D3.1- UTM Box user manual

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Ref.	File Name	Description
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AD 2	D2.6 – CONOPS and System requirements	System requirements of Certiflight
AD 3	D2.3- U-space regulation compliance and standards	U-space/UTM applicable regulations and Standard

REFERENCE DOCUMENTS		
Ref.	File Name	Description
RD 1	D3.2 CERTIFLIGHT platform user manual	This deliverable describes the features of Certiflight platform
RD 2	D3.3 TN2: MAIA UTM update IF/ICD report	This document describes how the MAIA UTM platform has been updated to interface with Certiflight services.
RD 3	D.3.4 TN3: D-FLIGHT UTM update IF/ICD report	This document describes how the d-flight platform has been updated to interface with Certiflight services.
RD 4	D3.7 TN6: UNIFLY UTM update IF/ICD report	This document describes how the Unifly's UTM platform has been updated to interface with Certiflight services.
RD 5	DJI Payload SDK 3.8.0	Software documentation to interface with DJI Enterprise UAS

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SUMMARY

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Abstract

The document is composed by the following chapters:

1. Device for UAS, with general description of the device designed for UAS.
2. Device for GA, with general description of the device designed for GA.
3. Configuration, which is done using the dedicated device gateway.
4. Installation, to describe how users can properly mount the device on UAS and GA cockpit.
5. In-flight, to understand the information visualized on the compatible platforms.
6. An appendix with technical specification

This document represents the contractual deliverable of CERTIFLIGHT project: “D3.1 – UTM Box user manual”.

1 Scope of the document

The scope of the document is to describe how to set up and use the Certiflight devices.
This is an initial version of the document after platform development completion. The final issue is planned after testing completion.

1.1 Acronyms

Acronyms	Description
ADS-B	Automatic Dependent Surveillance - Broadcast
ASTM	American Society for Testing and Materials
EASA	European Union Aviation Safety Agency
EGNOS	European geostationary navigation overlay system
EGNSS	European Global Navigation Satellite System
FAT32	File Allocation Table 32 bit
FLARM	Flight Alarm
HMI	Human Machine Interface
GA	General Aviation
GPS	Global Positioning System
IP	Ingress Protection
GNSS	Global Navigation Satellite System
OSNMA	Open Service Navigation Message Authentication
RID	Remote Identification
SMA	SubMiniature version A
UAS	Unmanned Aerial System
USSP	U-space Service Provider
UTM	Unmanned Traffic Management

Table 1-1 Acronyms list

2 Introduction

CERTIFLIGHT would like to thank you for purchasing and using our products.
You can contact us if you have any doubts about the CERTIFLIGHT system or for more information send a mail to support@certiflight.info
The document contains graphic symbols to indicate suggestions, possible hazards, or damage to the equipment or its components. They are used as follows:

	This symbol indicates that the box contains suggestions and clarifying information.
	This symbol indicates important information that the user must follow for the device to function properly.

The Certiflight box is a tracking and remote identification device for aircraft systems, which features OSNMA Galileo/EGNOS enabled receiver capable to guarantee the authenticity of the position information at the origin.
The tracking information is cyphered for real-time transmission to CERTIFLIGHT Portal and permanently stored to a private Blockchain node, unalterable once stored.

In addition, beyond any mechanism to avoid the mechanical alteration, the device features a dedicated cyphering chipset, usually referred as secure element, tailored to avoid secrets exposure.

To meet the specific needs of UAS and General aviation operators, the device is presented in two versions: UAS and GA version.

3 Device for UAS

The device for UAS is a “UTM box” designed to be easily installed on light and small UAS. The weight is 90 grams with normal battery and 113g with additional battery for longer flight time. It can be mounted with dual lock tape or a specific adapter. Once installed, the device can communicate via direct interface (USB Type-C cable) and remote interface (cellular network). The device has 3 hours of flight time in continuous acquisiton and data transmission; with the extended battery it features up to 5 hours operating time without charging.
The UTM box also features Inertial Module Unit with Gyroscope, accelerometer, magnetometer and barometer sensors.
The UAS version of the device can operate in two modes:

- **Normal mode:** the device exclusively guarantees the authenticity of the position information (time and location of flight). This mode enables authenticated tracking service for U-space and light report on Certiflight Portal.
- **Payload mode:** the device couples the position information with the data acquired by the UAS. This information will be part of the full report generated by the Certiflight Portal. This feature is exclusive for UAS version of the device.

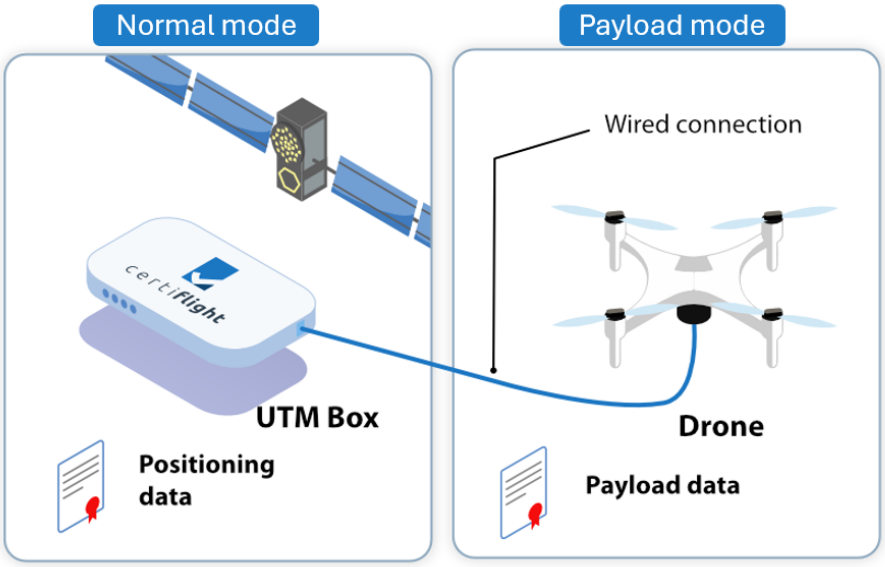


Figure 3-1 Device for UAS - Operating modes

3.1 General presentation

On the bottom side there are the power slide switch and USB Type-C connector for charging and payload interface. While on the front hand side, the device has four LED indicators, for which a specific section is dedicated.

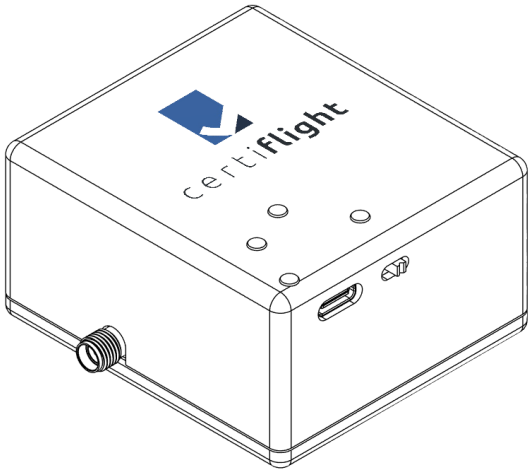


Figure 3-2 Device for UAS - front, bottom and left side views.

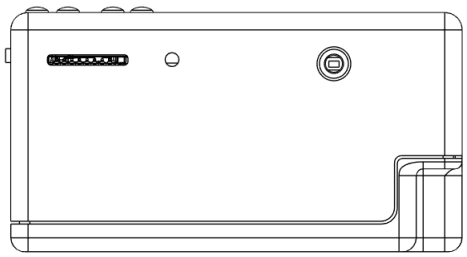


Figure 3-3 Device for UAS - right hand side view

On the right-hand side there the Micro SD slot with a dedicated LED and a custom button, used for future updates.

⚠ For a proper functioning, we recommended to use a MicroSD of 4GB or more formatted in FAT32

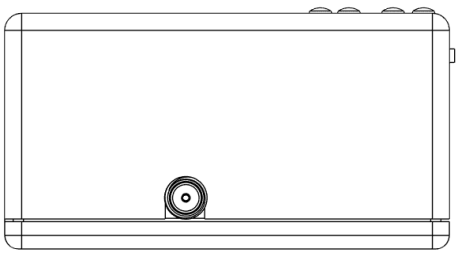


Figure 3-4 Device for UAS - left hand side view

The SMA connector for the external GNSS antenna is placed on the left-hand side.

