FlySafe!

See beyond obstacles, flying safely!

What is FlySafe!

FlySafe! is an application designed for iOS systems (iPhone and iPad) for obstacle detection during flight. This innovative application is equipped with an advanced warning system, both visual and audible, that alerts the user in the event of a possible collision with an obstacle, providing an advance warning as much as 30 seconds before imminent impact.

The main objective of **FlySafe!** is to ensure maximum safety when flying at low altitudes. Thanks to its sophisticated technology, the application is able to identify obstacles in the vicinity and warn the user in good time, enabling him or her to take the necessary corrective measures to avoid an accident.

The visual component of the alarm provides a clear and intuitive representation of the distance of the obstacle, while the audible alarm and the change of screen colour help to immediately capture the user's attention, ensuring a prompt response. **FlySafe!** is designed to be user-friendly, with an intuitive interface that allows for easy operation even in high-stress situations.

In addition, the app offers additional functionality, such as automatic flight logging and detailed reporting, allowing users to analyse flight data.

With **FlySafe!**, flying becomes not only an exciting experience but also an extremely safe one, thanks to its advanced technology and ability to anticipate and prevent potentially dangerous situations.

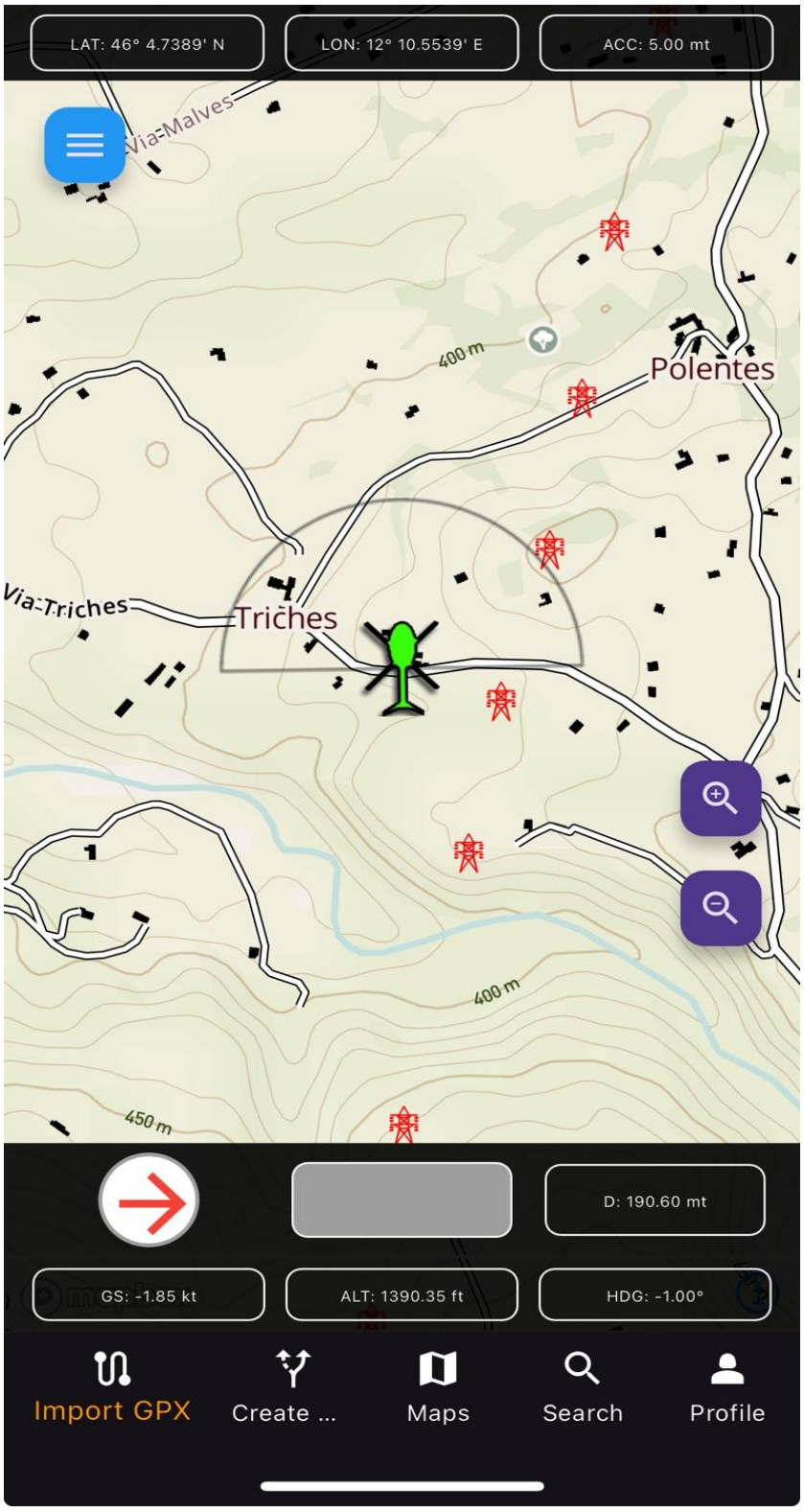
Foreword

Some considerations for installing and using FlySafe!

- Position tracking authorisation: required to ensure correct operation;
- Active connection: required to download maps and data; Camera authorisation: required for Augmented Reality (AR) mode only;
- Advanced functions: alarms, flight recording, weather and use of own data are only available with a subscription (including a 7-day free trial).

Main screen

The main interface of **FlySafe!** is intuitive and full of essential information for a safe and controlled flight.



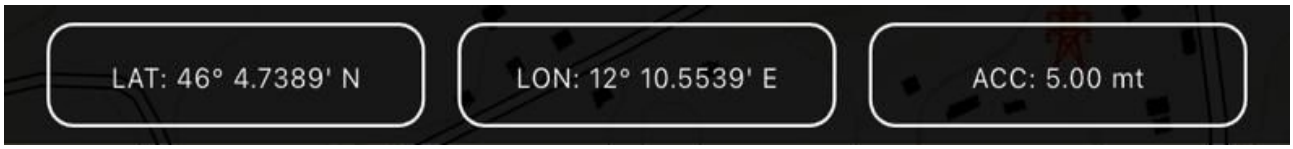
Layout Structure

The main screen is divided into five sections:

1. **Upper panel**

   Display:

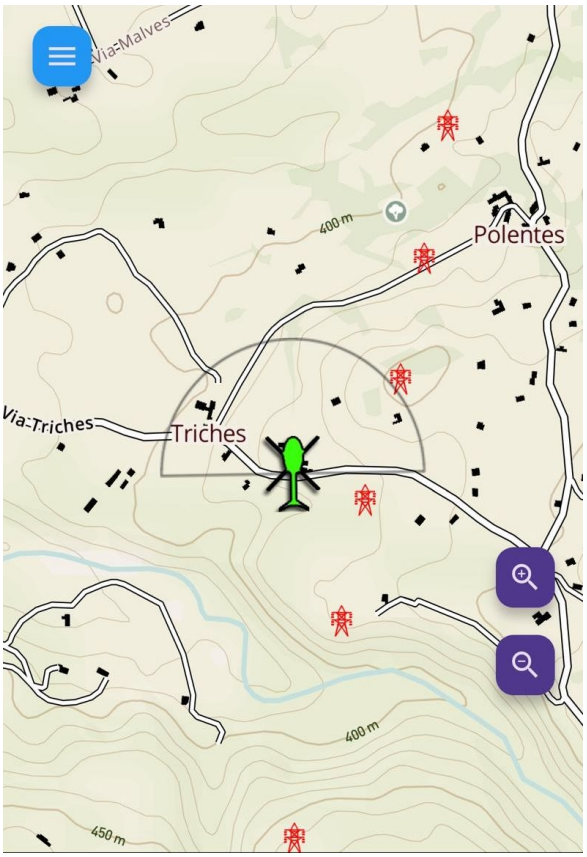
   - Latitude and longitude (expressed in degrees and first decimal places);
   - GPS signal accuracy (in metres) given by signal quality and number of GPS satellites;



2. **Central panel**

   Contains:

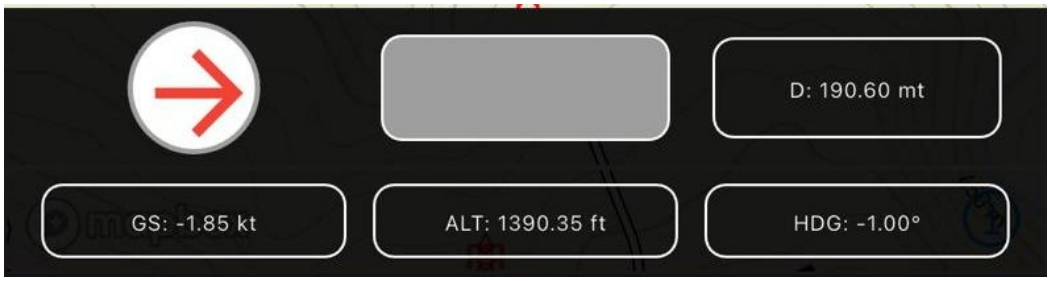
   - Map (default vector);
   - Position icon;
   - Zoom buttons;
   - Menu button.



