underwater acoustic positioning and communication.
RF	– Radio Frequency.

Appendix A: Planning a Mission

One of the essential features of the VU-GUI is to create a new mission. This section describes how to create a mission (the Mission1) from scratch and save it correctly.

These are the main steps:

- Create a new mission
- Plan the route
- Configure vehicle actions and sensors
- Save the mission

Creating a new mission

The operator can create a new mission selecting the "New mission" menu from the menu bar (FIGURE 75 – FILE > NEW MISSION), or clicking on the "New mission" button from the main toolbar (FIGURE 11 – THE MAIN TOOLBAR), or typing the keyboard shortcut "Ctrl + n".

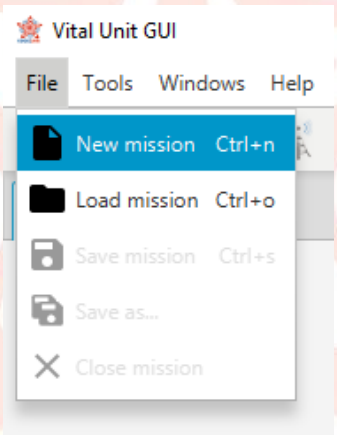


Figure 75 – File > New Mission

A dialog allows the operator to enter the name of the mission and select the time zone offset (FIGURE 76 – NEW MISSION DIALOG).

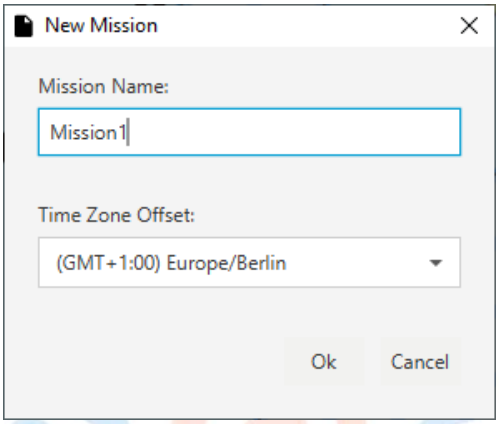


Figure 76 – New Mission Dialog

Clicking on the "Ok" button it will be possible to plan the route of the Mission1.

Route planning

As described above, the operator can plan the route using the add waypoint and/or the add lawn mower tool (11.3.10 ADD WAYPOINT, 11.3.11 ADD LAWN MOWER).