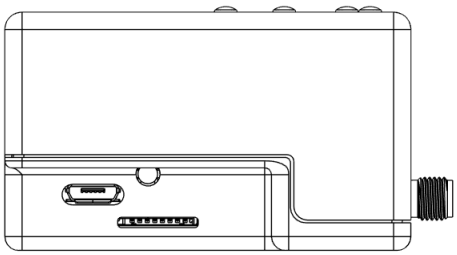


Figure 3-5 Device for UAS - top hand side view

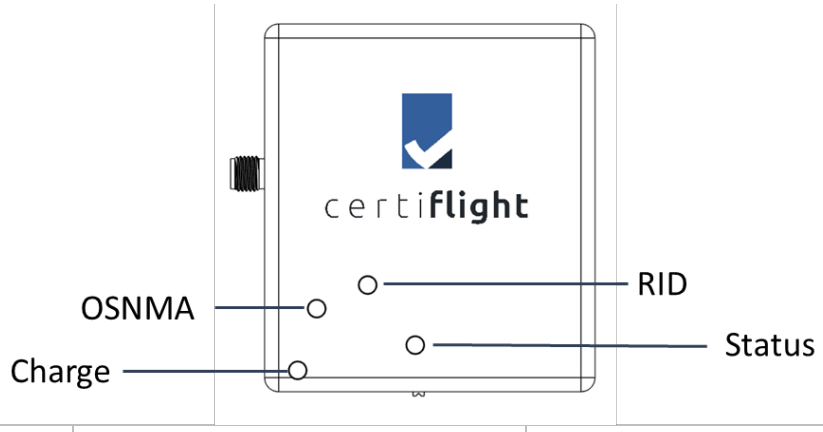
The top-hand side presents an additional SD card and a service only micro-USB port.

3.2 Package

In the box, in addition to the device, the user will find:

- USB Type A – USB Type C charging cable
- Canopus 3M Lock Fastener Tape
- GNSS Antenna with dedicated RF SMA cable
- Mounting adapter for DJI M300 (on request)

3.3 LED Indicators



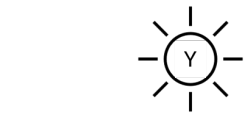
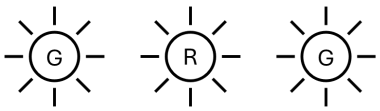
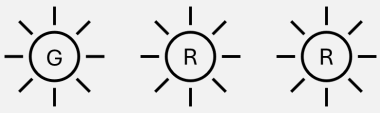
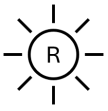
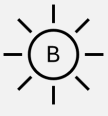
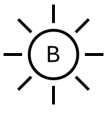
STATUS		Flashing Yellow Component Preparation
		Flashing Green Ready to fly
		Alternating flashing Green and Red – Prevailing Green Battery level < 40%
		Alternating Green and Red – Prevailing red Battery level < 30%
		Flashing red Device in sleep – Please recharge
		Solid Red: Data storage error, check SD card
CHARGE Built-in battery charging		Solid Red: Charging Off: Charging complete.
OSNMA Position authentication		Flashing: OSNMA is active
RID Remote Identification		Fast flashing blue: RID is active

Table 3-1 Device for UAS - LED indicators description

3.4 Charging

The Certiflight Box can be charged via the USB cable in the box from any 5V compatible source, such as a computer's USB port, a powerbank or a smartphone adapter. The light on Charge LED indicates that the device is charging. The same LED will turn off once charging is complete.

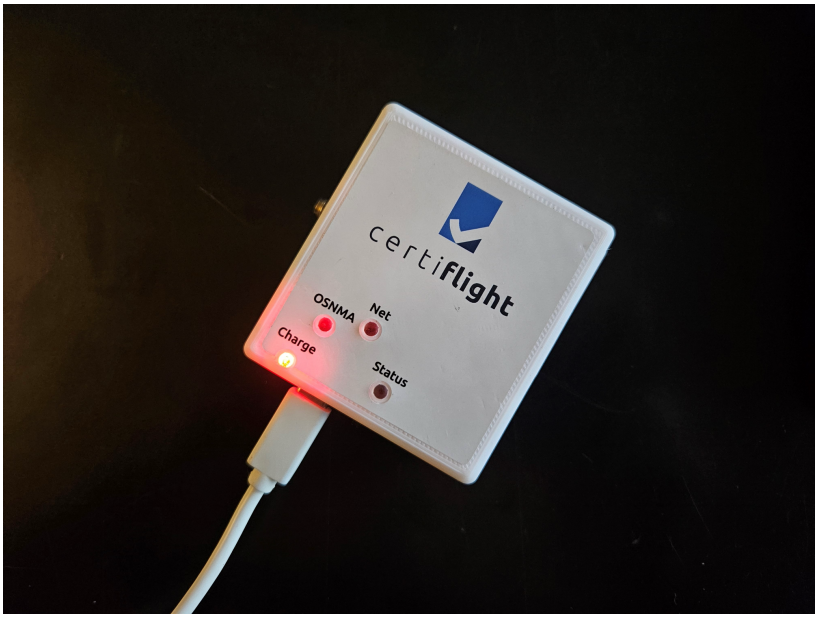


Figure 3-6 Device for UAS during the charging

⚠ Charging via cables with the USB-C connector on both sides is not supported in this version.

4 Device for General Aviation

The device for General Aviation is a UTM box designed for light and small planes.
It features all the UAS version characteristics plus ADS-B-in and FLARM-in/out support and a display as HMI. The 4,3 inches display shows other planes in the surrounding area and provides visual advisory warnings and indication to help the pilot in collision avoidance maneuvers.
The embedded battery guarantees up to 8 hours operating time without charging.

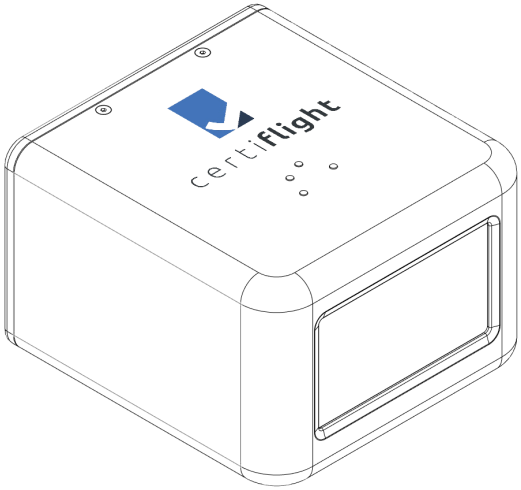


Figure 4-1 Device for GA - front, top and left-hand side view

On the top hand side, the device has four LED indicators, for which a specific section is dedicated.

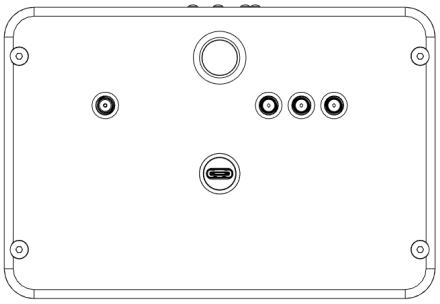


Figure 4-2 Device for GA - rear side view

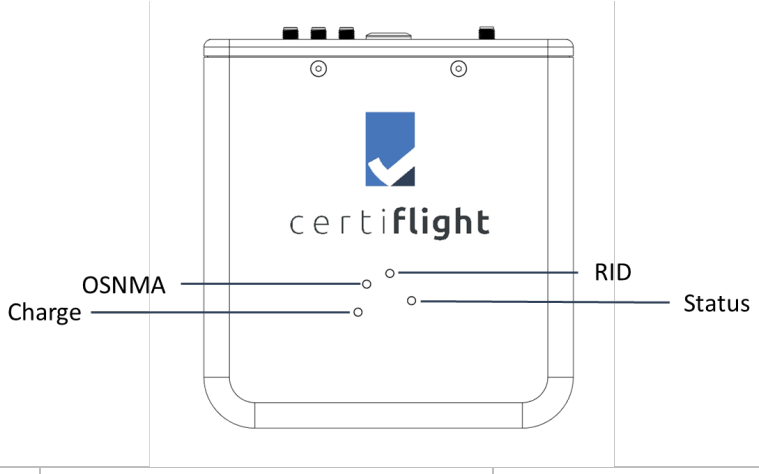
The rear-hand side presents four RF SMA connectors, starting from left-hand side: primary GNSS antenna, ADS-B, FLARM, aux GNSS antenna.
Also on the same side, there are the power button and the USB Type connector for charging.