3. Bottom panel

Include:

- Compass: indicates the direction of the obstacle in relation to one's own heading;
- Visual alarm (grey if inactive);
- Distance of the obstacle in metres;
- Ground speed (in knots);
- Altitude (in ft);
- Heading.



4. Route Panel

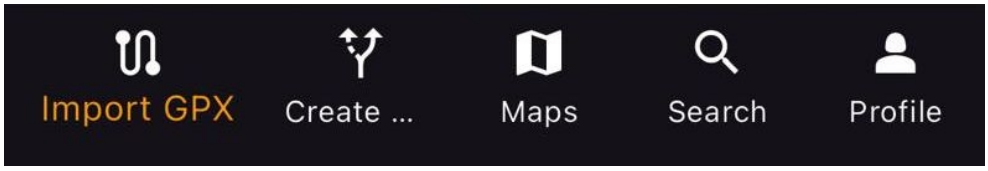
Only active with a loaded route, show:

- Bearing, Azimuth;
- Distance;
- Estimated time of arrival.

5. Quick menu

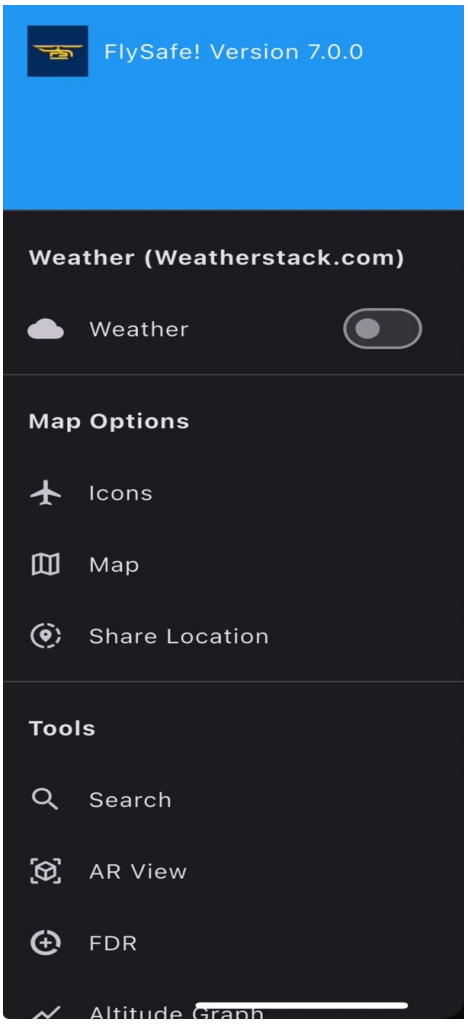
Access to:

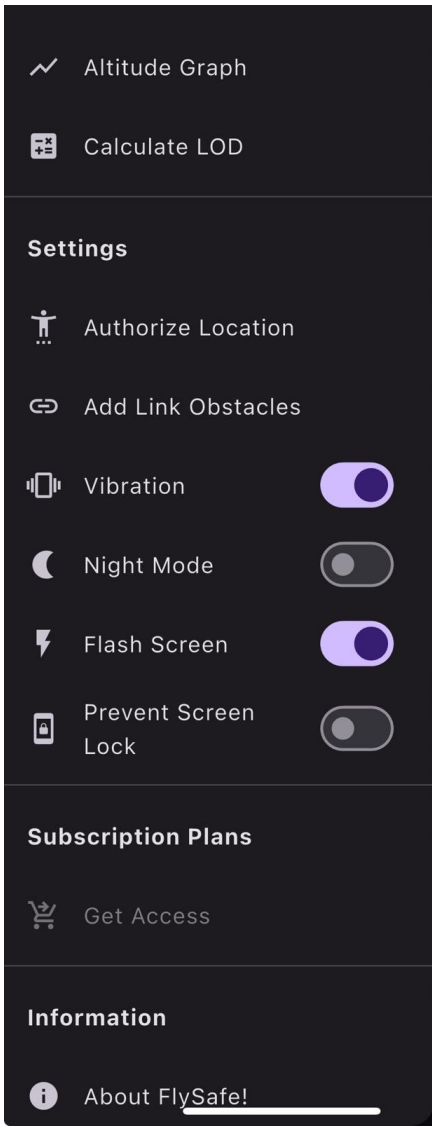
- Loading routes (GPX);
- Creation of new routes;
- Selection of maps;
- Search function;
- User profile;