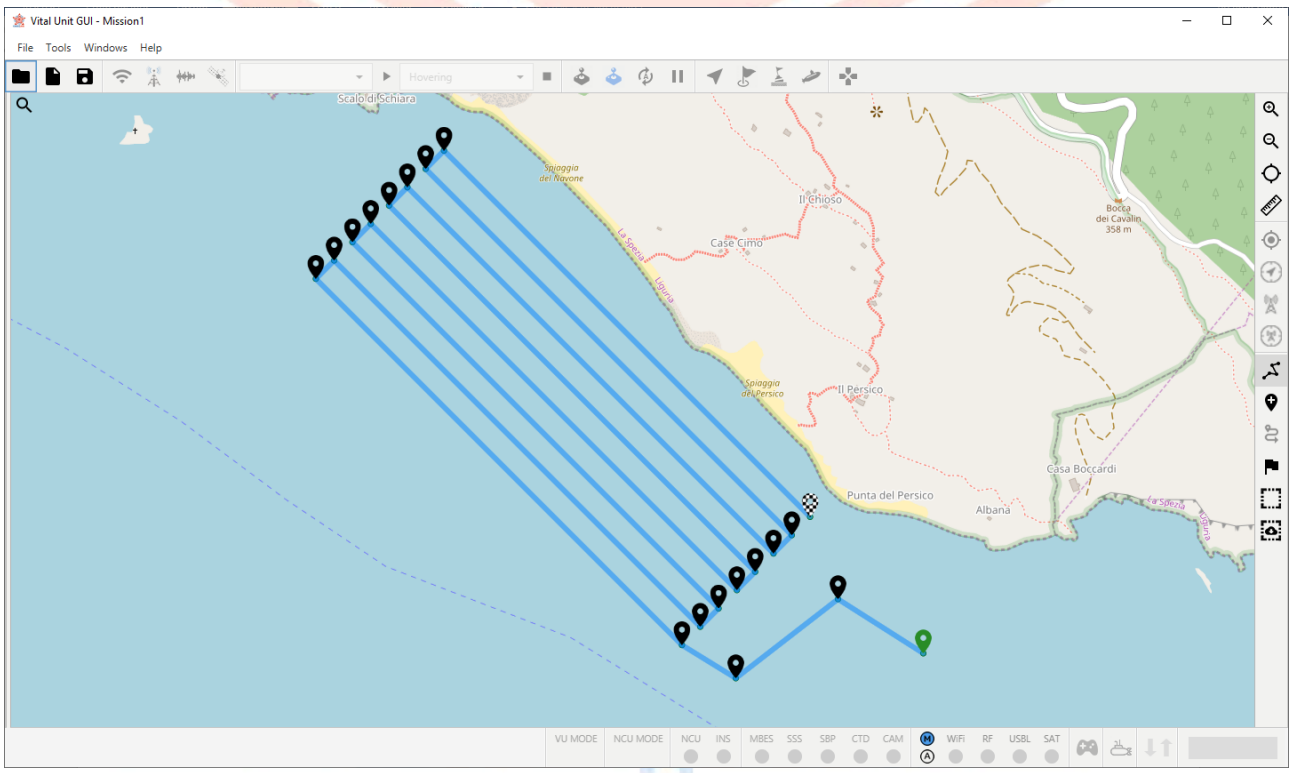


Figure 77 – Mission1: the route

Each waypoint represents the spatial coordinates that have to be reached by the vehicle to complete the mission. The first waypoint of the route is green colored, while the last has a checkered texture (FIGURE 77 – MISSION1: THE ROUTE).

Configuring actions and sensors

By clicking on a waypoint, all the parameters related to it will be shown in the Mission Planner tab (13.1 MISSION PLANNER) and can be modified to define the actions of the vehicle and the sensors at that point.

As described above, the actions allowed for each waypoint are of five types: *Hovering, Goto Waypoint, Surfacing, Floating* and *End Mission*; the last one is available only for the last waypoint. For each waypoint is also possible to configure the parameters of the sensors in the Sensor Settings tab (13.1.5 SENSORS SETTINGS TAB).

Using the selection tool (11.3.13 SELECTION TOOL) the operator can configure multiple waypoints and actions at once time.