4.1 Package

In the box, in addition to the device, the user will find:

- USB Type A – USB Type C charging cable
- Canopus 3M Lock Fastener Tape
- GNSS Antenna with dedicated SMA cable
- ADS-B and FLARM antennas

4.2 LED Indicators



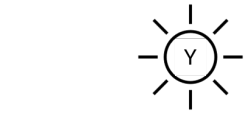
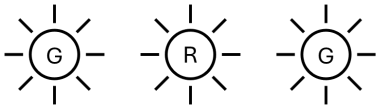
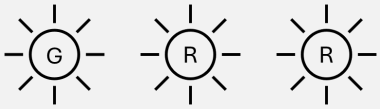
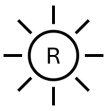
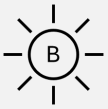
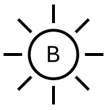
STATUS		Flashing Yellow Component Preparation
		Flashing Green Ready to fly
		Alternating flashing Green and Red – Prevailing Green Battery level < 40%
		Alternating Green and Red – Prevailing red Battery level < 30%
		Flashing red Device in sleep – Please recharge
		Solid Red: Data storage error, check SD card
CHARGE Built-in battery charging		Solid Red: Charging Off: Charging complete.
OSNMA Position authentication		Flashing: OSNMA is active
RID Remote Identification		Flashing: RID is active

Table 4-1 Device for GA - LED indicators description

4.3 Display

The display indications helps the pilot for situational awareness, providing information of surrounding traffic. The following table describes the different messages displayed on the device.

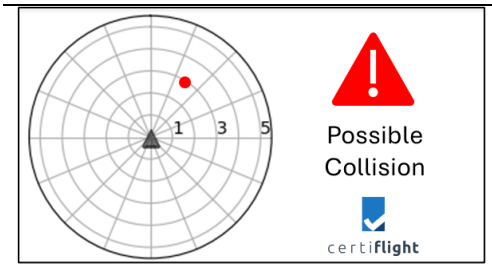
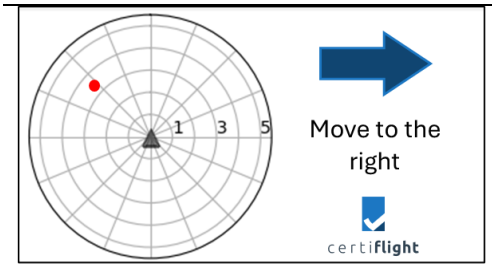
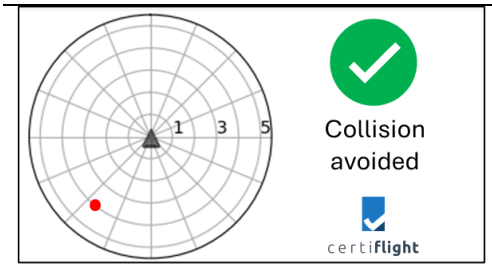
	**Normal operating status** The device is running normally. It displays a radar chart with traffic in the proximity (5NM). The traffic is displayed considering the current aircraft heading.
	**Warning message of possible collision** The embedded collision avoidance algorithm raises a warning to the pilot.
	**Course change suggestion to avoid collision.** The device suggests temporary course change to avoid other traffic. This message appears few seconds after the collision warning message and only disappears when the collision has been avoided.
	**Collision avoided message** This message appears when the other traffic has been avoided.

Table 4-2 Device for GA - Displayed messages description

5 Configuration

The configuration of both devices can be done through the device gateway: https://pollicino.topview.it/
This configuration on this portal is needed only for the first time of device initialization and Network Remote ID features.
Once registered, the user can access the profile settings, the map to check the active devices, and the list of devices paired to the account.
To register as a new user, log in to the device portal and click on "Sign up" in the top menu.

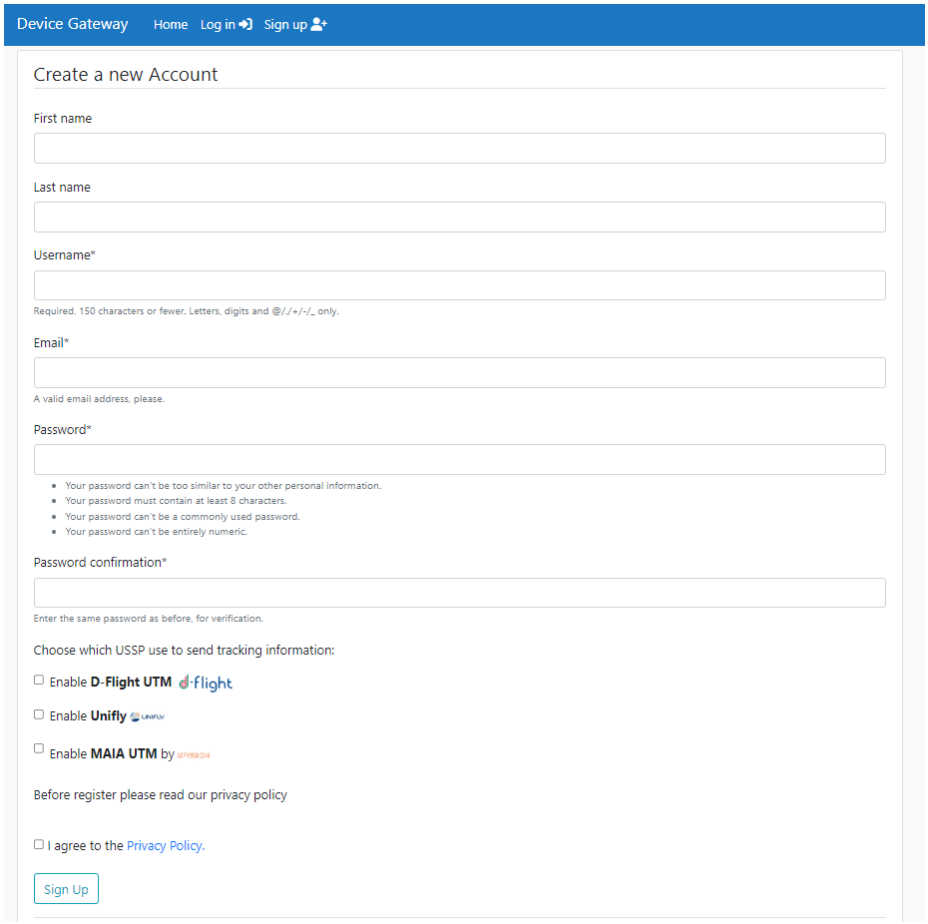


Figure 5-1 Device Gateway - Registration screen

To register as a new user, log in to the device portal and click on "Sign up" in the top menu.

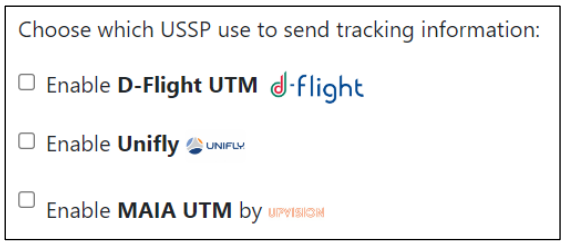


Figure 5-2 Device Gateway - USSP selection in registration screen

The password cannot be similar to personal information (e.g. first or last name) and must contain at least eight alphanumeric characters. The data is processed according to TopView's Privacy Policy.

5.1 First initialization

To pair the Certiflight Box with the user account, please follow these steps when you turn it on for the first time:

1. Connect to the device portal: https://pollicino.topview.it/
2. Log in

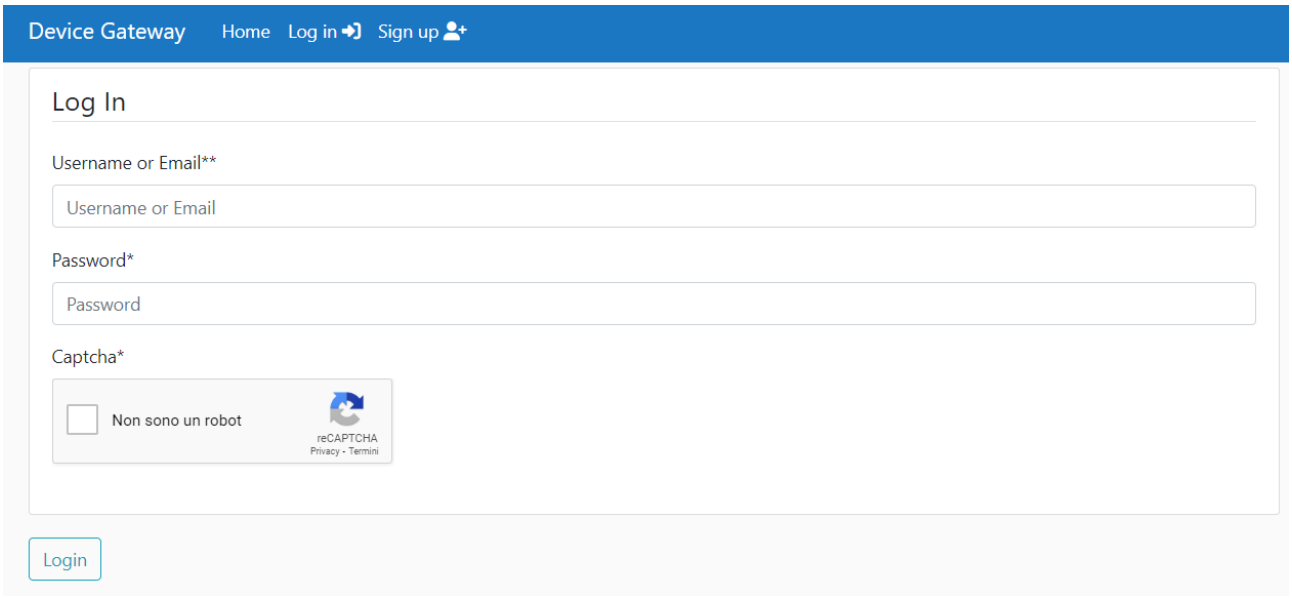


Figure 5-3 Device Gateway - Login screen

In case of a forgotten password, click on "forgot password?"