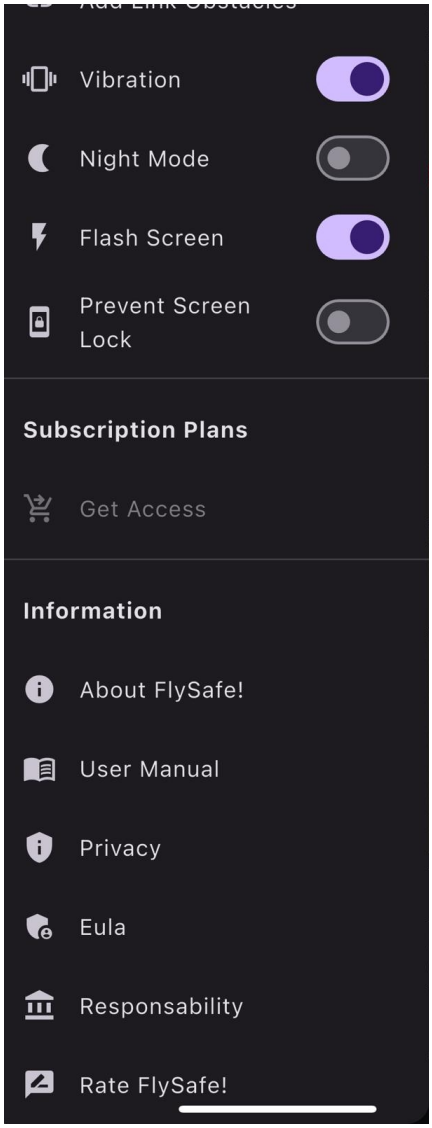

Import GPX
Create ...
Maps
Search
Profile

Main menu

From the main screen, clicking on the icon in the top left-hand corner (hamburgher), you access the menu with the following functions:

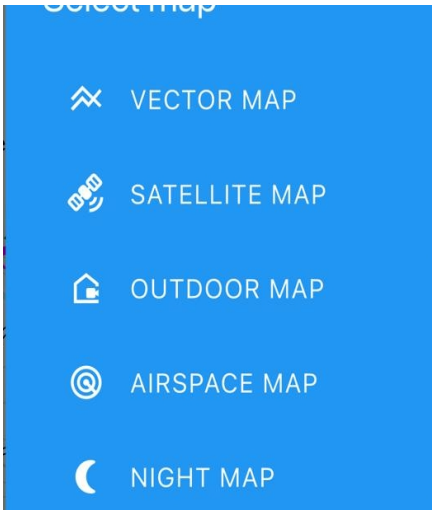


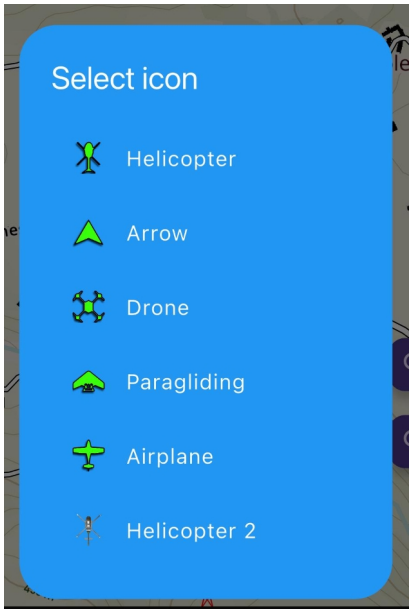




- Weather: shows location-based weather information (requires an active subscription).

- Map Options: allows you to choose between different map options and location icons.
  - Maps available: vector (default), satellite, outdoor, airspace and night maps;
  - Available icons: helicopter (default), arrow, drone, paraglider, plane, etc;

