# HIL Simulator

*Release 6.8.25*

**Embention**

**2023-08-04**

# CONTENTS


1 Introduction 3

2 Software Installation 5

3 Operation 7

4 X-Plane 11 11

5 Troubleshooting 19

VERONTE
HIL

CHAPTER

ONE

# INTRODUCTION

**HIL Simulator** is the Veronte application to perform HIL (Hardware In the Loop) simulations. This kind of simulation runs Veronte software with a real autopilot (**1x** or **4x**), taking simulator input as real sensor data. The whole flight is controlled by the real autopilot in a virtual environment, making it the perfect tool for vehicle development and training operators in the use of Veronte autopilot, prior to conducting real flight operations.

**HIL simulator** is designed for applications such as:

- Pilot training.
- Veronte configuration for unmanned platform control.
- PID setting.
- Mission configuration.
- Aircraft performance validation.

The operator can fly the system as a real flight, being compatible with main Veronte features: real-time mission edit, in-flight automatic to manual control, flight data recording… Sometimes, during an edition saving, the simulation fails because the simulation link suffers a little interruption (this fact does not exist in real flights).

**Warning:** When using HIL Simulator, real control actuators will move as a real flight. In order to avoid damage people or equipment, make sure that motors are disconnected and there is no shock risk due to actuators movement.

**HIL Simulator** is employed along with:

- **Veronte Link** to connect the autopilot with a computer. To read the user manual click here.
- **Veronte Ops** to operate the auopilot during simulations. To read the user manual click here.
- **Microsoft Flight Simulator** or **X Plane 11** to simulate flights.