3. From the top menu, select "DEVICES" to register the device and then click on "Register a new device".

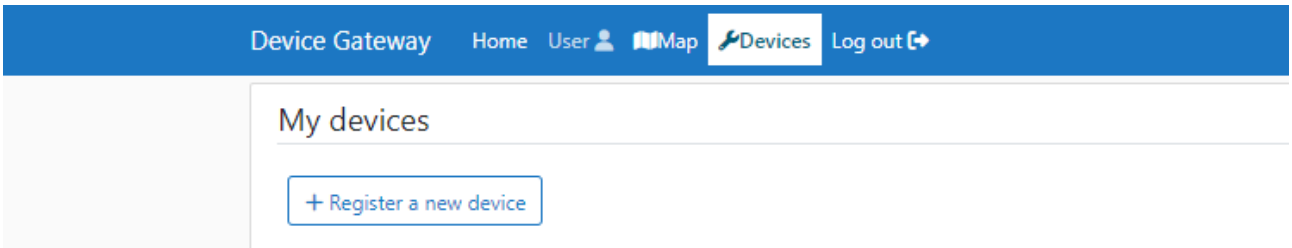


Figure 5-4 Device Gateway - Register new device button

4. Select “Certiflight Box” in the scrolling menu.
5. Enter the Serial Number printed on the label on the back of the device and click "Submit”.

Figure 5-5 Serial number example

6. Turn on the device using the slide switch and wait for the first registration to be made to the 4G/5G telephone network.
7. Wait for the confirmation of device verification (message)
8. Scan the QR code or click on the link and sign-in to pair the device to your Certiflight account.

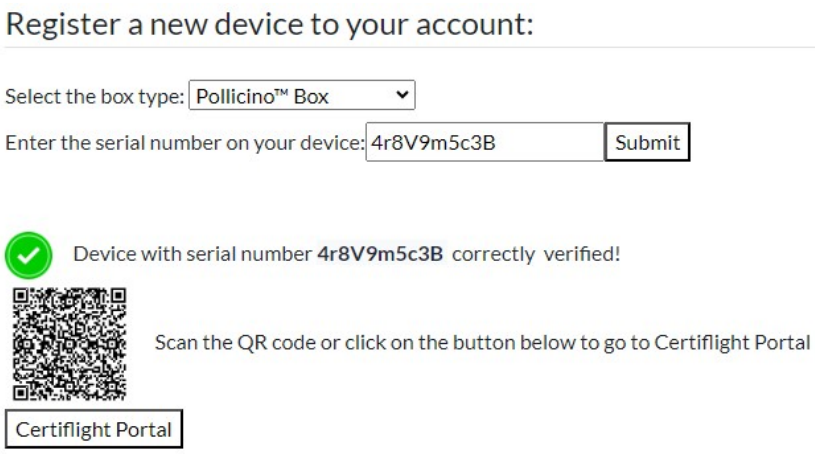


Figure 5-6 Confirmation of device verification

⚠	When first turned on, the RID LED will flash for about two minutes. Do not turn off the device. This phase ends when the STATUS LED flashes green along with the OSNMA and RID LEDs in blue.

5.2 User Settings

By clicking on the username in the top menu, user can access their profile settings.
Then the user can change first name, last name, phone, company, and country.

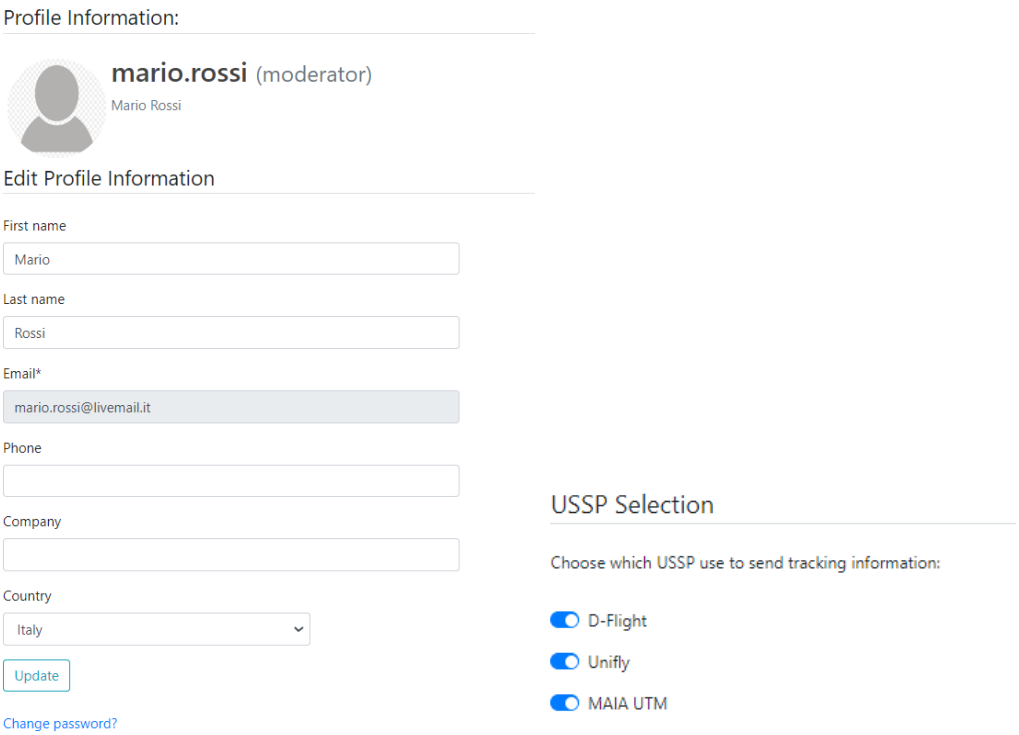


Figure 5-7 Profile information and USSP selector

Scrolling down the user can find the U-space Service Provider selector. Each toggle enables the transmission of the Authenticated tracking information to the selected UTM supplier and the displays the specific fields to be configured in the devices section.

5.3 Map

In the map section, you can view the location of active devices and the information transmitted.

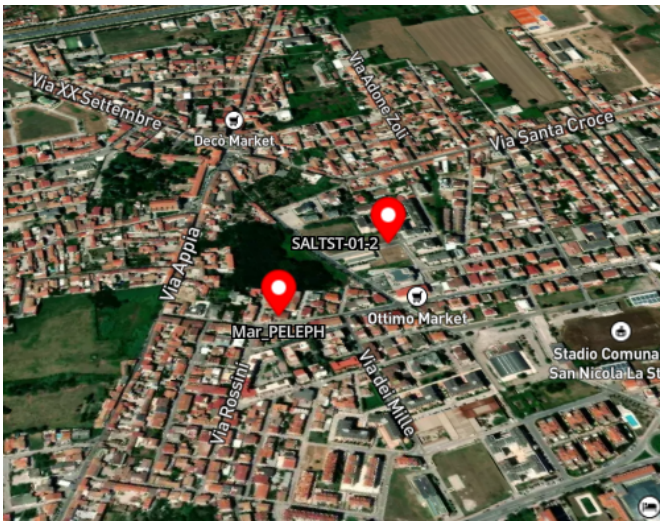


Figure 5-8 Device Gateway - Non-authenticated position

Use the map section of the Device Gateway is used only to verify that the data are correctly transmitted to the selected U-space/UTM Service Providers.