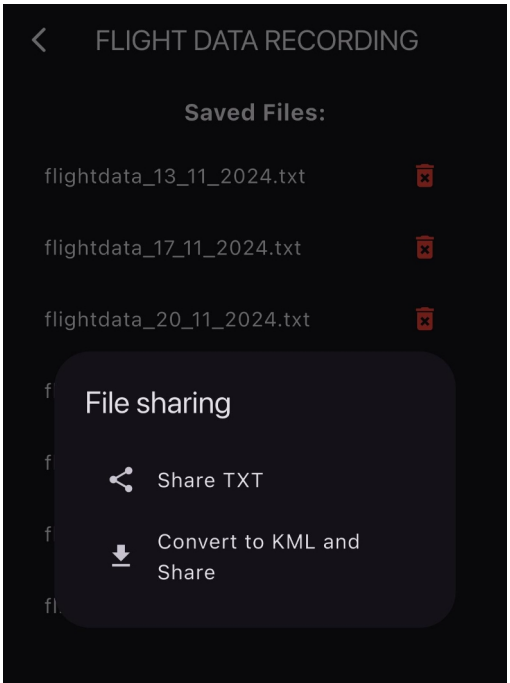




- Share Location: allows you to share a location.

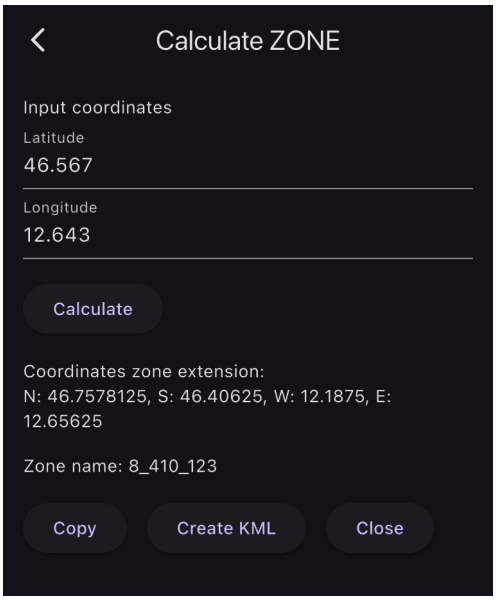
- Tools:
  - Search: opens the search screen. Insights into"**Creating a Route**";
  - AR View: Augmented Reality mode. You can visualise the position of obstacles by viewing them in the surrounding environment;

- FDR:
  - Daily flight data records (available with an active subscription) with the possibility of condisioning in TXT or KML format;



- Altitude Graph:
  - altitude change in real time;

- Calculate LOD:
  - A tool for creating obstacle files. Read more in the section "**Creation of obstacle files**".



- Settings:
  - Authorize Location: for direct access to location authorisations;
  - Add Link Obstacles: you can use your own obstacle database in **FlySafe!** (example link: https://www.miosito/obstacles);
  - Vibration: enables the device to vibrate when an alarm is triggered (active by default);
  - Night Mode: decreases the brightness of the screen;
  - Flash Screen: colours the screen with the same colour as the alarm (active by default);
  - Prevent Screen Lock: prevents the screen from being locked (not active by default).

- Subscription Plans
  - Get Access: subscription. Once the purchase is complete, **FlySafe!** must be restarted for the changes to take effect.

- Information
  - About **FlySafe!**: information on the app;
  - User Manual: user manual;
  - Privacy: privacy information;
  - Eula: information on the Eula;
  - Responsability: exclusion of liability in the use of **FlySafe!**;
  - Rate **FlySafe!**: evaluate the app.

Types of Alarm

Alarms are activated according to the speed of the flight and the distance to the potential impact. They are classified into three severity levels, each represented by a different colour:

1. **Green**:
    - Time to impact: between 30 and 21 seconds.
    - Effects:
        - Alert sound.
        - Device vibration.
        - Visual indication on the bottom panel and green screen flash.
2. **Yellow**:
    - Time to impact: between 20 and 16 seconds.
    - Effects:
        - Alert sound.
        - Device vibration.
        - Visual indication on the bottom panel and yellow screen flash.
3. **Red**:
    - Time to impact: less than 15 seconds.
    - Effectsi:
        - Alert sound.
        - Device vibration.
        - Visual indication on the bottom panel and red screen flash.

Activation Conditions

- Alarms are activated even if the obstacle is at a lower altitude than the navigation altitude, as long as the height difference is within 75 metres of the flight altitude.

Obstacle Detection Cone

- Central icon:
  - Located in the centre of the map, it represents the user's current position during the flight. Associated with the icon is the bearing cone.
- Cone characteristics:
  - Variable width:
    - Low speed: wide cone opening (180°) for greater coverage.
    - High speed: the cone shrinks to improve accuracy and detection depth.
  - Direction: the cone is always directed towards the bow, but alarms are activated regardless of the direction of movement.