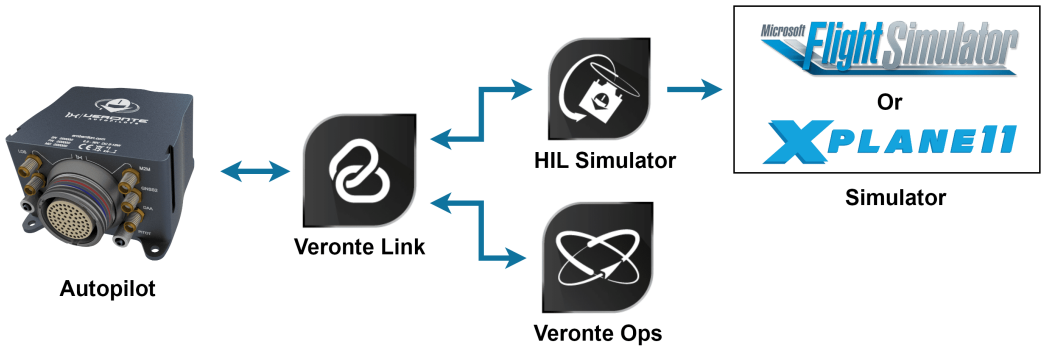



Fig. 1: **Applications Diagram**

CHAPTER

TWO

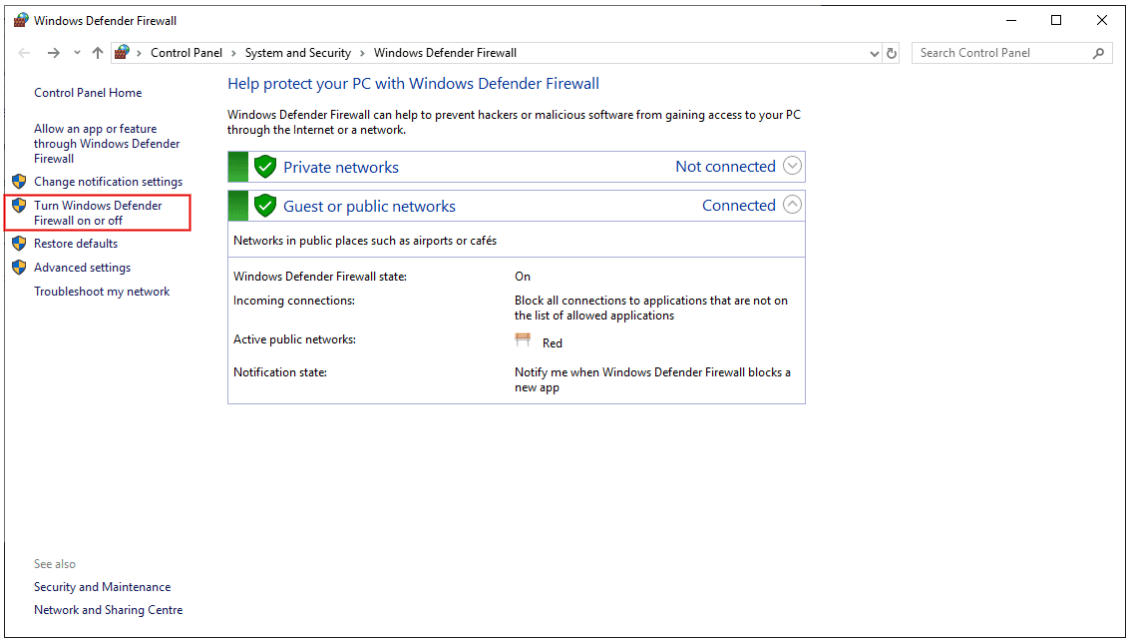
# SOFTWARE INSTALLATION

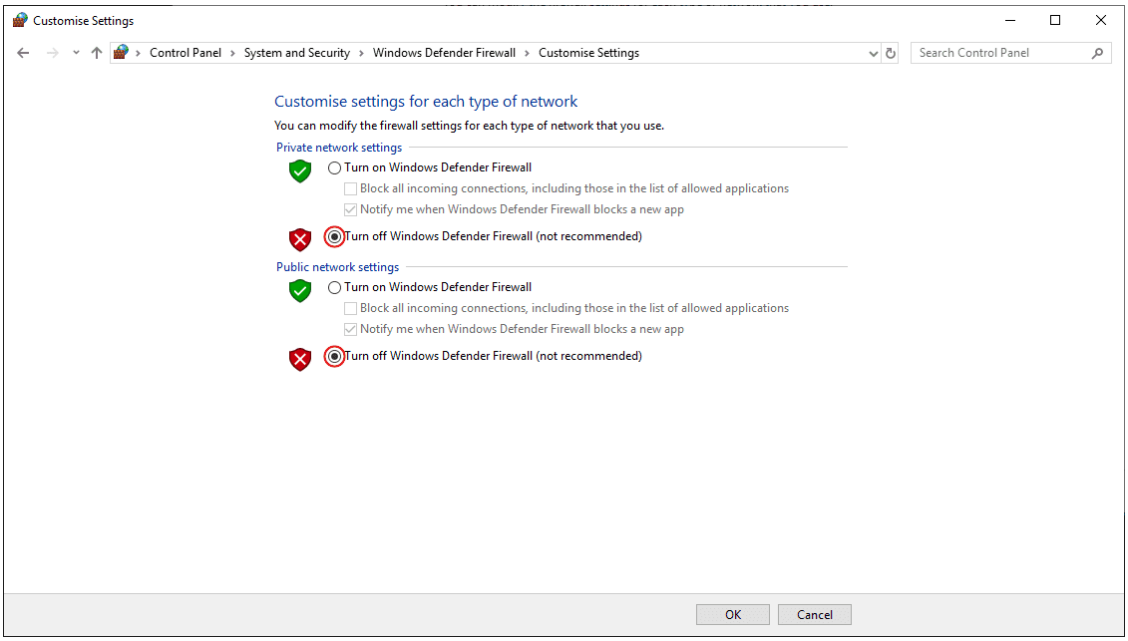
Once the **Veronte Autopilot 1x** has been purchased, a GitHub release should be created for the customer with the application.

To access to the release and download the software, read the Releases section of the **Joint Collaboration Framework** manual.

To install Hil Simulator on Windows, execute VeronteHil.exe and follow the Setup Wizard instructions.

In case of any issue during installation, please disable Windows Defender and Firewall. To disable Firewall, go to "Control Panel" and "Firewall of windows", then click on **Turn off**.




Customise Settings
Control Panel › System and Security › Windows Defender Firewall › Customise Settings
Search Control Panel
Customise settings for each type of network
You can modify the firewall settings for each type of network that you use.
Private network settings
Turn on Windows Defender Firewall
Block all incoming connections, including those in the list of allowed applications
Notify me when Windows Defender Firewall blocks a new app
Turn off Windows Defender Firewall (not recommended)
Public network settings
Turn on Windows Defender Firewall
Block all incoming connections, including those in the list of allowed applications
Notify me when Windows Defender Firewall blocks a new app
Turn off Windows Defender Firewall (not recommended)
OK
Cancel

CHAPTER

THREE

# OPERATION

To start using **HIL Simulator**, follow the next steps:

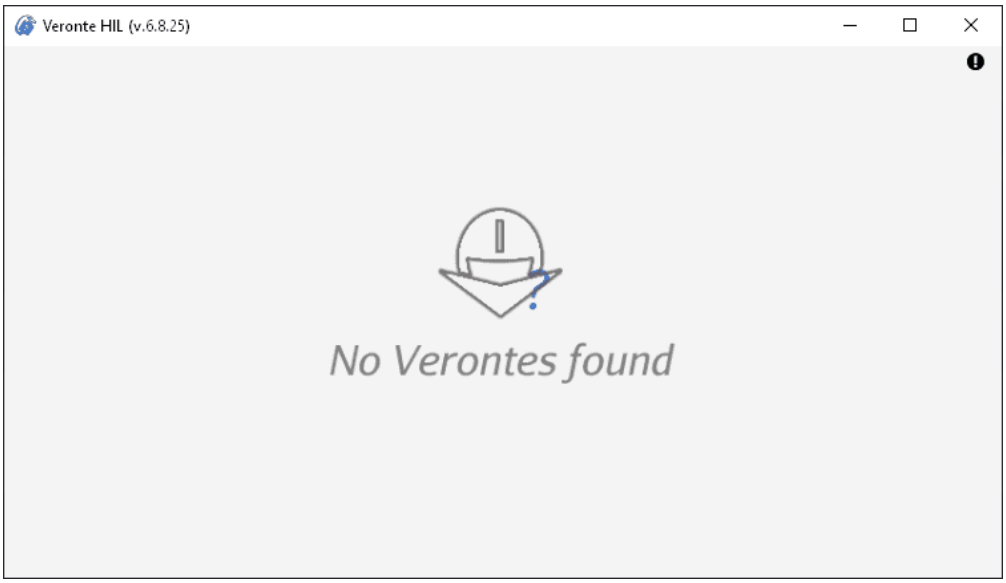
- **1. Connect the autopilot to a computer.**

  Use **Veronte Link** to stablish the connection, read the user manual for more information.

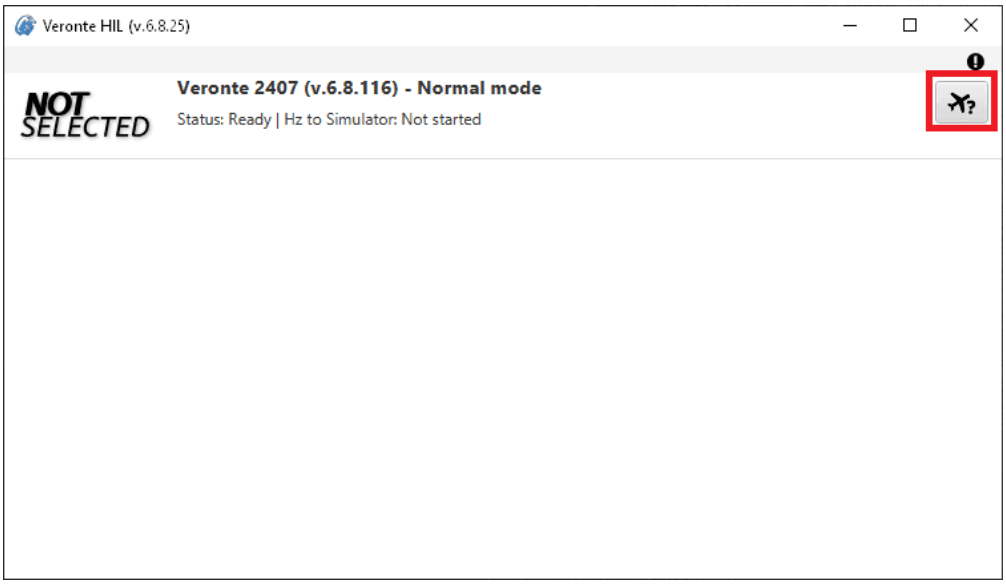
Fig. 1: **Open Veronte Link**

- **2. Open HIL Simulator.**

  The following window will pop up for a second.