The icon appears in two different colours:

	Non authenticated position
	Authenticated position

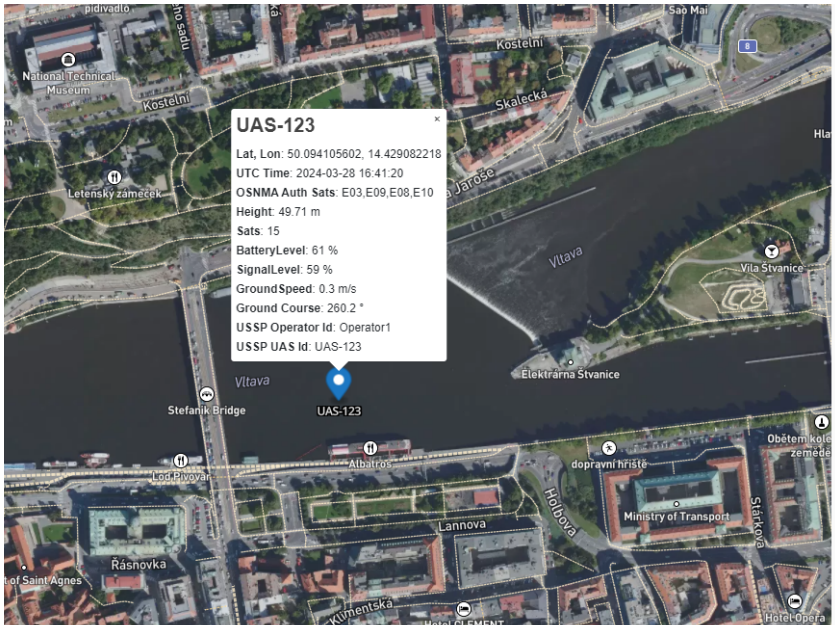


Figure 5-9 Device Gateway - Authenticated position

Clicking on the icon will bring up a pop-up window with the tracking information described in the table below.

Field Name	Description
Lat, Lon	Geographic coordinates in degrees with eight decimals
UTC Time	Coordinated Universal Time (Greenwich Meridian) In the format YYYY-MM-DD hh:mm:ss
Height	Altitude from Mean Sea Level (MSL)
Sats	Number of satellites used in PVT solution
OSNMA Auth Sats	List (PRN) of authenticetd satellites (Galileo Only)
Battery Level	Battery level in %
Signal Level	4G/5G Cellular netework signal Level in %
Ground Speed	Horizontal speed in meters per second (m/s)
Ground Course	Direction in which the track moves in degrees (°)
USSP OplD	EASA Operator Code
USSP UAS ID	Drone Identification Code (i.e. Callsign, tail number)

Table 5-1 Device Gateway - Tracking information

5.4 Device settings

In the devices section of the Device Gateway, the user can sort all the Certiflight Boxes associated with their account. In this section the user can configure the Network Remote ID parameters to be transmitted to U-space Service Providers
For each device, the user can configure the dedicated parameters.

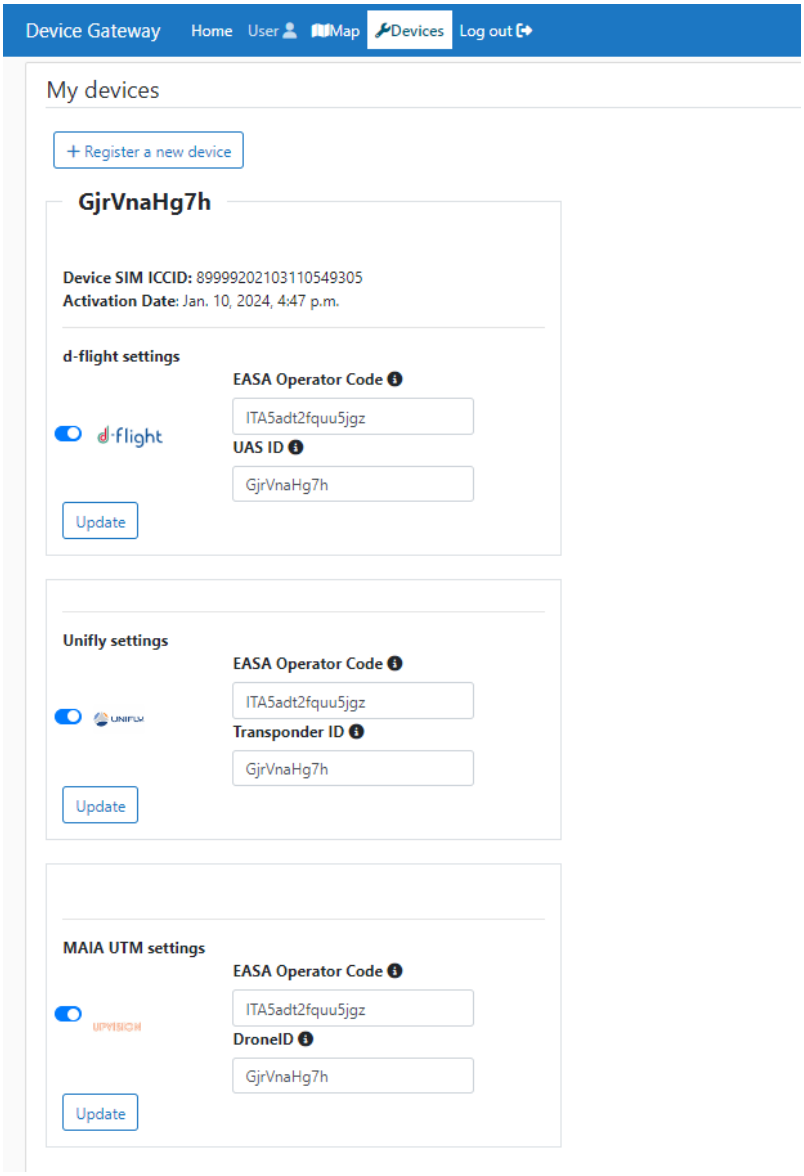


Figure 5-10 Device Gateway – Device setting and UTM/USSP parameters

The EASA operator code consists of 16 alphanumeric characters. In Italy, the code is assigned to operators registered on the d-flight portal.

6 Installation

Once registered on the portal, the device will work in all outdoor areas with adequate GNSS signal and 4G/5G cellular network coverage.

6.1 Mounting the Device for UAS

To install the device for UAS use the CANOPUS 3M Dual Lock tape in the package. The tape is made up of two parts, the first must be attached with the embedded glue layer on the back of the Certiflight Box while the counterpart must be placed on the drone. Follow these steps:

1. Find the flat surface on the drone for the Dual Lock counterpart.
2. Wipe the surface with an alcohol cloth.
3. Wait a few minutes for the alcohol to evaporate.
4. Remove the film from the coupling piece and stick it on the drone.
5. Wait five minutes, so that the glue adheres.
6. Clip the device to the coupling piece on the drone.
7. Make sure the glue on both sides holds securely by repeatedly removing the device from the drone.

The CANOPUS 3M Dual Lock tape supplied in the package guarantees superior performance compared to traditional Velcro.

6.1.1 Dedicated mounting adapter

Alternatively, for DJI M300 users we provide a dedicated mounting adapter, which use the screw-holes on the topside of the drone.

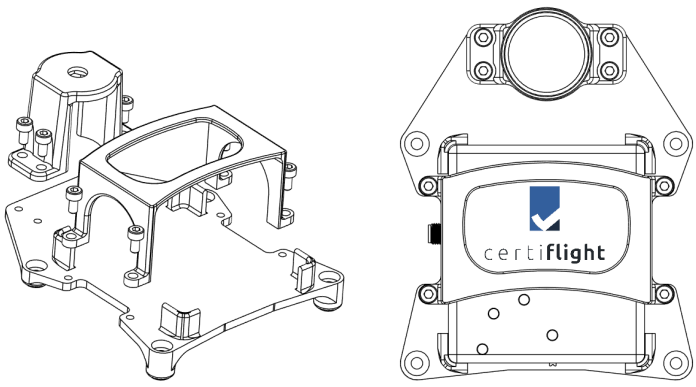


Figure 6-1 Device for UAS - Mounting adapter

Figure 6-2 Device mounted on DJI M300

6.1.2 Payload mode

The device for UAS can capture and store on the Certiflight UTM Box some specific events through the drone can bus port such as time and place of the photo shooting or video recording.
To exploit the device Payload mode feature, please follow these steps:

1. Connect the device with USB Type C port to the drone (DJI Matrice series supported) .
2. The LED Status flashed Blue and then Green.
3. Now the device is ready to record the events from the drone.

To use the payload mode with Enterprise DJI drones (in particular the Matrice series), the device must be connected to the e-port as shown in the figure below.