Detection cone

- It can be imagined as an invisible sphere:
  - The radius of the sphere increases with the speed of the aircraft.
  - Operation:
    - If an obstacle enters the sphere and the impact time falls within one of three intervals (green, yellow, red), an alarm is generated.
    - The sphere guarantees complete coverage, regardless of the direction of movement.

Dynamic Functionality

The alarm system is designed to be adaptive and intuitive, ensuring:

- Increased safety during flight.
- Optimisation of obstacle perception, both at low and high speeds.
- Improved pilot awareness through clear visualisation and instant notifications.

This combination of visual, audible and tactile notifications contributes to significantly improved safety by providing the driver with a real-time perception of the surrounding situation.

Obstacles

The default database of **FlySafe!** includes a selection of flight obstacles that represent the most common and significant risks for pilots. The obstacles currently mapped are:

- Electricity pylons: energy transport structures.
- Pylons: towers or columns that can support infrastructure or cables.
- Cable cars: suspended transport systems that can represent moving obstacles.
- Cableways: fixed and/or mobile cables used for transporting materials or persons.
- Antennas: transmission devices, often placed in elevated areas.
- Other: any obstacle that does not fall into the previous categories but represents a potential risk.

Limitations of the Current Database
Although the database includes critical obstacles, its completeness is limited.
The main issues are:

- Lack of complete data: in many Italian regions, barrier data is either not up-to-date or completely absent.
- Uneven geographical coverage: some provinces offer accurate and complete data, while others have no official mapping.

This situation represents a potential risk for pilots, especially in areas with undocumented infrastructure.

Solutions included in **FlySafe!**
The new version of FlySafe! introduces a feature that allows users to use customised data in their database by bypassing the default data. This innovation will allow:

- Use of own obstacle database:
    - Users will be able to manage their own obstacle database completely independently.
    - Customisation based on the specific needs of the flight.
- Enhanced security:
    - Pilots will be able to have a more accurate mapping of flight areas, improving their ability to avoid obstacles.
- Collaboration: pilots, technicians can contribute to the construction of a more complete database.

Advantages of Customisation
This new feature elevates FlySafe! to an even more reliable tool:

- Better adaptability to local conditions.
- Increased confidence in using the app due to the possibility of using accurate and relevant information.
- Reduction of risks from unmapped obstacles, particularly in areas with gaps in official data.

For the creation of a customised database, please refer to the section "**Creating Obstacle Files**".

Quick Menu

1. Profile

- Profile creation is required if the route creation function is to be used.
- The data entered in the profile are only used to generate GPX files, guaranteeing user privacy.

Profile fields:

Name:

Enter the name, company, base or airport of departure.

Position:

- It allows GPS coordinates to be automatically acquired by clicking on the associated icon.

Notes:

- Space for personal notes. Notes are not included in the generated GPX files.

Privacy notice:
No data entered is shared with third parties or used for other purposes.