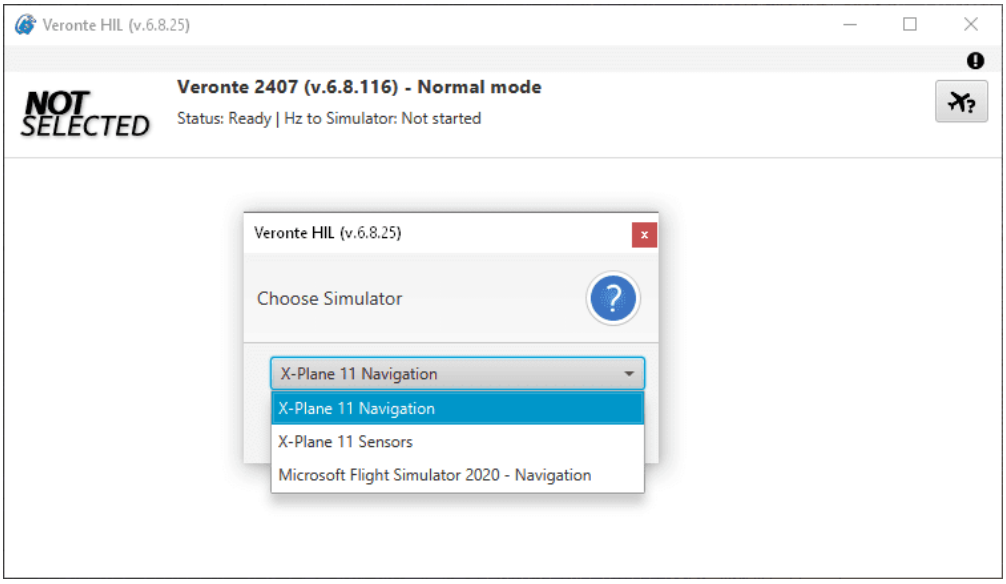

If the autopilot is properly connected, then the window will change as follows.



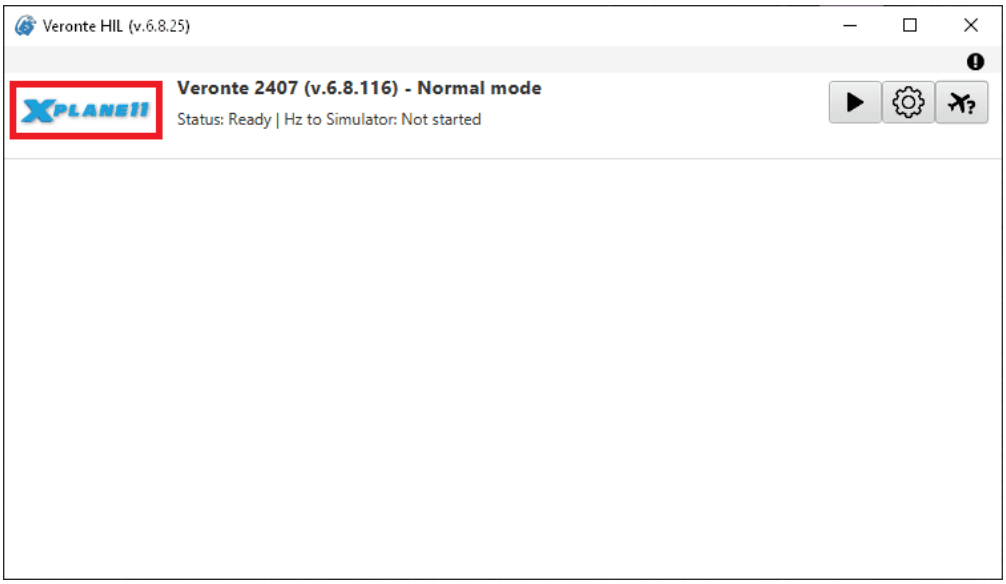

**Note:** **HIL Simulator** will run minimized in the Windows taskbar:

- **3. Choose a simulator.**

  Click on to choose one.




Then, **HIL Simulator** will be ready to start.