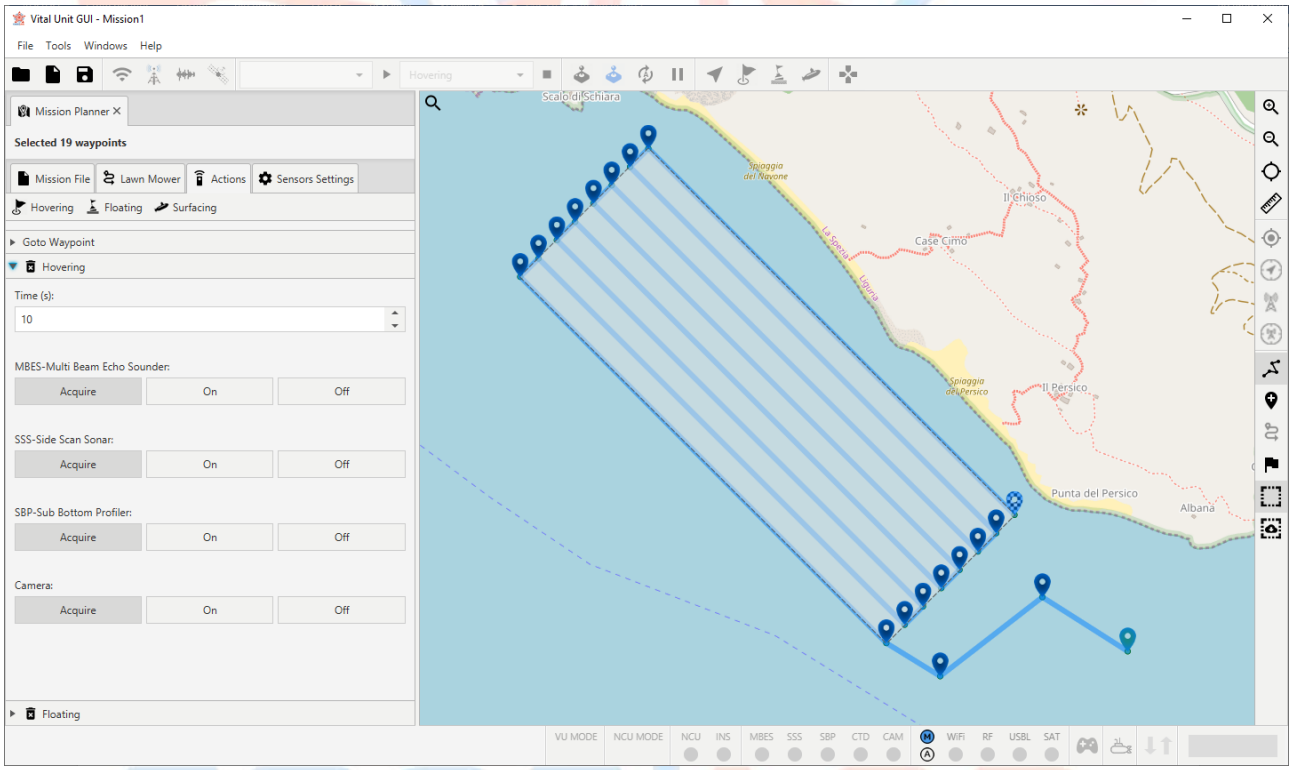


Figure 78 – Mission1: actions and sensors configuration

For the Mission1 example, we have added a hovering and a floating operation for all waypoints and the sensors have the same configuration (FIGURE 78 – MISSION1: ACTIONS AND SENSORS CONFIGURATION).

Saving the mission

Once the mission is planned, it can be saved just selecting the “Save mission” menu from the menu bar (FIGURE 79 – FILE > SAVE MISSION), or clicking on the “Save mission” button from the main toolbar (FIGURE 11 – THE MAIN TOOLBAR), or typing the keyboard shortcut “Ctrl + s”.