Example of a GPX file created with **FlySafe!:**

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<gpx>
   <metadata>
      <link href="https://www.flysafety.it">
         <text>FlySafe!</text>
      </link>
      <name>Created with FlySafe!</name>
      <time>2024-12-06T09:50:23.361846</time>
   </metadata>
   <rte>
      <rtept lon="11.947837" lat="46.129825">
         <name>Nome inserito nel profilo</name>
         <time>2024-12-06T09:50:23.361846</time>
      </rtept>
      <rtept lon="11.946814364329384" lat="46.129862163700324">
         <name>Destinazione</name>
      </rtept>
   </rte>
</gpx>
```

2. Import GPX

Allows the import of GPX files that have been:

- Shared by other users.

- Downloaded from external sources, such as portals or navigation databases.

3. Create GPX
    - It offers the possibility of creating a GPX file directly in the app, which can then be saved and later imported for use.

4. Maps
    - Opens the menu for changing the map.

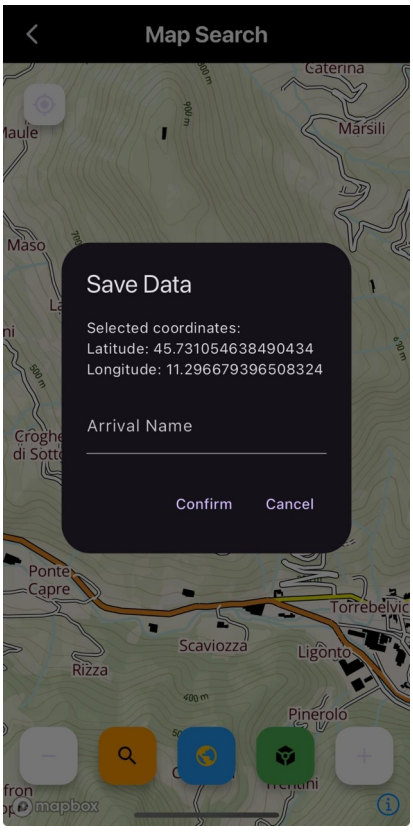
5. Search
    - Search pattern and end point creation.

Creating a Route
Create GPX

To create a GPX file in FlySafe! you must first define an end point using the Search page. The process is simple and intuitive:

- Locate the desired point on the map:
  Using the search function or by manually exploring the map.
- Select the point:
  Press and hold your finger on the chosen point on the map.
- Enter the name of the point:
  A pop-up window will appear, allowing you to assign a name to the selected point. This name will be used in the GPX file to identify the arrival point.
- Save and continue:
  Once the point has been created, it will be possible to proceed with the generation of the GPX file.

This procedure ensures that each arrival point is customised and well defined for inclusion in the GPX file, making route planning precise and customised.



On the Search screen, it is also possible:

- Searching for a point by entering coordinates;
- 3D map visualisation;

- Display a portion of a map as a 3D object and in AR.

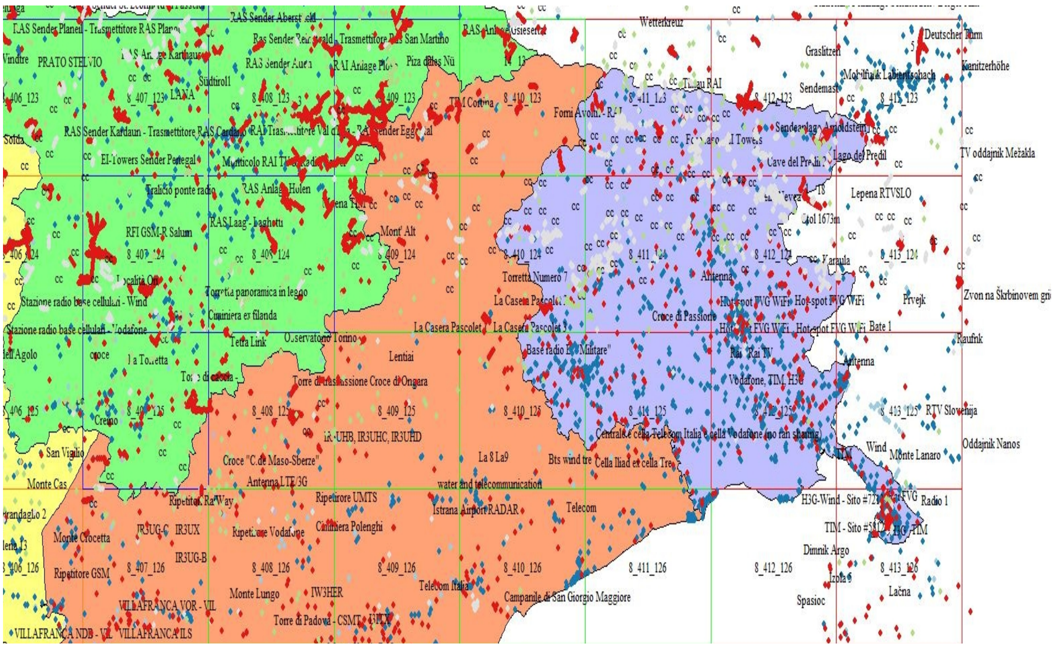
After creating the arrival point on the Search page, the saved data are automatically returned to the Create GPX section. From here, the GPX file is generated and then imported.

Creation of obstacle files

In **FlySafe!**, the process of downloading obstacle data is optimised by subdividing the globe into small geographical zones. This subdivision allows FlySafe! to download location-specific zone data, ensuring a faster and more efficient process.

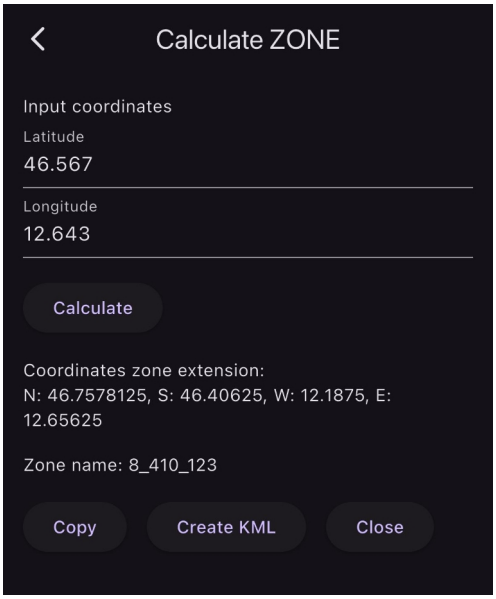
Each geographical zone is pre-loaded with obstacle data, allowing users to benefit from faster downloads and immediate access to local information. In addition, the ability to more schematically edit obstacle data allows users to customise the display of information according to their preferences and needs.

This zonal structure in **FlySafe!** not only optimises the app's performance, but also provides a flexible approach to managing and customising obstacle data, helping to make the flight experience even more efficient and personalised.



The image shows the different subdivision zones.

The definition and creation of these zones is done through the **Calculate LOD** tool. This tool allows the coordinates of a point to be entered to derive the code name of the zone and its extent.



Data can then be copied or saved in KML format for use in a GIS environment.

The name of the area is divided into three codes:

1. The first code (8) is the area size type or LOD. 0 corresponds to the entire area of the globe. In **FlySafe!** 8 will always be used;
2. The second and third codes identify the row and column where the zone is located.

Once the area has been imported into GIS software, we can populate it with data exclusively as points. Lines and areas must always be represented by points.

Each point must have, in addition to the coordinates, the altitude. The latter must be the altitude of the top of the obstacle.

Example 1: We know the coordinates of a point representing a high voltage pylon but not its height. The base of the pylon is at an altitude of 345 metres above sea level. This point will report the coordinates and altitude 345 mslm (**FlySafe!** will then handle the data appropriately).

Example 2: We know the coordinates of a point representing a high voltage pylon. The base of the pylon is at an altitude of 345 metres above sea level and has a height of 42 metres. This point will show the coordinates and altitude 345 + 42 m, i.e. 387 mslm.

A cable (e.g. a cable car) is handled in the same way. The line can be populated with points (depending on its length).

An area may be populated with points both along the perimeter and in the area itself. With this system, it will also be possible to create a three-dimensional area.

Once the point input phase is complete, the file is saved in KML format, only points and giving the name of the zone.

To enable rapid file exchange between **FlySafe!** and a server, we change the file from kml to txt.

Once the new files are available, **FlySafe!** will automatically calculate the correct code for the file to be downloaded based on the location.

Example of a KML file.