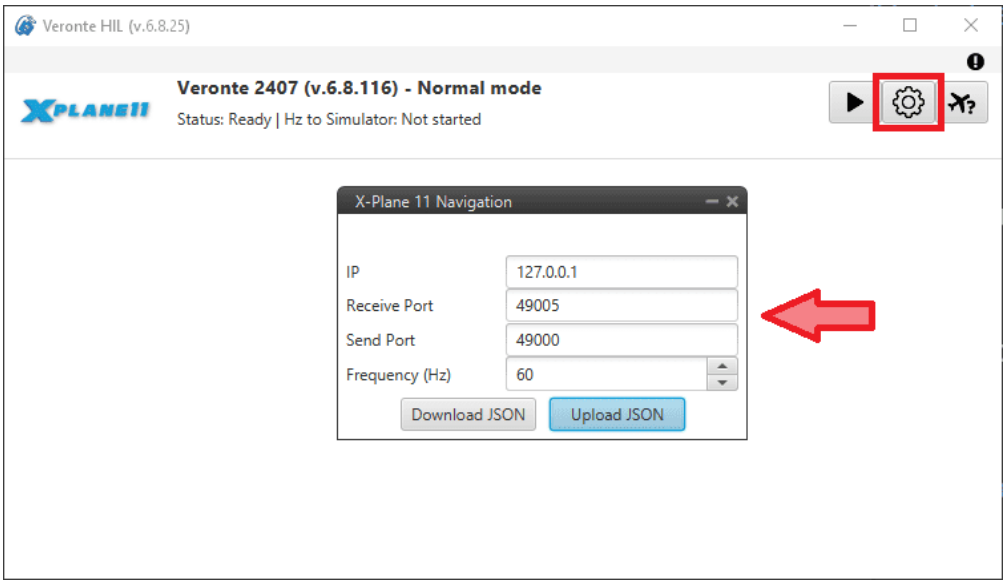



The following video summarizes steps 2 and 3:

Fig. 2: **Open HIL simulator and choose simulator**

- **4. Configure the simulator (optional).**

  Default configuration parameters are recommended. To change them, click on .




  These four parameters must have the same value for the simulator. They are configured for **X-Plane 11** in *X-Plane Settings*. **Frequency (Hz)** of **Hil Simulator** corresponds to **UDP Rate** (packets per second) of X-Plane, since the autopilot sends and receives data at this frequency.

After following the previous steps, read *X-Plane 11* section to simulate the connected autopilot.

CHAPTER

FOUR

# X-PLANE 11

Veronte systems are compatible with X-Plane 11 for HIL simulation. X-Plane 11 communications settings must be edited in order to have communication with Veronte systems. Follow the next steps in order to make a proper configuration.

**Note:** For low-performance computers, it may be needed to reduce the graphics quality on the simulator, as described below.

- **1. Aircraft Model Installation.**

  X-Plane 11 simulator is compatible with a wide variety of platforms: airplane, helicopter, multicopter, surface vehicle… In order to create the platform model, Plane Maker tool provided by X-Plane 11 must be used. Once the aircraft model has been created, it can be integrated on the X-Plane 11 simulator by following the next sub steps:

  - 1.1: Copy the model folder to the "Aircraft" folder within the X-Plane 11 installation directory.
  - 1.2: Copy the content in the "Airfoils" folder, available in the aircraft model folder, to the "Airfoils" directory within the X-Plane 11 installation directory.