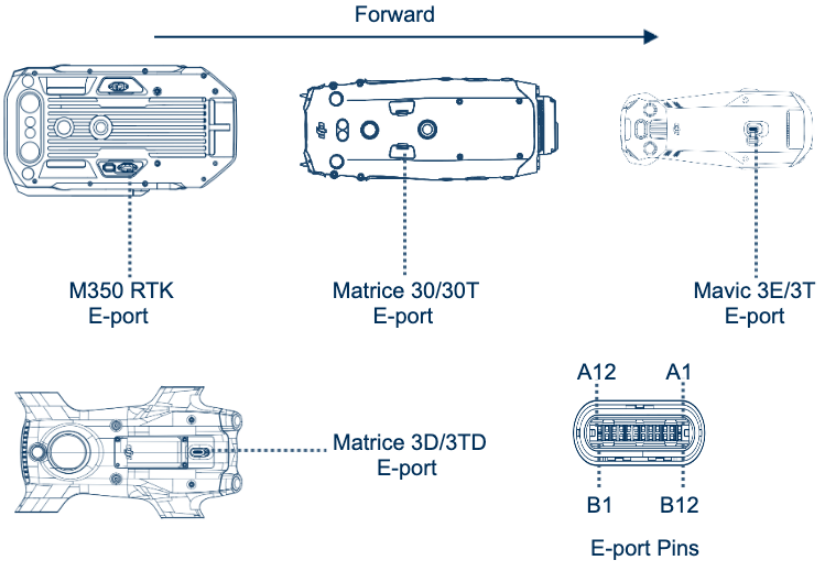


Figure 6-3 DJI E-port for Payload mode

This function is in beta testing phase. It was tested on M300 RTK drone (Matrice series)

6.2 Mounting the Device for GA

To install the device for General Aviation, use the CANOPUS 3M Dual Lock tape in the package. The tape is made up of two parts, the first must be attached with the embedded glue layer on the back of the Certiflight Box while the counterpart must be placed on the cockpit. Follow these steps:

1. Find the flat surface on the cockpit for the Dual Lock counterpart.
2. Wipe the surface with an alcohol cloth.
3. Wait a few minutes for the alcohol to evaporate.
4. Remove the film from the coupling piece and stick it on the cockpit.
5. Wait five minutes, so that the glue adheres.
6. Clip the device to the coupling piece on the cockpit.
7. Make sure the glue on both sides holds securely by repeatedly removing the device from the cockpit.

The CANOPUS 3M Dual Lock tape supplied in the package guarantees superior performance compared to traditional Velcro.

6.2.1 Placing the antennas

For better performance the antennas must be mounted on a ground-plane to radiate efficiently. The antenna should be mounted at the edge of the ground-plane of the cockpit.
GNSS antenna should be directed to the sky for optimal satellite signal reception.
FLARM antenna should be placed in such a way to potentially “see” all other air traffic in the vicinity of the vehicle (e.g. mounted facing in the main direction of flight of the vehicle).
ADS-B antenna can be placed like FLARM antenna, however since the typical ADS-B signal strength is far greater than the one of FLARM the antenna mounting position is less crucial in comparison to FLARM and can be compromised in FLARMs favour.

Also, no metal should be used near the antenna, with at least 20mm of clearance required, the more clearance the better.
Keep separation between antennas and do not cross over antenna cables.

7 Inflight

For each flight operation, it is recommended to follow these steps:

- Turn on the device.
- Check the battery level as indicated in section 3.1 and 4.2.
- Wait until all components of the device are ready (Status LED flashing green)
- Carrying out the mission
- At the end of the mission, turn off the device.

Check the battery level of the Certiflight Box the day before the mission and if necessary, recharge it to 100%

7.1 Use of Certiflight Portal

The Certiflight Portal is the dedicated web app for Certiflight services. To access it the user must be registered. Once turned on the device track and position information are visible on the Certiflight Portal.

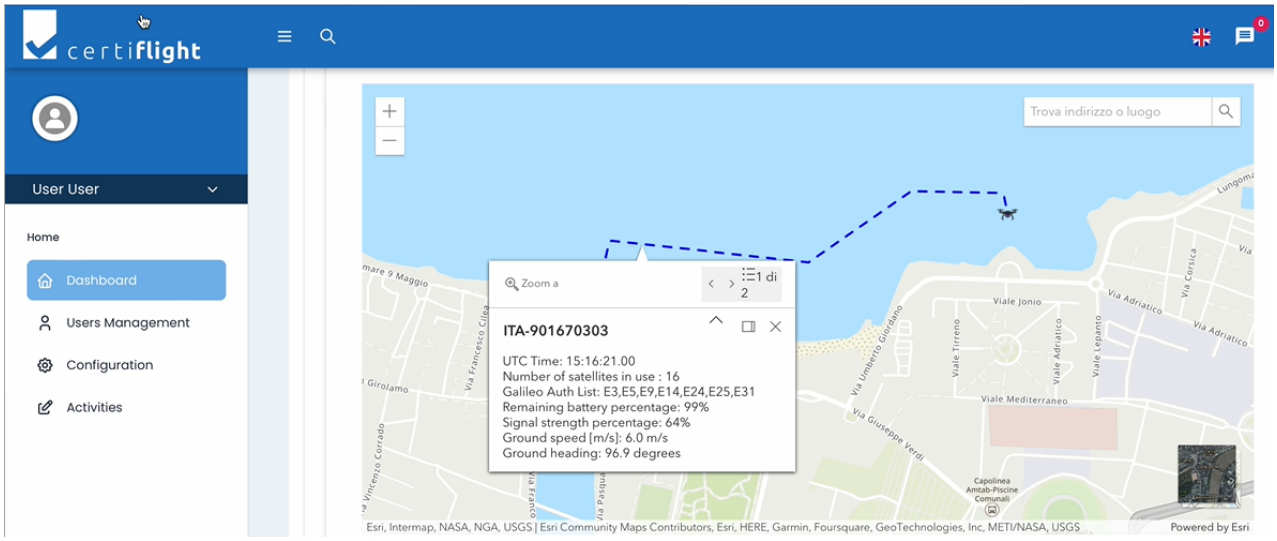


Figure 7-1 Visualization on CERTIFLIGHT Portal

In particular, the user can visualize:

- Device ID
- UTC Time
- Number of satellites in use
- Number of Authenticated Galileo Satellites
- Battery status
- 4G/5G Cellular signal strength
- Ground speed.
- Ground heading.

For more information about Certiflight Portal features please also read the dedicated user manual.

7.2 Visualization on d-flight

The operator registered on the d-flight platform can access the tracking service by associating Certiflight Box with the EASA operator code.
The tracking service allows the user to share the position of their UAS on the map with all other users who have access to the portal in relation to the area of interest, with a view to situational awareness. In particular, Italy has been divided into multiple areas of interest and users belonging to the same area of interest will be able to view the tracks of other d-flight users.

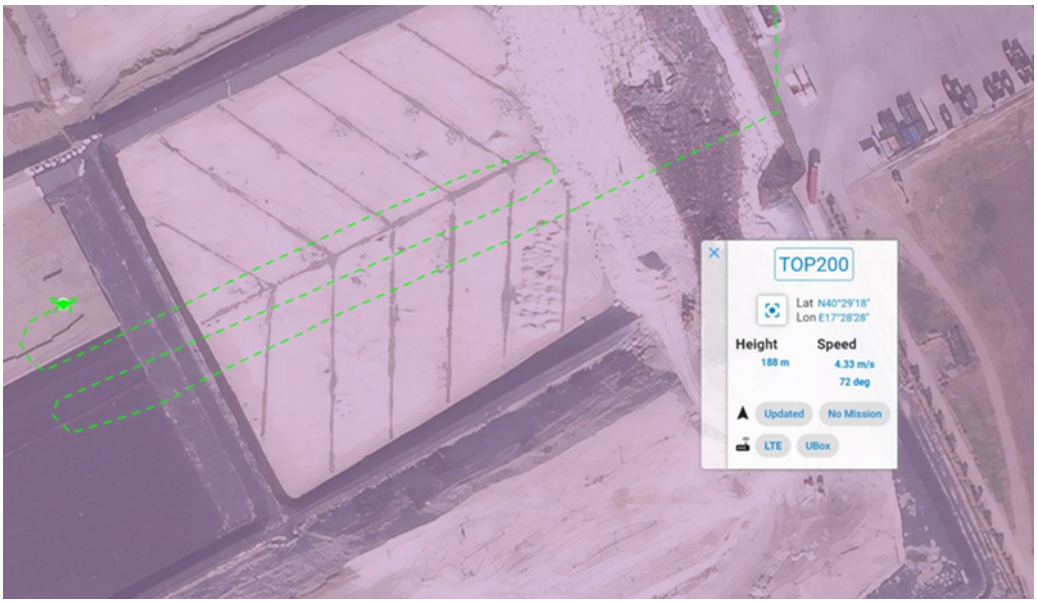


Figure 7-2 Tracking visualization on d-flight platform

By clicking on the UAS icon, the platform shows a pop-up with the following information:

- UAS Identifier
- Coordinates (Latitude/Longitude)
- Height and Speed
- Track Status

⚠ To view the tracks in your area of interest, it is essential to allow access to the displaying device's location to d-flight and set the map to a zoom of 1:25000 or more.