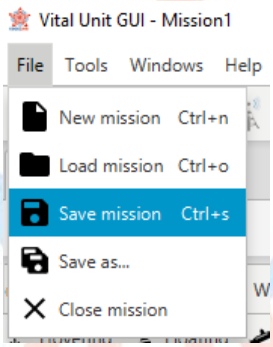


Figure 79 – File > Save Mission

```
0;CONFIG;1;+02:00;Europe/Berlin;0;0;0;END;1
1;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;57
2;GOTOWP;440620243;98000074;0;1;5;0;0;0;0;0;0;0;0;END;1A
3;HOVERING;10;2;2;2;2;0;0;0;END;4
4;FLOATING;10;2;2;2;2;0;0;0;END;15
5;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;53
6;GOTOWP;440629649;97979474;0;1;5;0;0;0;0;0;0;0;0;END;15
7;HOVERING;10;2;2;2;2;0;0;0;END;0
8;FLOATING;10;2;2;2;2;0;0;0;END;19
9;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;5F
10;GOTOWP;440615926;97954798;0;1;5;0;0;0;0;0;0;0;0;END;25
11;HOVERING;10;2;2;2;2;0;0;0;END;37
12;FLOATING;10;2;2;2;2;0;0;0;END;22
13;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;64
14;GOTOWP;440621679;97941796;0;1;5;0;0;0;0;0;0;0;16;END;1E
15;HOVERING;10;2;2;2;2;0;0;0;END;33
16;FLOATING;10;2;2;2;2;0;0;0;END;26
17;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;60
18;GOTOWP;440685202;97853392;0;1;5;0;0;0;0;0;0;0;0;END;21
19;HOVERING;10;2;2;2;2;0;0;0;END;3F
20;FLOATING;10;2;2;2;2;0;0;0;END;23
21;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;65
22;GOTOWP;440688377;97857812;0;1;5;0;0;0;0;0;0;0;0;END;21
23;HOVERING;10;2;2;2;2;0;0;0;END;36
24;FLOATING;10;2;2;2;2;0;0;0;END;27
25;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;61
26;GOTOWP;440624855;97946216;0;1;5;0;0;0;0;0;0;0;0;END;27
27;HOVERING;10;2;2;2;2;0;0;0;END;32
28;FLOATING;10;2;2;2;2;0;0;0;END;2B
29;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;6D
30;GOTOWP;440628031;97950635;0;1;5;0;0;0;0;0;0;0;0;END;24
31;HOVERING;10;2;2;2;2;0;0;0;END;35
32;FLOATING;10;2;2;2;2;0;0;0;END;20
33;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;66
34;GOTOWP;440691553;97862231;0;1;5;0;0;0;0;0;0;0;0;END;23
35;HOVERING;10;2;2;2;2;0;0;0;END;31
36;FLOATING;10;2;2;2;2;0;0;0;END;24
37;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;62
38;GOTOWP;440694729;97866651;0;1;5;0;0;0;0;0;0;0;0;END;23
39;HOVERING;10;2;2;2;2;0;0;0;END;3D
40;FLOATING;10;2;2;2;2;0;0;0;END;25
41;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;63
42;GOTOWP;440631207;97955055;0;1;5;0;0;0;0;0;0;0;0;END;2B
43;HOVERING;10;2;2;2;2;0;0;0;END;30
44;FLOATING;10;2;2;2;2;0;0;0;END;21
45;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;67
46;GOTOWP;440634383;97959475;0;1;5;0;0;0;0;0;0;0;0;END;2D
47;HOVERING;10;2;2;2;2;0;0;0;END;34
48;FLOATING;10;2;2;2;2;0;0;0;END;2D
49;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;6B
50;GOTOWP;440697904;97871071;0;1;5;0;0;0;0;0;0;0;0;END;2D
51;HOVERING;10;2;2;2;2;0;0;0;END;33
52;FLOATING;10;2;2;2;2;0;0;0;END;26
53;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;60
54;GOTOWP;440701080;97875491;0;1;5;0;0;0;0;0;0;0;0;END;2C
55;HOVERING;10;2;2;2;2;0;0;0;END;37
56;FLOATING;10;2;2;2;2;0;0;0;END;22
57;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;64
58;GOTOWP;440637559;97963895;0;1;5;0;0;0;0;0;0;0;0;END;2B
59;HOVERING;10;2;2;2;2;0;0;0;END;3B
60;FLOATING;10;2;2;2;2;0;0;0;END;27
61;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;61
62;GOTOWP;440640735;97968315;0;1;5;0;0;0;0;0;0;0;0;END;22
63;HOVERING;10;2;2;2;2;0;0;0;END;32
64;FLOATING;10;2;2;2;2;0;0;0;END;23
65;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;65
66;GOTOWP;440704255;97879911;0;1;5;0;0;0;0;0;0;0;0;END;2B
67;HOVERING;10;2;2;2;2;0;0;0;END;36
68;FLOATING;10;2;2;2;2;0;0;0;END;2F
69;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;69
70;GOTOWP;440707431;97884330;0;1;5;0;0;0;0;0;0;0;0;END;20
71;HOVERING;10;2;2;2;2;0;0;0;END;31
72;FLOATING;10;2;2;2;2;0;0;0;END;24
73;CONFIGS;0;15;0;0;0;0;0;0;0;0;0;1;0;1;0;0;0;0;4;5;0;0;0;1;0;0;0;END;62
74;GOTOWP;440643911;97972734;0;1;5;0;0;0;0;0;0;0;0;END;22
75;HOVERING;10;2;2;2;2;0;0;0;END;35
76;FLOATING;10;2;2;2;2;0;0;0;END;20
77;ENDMISSION;1;0;0;0;0;0;0;END;2
```

Figure 80 - Mission1: mission file output