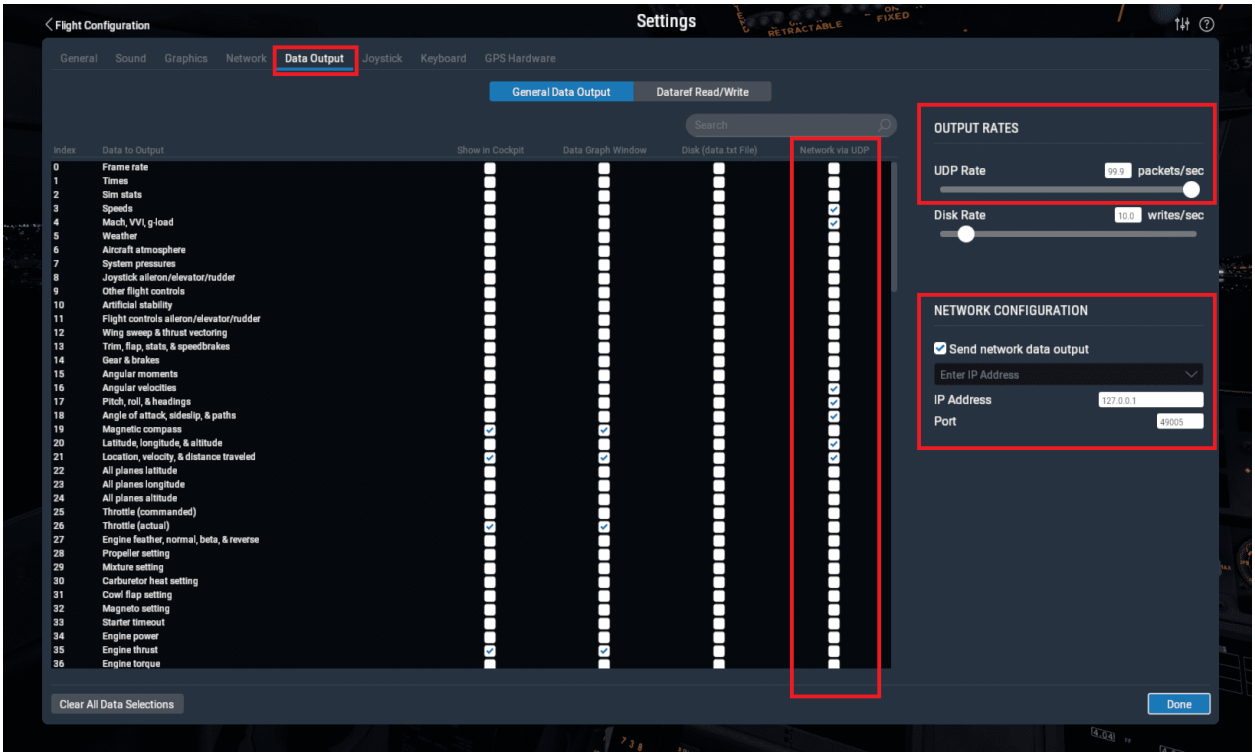
- **2. Custom airport.**

  X-Plane flight starts from an airport; a custom airport must be defined for simulating in case of not having available airports. In addition, it is possible to create a new airport. In order to do that, the user should follow the X-Plane tutorial presented in the next link. Once the airport has been created, copy the model folder to the X-Plane 11 installation directory.

- **3. X-Plane Settings.**

  Data transmission settings of X-Plane must be edited on **Settings** ⇒ **Data Output**. This configuration must coincide with **Hil Simulator**. Select all the variables to sent through the UDP Network and set the UDP rate at maximum speed. The network configuration must be configured as shown in the following table and picture.

| Parameter | Value |
|---|---|
| 3 - Speeds | Mark ☑ in the **Network via UDP** column |
| 4 - Mach, VVI, g-load | |
| 16 - Angular velocities | |
| 17 - Pitch, roll & headings | |
| 18 - Angle of attack, sideslip & paths | |
| 20 - Latitude, longitude & altitude | |
| 21 - Location, velocity & distance traveled | |
| IP | 127.0.0.1 |
| Receive port | 49005 |
| Send port | 49000 |
| UDP rate (packets / second) | Hil Simulator frequency, with 99 as maximum value |




- **4. X-Plane 11 Setup.**

  Open X-Plane 11 ⇒ **Main menu**. To start a simulation click on **New Flight**:

Then, the following window will be displayed. Select which **aircraft** to use, the starting **airport** and weather conditions to simulate. Finally, click on **Start Flight** the start de simulation:

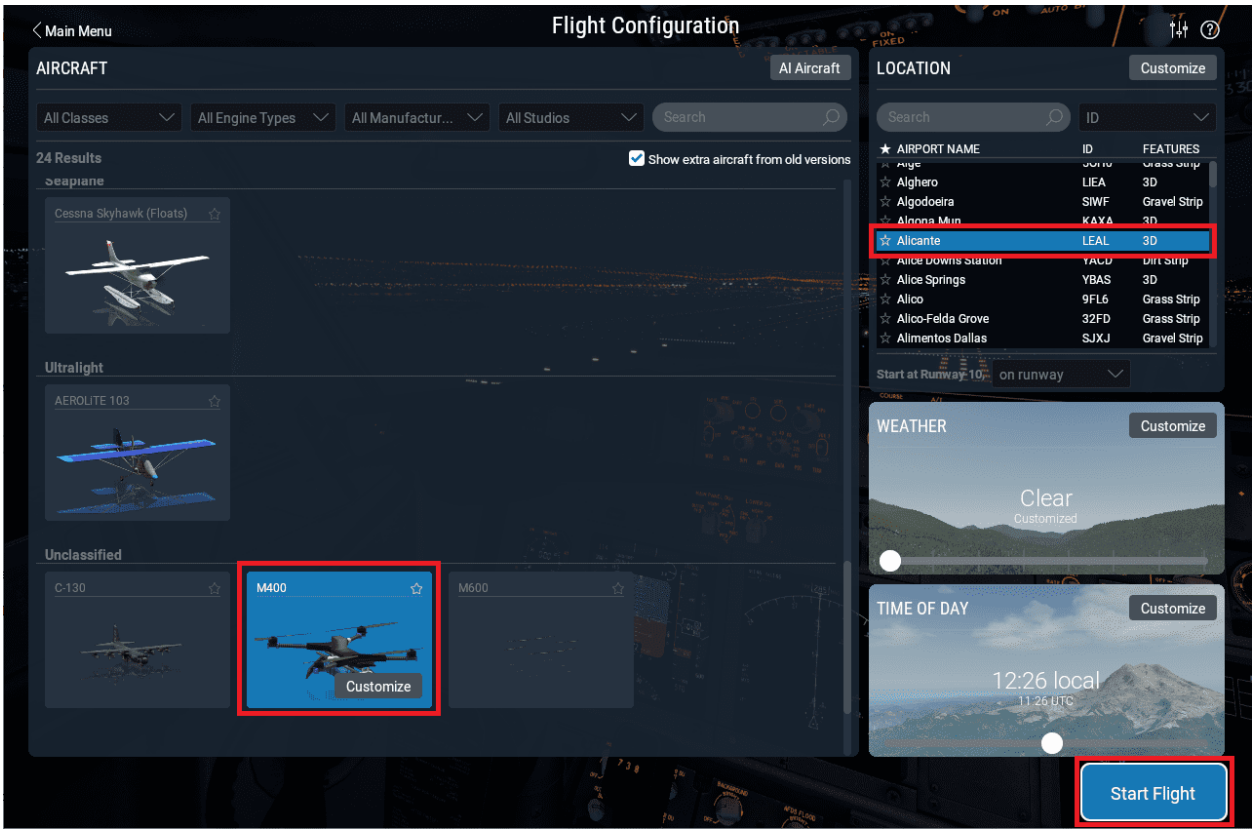



Fig. 1: **X-Plane 11 Setup**

- **5. Run simulation.**

  Once X-Plane is configured, click on of **HIL Simulator** to enable the sending of commands. The frequency to the simulator should then be set to, approximately, the previously configured frequency:

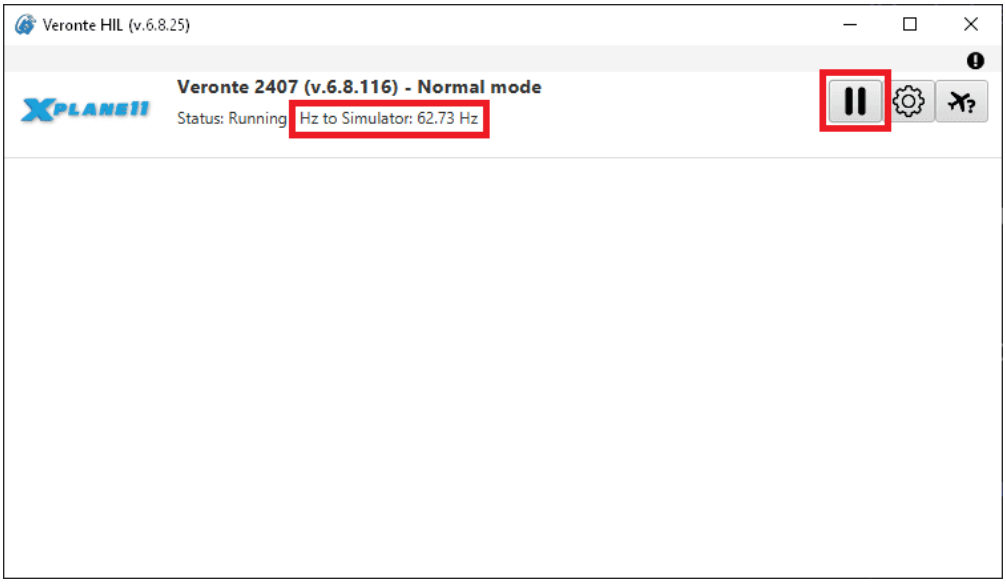



Fig. 2: **HIL - Run simulation**

- **6. Check sending/receiving data.**

  Go to **Settings** ⇒ **Network tab**. Check that the *sending* and *receiving data to* is correct:

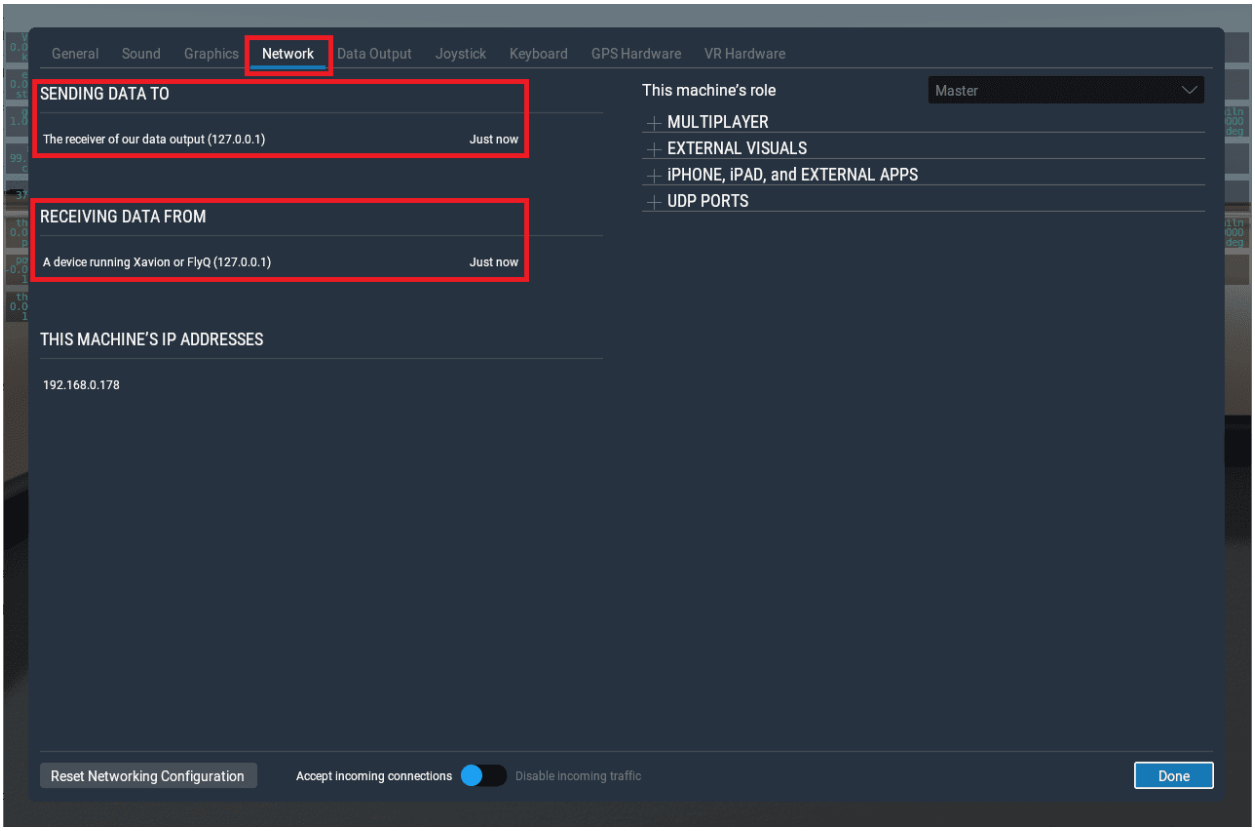



Fig. 3: **Check sending/receiving data**

Once the hardware has been connected and the software has been configured, operation can start and the system can be operated as a real flight.

GPS will be simulated and the UAV should be visible on **Veronte Ops** in the selected airport, with a colored icon as follows:

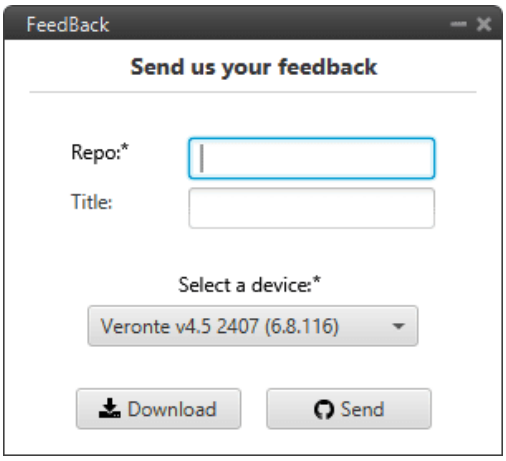
Fig. 4: **Veronte Ops**

**Warning:** The simulation starts when the aircraft is in the initial phase (when it is powered). In this phase, X-Plane will simulate the GPS signal to locate the autopilot.

With GPS signal it is possible to pass the system to Standby phase and to start flight. Once the aircraft has taken off from the airport on X-Plane, the automatic control will start and the aircraft will fly, according to the defined mission on **Veronte Ops**. For more information about **Veronte Ops**, read the User Manual, remember to select the employed software version.

CHAPTER

FIVE

# TROUBLESHOOTING

In case of any issue or suggestion, it is possible to send a report pressing .