The UAS track is represented by a dotted line and is also highlighted with the following colors:

- Green: data properly transmitted.
- Grey: Data Transmission Error.

⚠ The operator is required to fly according to the UAS regulations and, if necessary, obtain authorization to fly the drone.
Before flying, check the geographical zones on the d-flight platform.
For more information, visit https://www.enac.gov.it/sicurezza-aerea/droni/normativa-droni.

7.2.1 Authenticated tracking on d-flight

The authenticated tracks coming from Certiflight can be identified with a distinct symbol overlay, ensuring clear differentiation from the standard tracks.
Moreover, a dedicated panel has been introduced to display the metadata associated with each track. This panel furnishes comprehensive information regarding augmented data and/or raw satellite data, enhancing the overall data visualization and analysis capabilities of the platform.

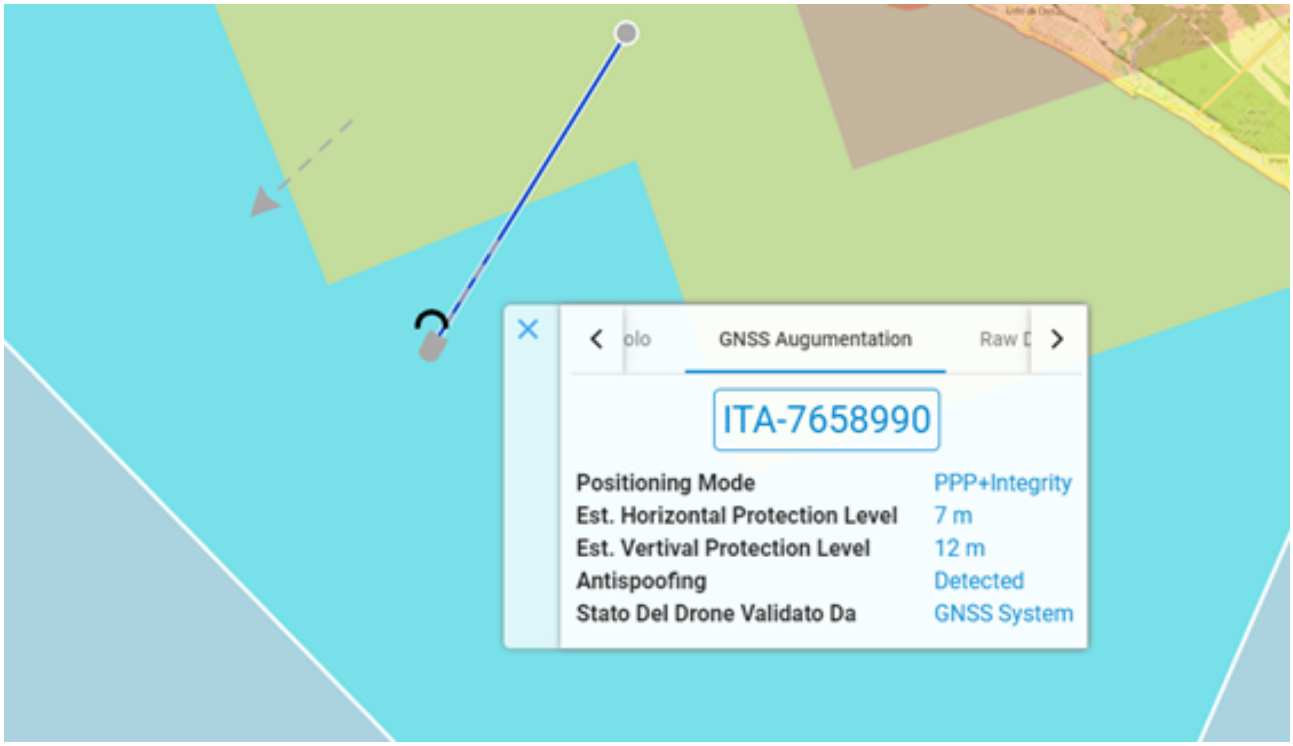


Figure 7-3 Authenticated tracking on D-flight platform

7.3 Visualization on Unifly

The operator registered on the Unifly platform can visualize its own fleet tracks and the flight tracks in the surroundings.

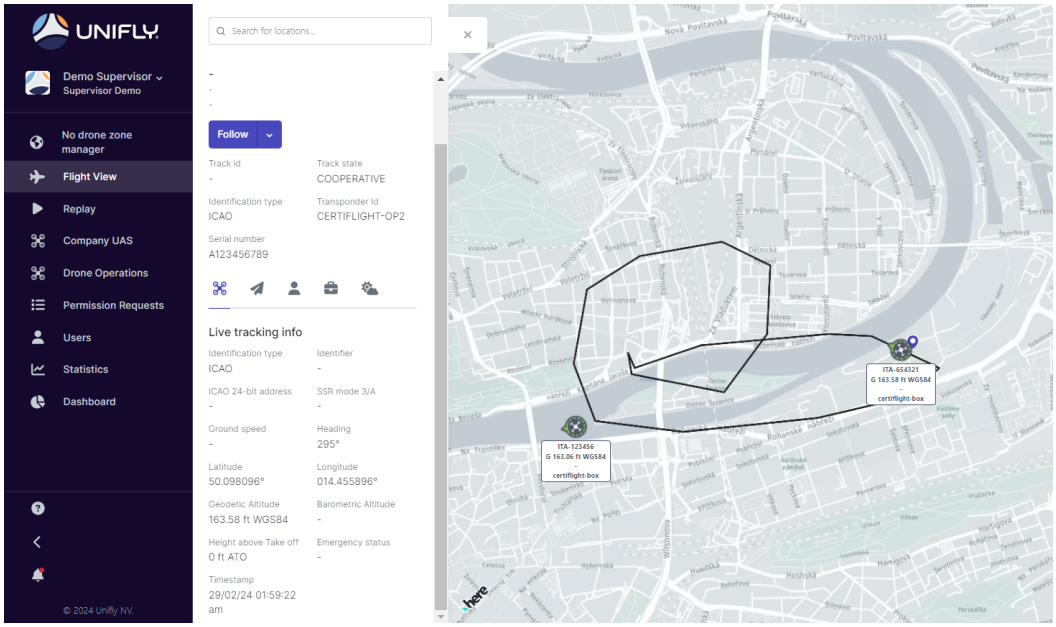


Figure 7-4 Track visualization on Unifly UTM

By clicking on the UAS icon, the platform shows a side window the following information:

- Track id
- Track state
- Transponder ID
- Serial Number
- Coordinates (Latitude/Longitude)
- Geodedic Altitude
- Ground Speed
- Heading

7.3.1 Authenticated tracking on Unifly

Unifly system interface visualises the Authenticated tracks in real-time and make them distinguishable from standard tracks with a different colouring and a label:

- Authenticated track appears in green colour and labelled “AUTHENTICATED“;
- Non-Authenticated track has orange colour and label “NON - AUTH“

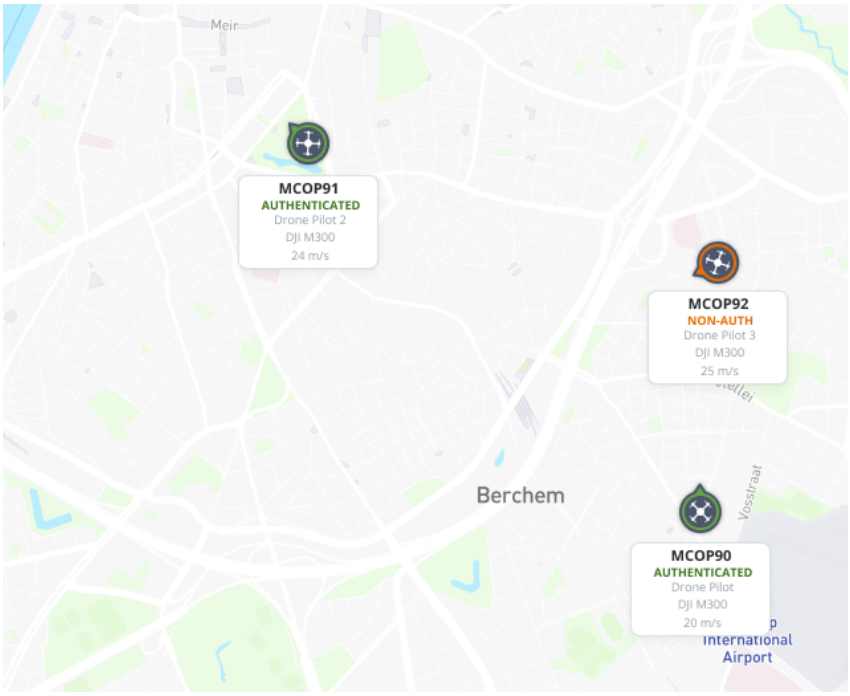


Figure 7-5 Authenticated tracking visualization on Unifly platform

7.4 Visualization on Maia UTM

The operator registered on the Maia UTM platform can access the tracking service by associating Certiflight Box with the EASA operator code.
The MAIA application shows drone ID, operator name, map, flight plan, elapsed trajectory, flight vector and airspace/geo zone layers.

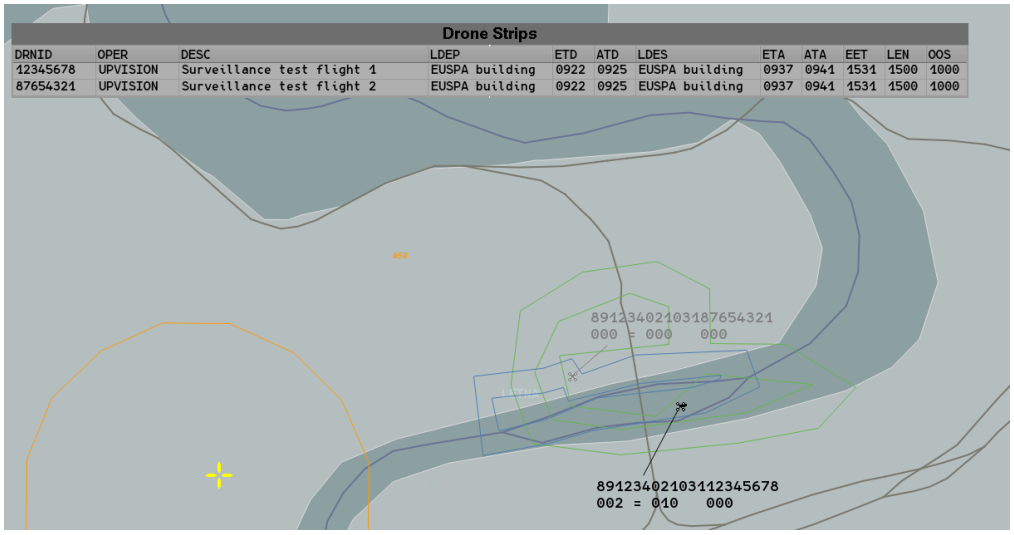


Figure 7-6 Visualization on MAIA UTM

7.4.1 Authenticated tracking Maia UTM

The authenticated track is depicted in bold black while non authenticated track is shown in shadow gradient.

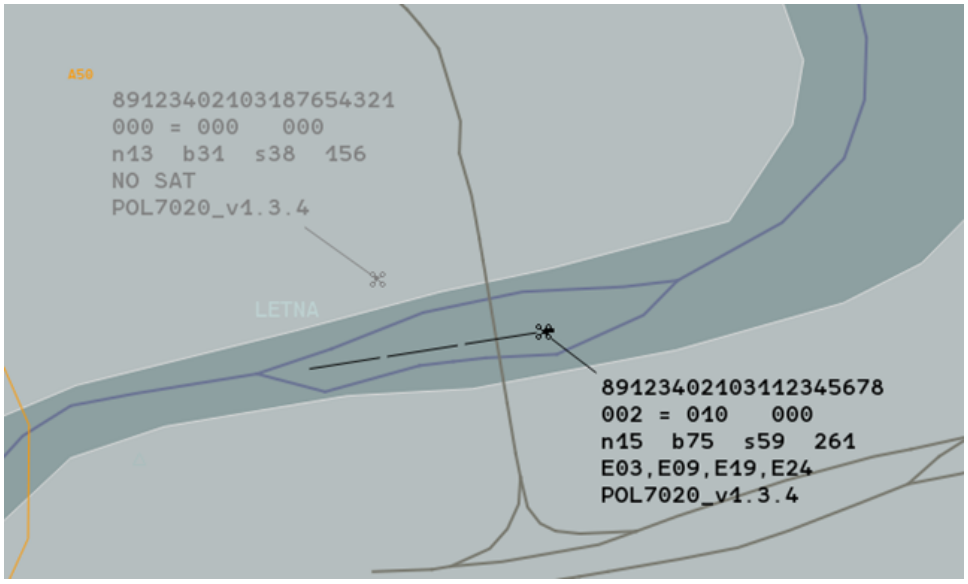
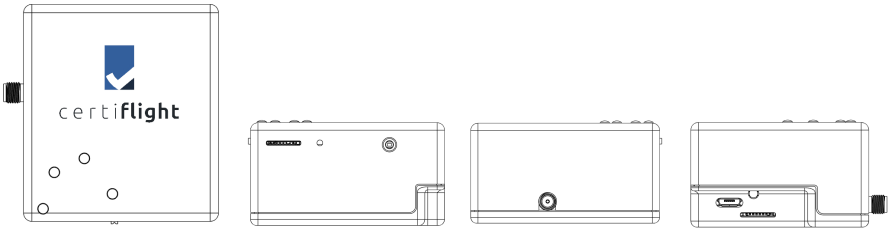


Figure 7-7 tracking and authenticated tracking on MAIA UTM

APPENDIX

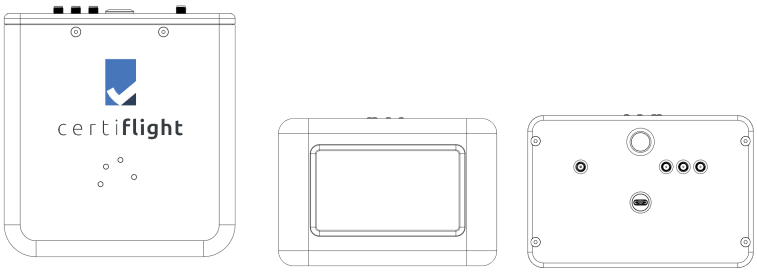
Technical Specifications of Device for UAS



Dimensions (WxHxT)	65x59x35 mm
Weight	90 g (normal version) 113 (extended battery)
Enclosure	Self-extinguishing ABS
Fixing mechanism	CANOPUS 3M Dual Lock SJ3550 CF Extra; mechanical adapters for DJI (opt.)
Degree of protection	IP43
Operating Temperature	-20°C / +50°C
Turning on	Manual (slide switch)
LED Indicators	OSNMA, RID, STATUS, CHARGE
Battery life	3 hours in continuous transmission 5 hours in continuous transmission (extended battery)
Charging	5V – USB type C connector
Positioning	GPS/GALILEO with OSNMA feature (default configuration)
Data Transmission Frequency	1 Hz (1 sample per second)
Network connection	NB-IoT Built-in SIM and antenna
4G / 5G bands	B1/B2/B3/B4/B5/B8/B12/B13/B14/B17/B18/B19/ B20/B25/B26/B28/B66/B70/B85/B1/B3/B5/B8/B20/B28
Inflight identification	Network Remote ID
Reference Standards	EASA 2022/024/R (U-Space); ASTM F3411-22 (Specification for remote ID and tracking)
Inertial Module	Gyroscope, accelerometer, magnetometer, barometer

Cyphering and authentication	Crypto Element Device with Secure Hardware-based Key Storage. Secure element for Authentication and key generation.

Technical Specifications of Device for GA



Dimensions (WxHxT)	145x98.5x157 mm
Weight	300 g
Enclosure	Self-extinguishing ABS
Fixing mechanism	CANOPUS 3M Dual Lock SJ3550 CF Extra
Degree of protection	IP43
Operating Temperature	-20°C / +50°C
Turning on	Manual (button)
LED Indicators	OSNMA, RID, STATUS, CHARGE
Battery life	Up to 8 hours continuous transmission
Charging	5V - USB/C connector
Positioning	GPS/GLONASS/GALILEO with OSNMA feature
Data Transmission Frequency	1 Hz (1 sample per second)
Network connection	NB-IoT Built-in SIM and antenna
4G / 5G bands	B1/B2/B3/B4/B5/B8/B12/B13/B14/B17/B18/B19/ B20/B25/B26/B28/B66/B70/B85/B1/B3/B5/B8/B20/B28
Inflight identification	Network Remote ID, ADS-B IN/ FLARM IN-OUT
Reference Standards	EASA 2022/024/R (U-Space); ASTM F3411-22 (Specification for remote ID and tracking)
Inertial Module	Gyroscope, accelerometer, magnetometer, barometer
Cyphering and authentication	Crypto Element Device with Secure Hardware-based Key Storage. Secure element for Authentication and key generation.