```
<Placemark>
    <description>Unknown Point Feature</description>
    <styleUrl>#point1</styleUrl>
    <Point>
      <altitudeMode>clampToGround</altitudeMode>
      <extrude>0</extrude>

<coordinates>11.6902019000,45.4094098000,16.608</coordinates>
```

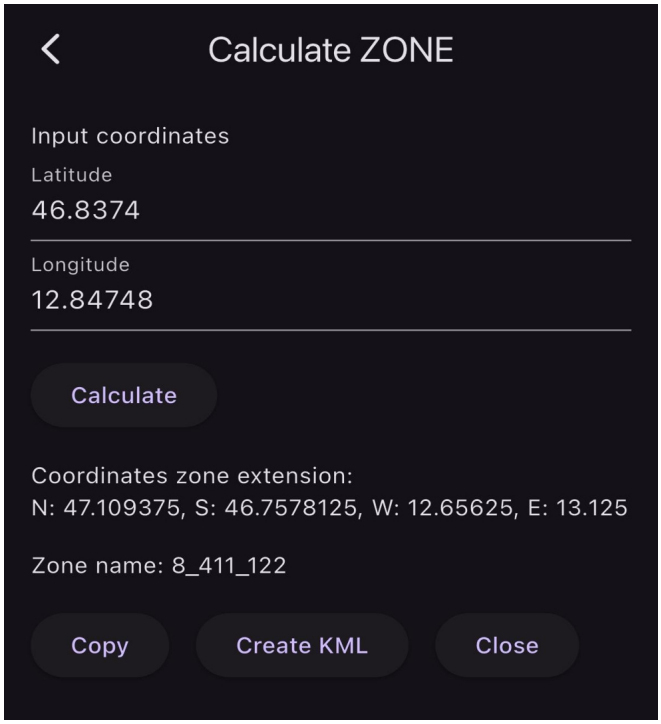
```
      </Point>
    </Placemark>
```

Obstacle creation tutorial

In this short tutorial for creating obstacles, I will use the GlobalMapper software. The essential creation and saving steps are given.

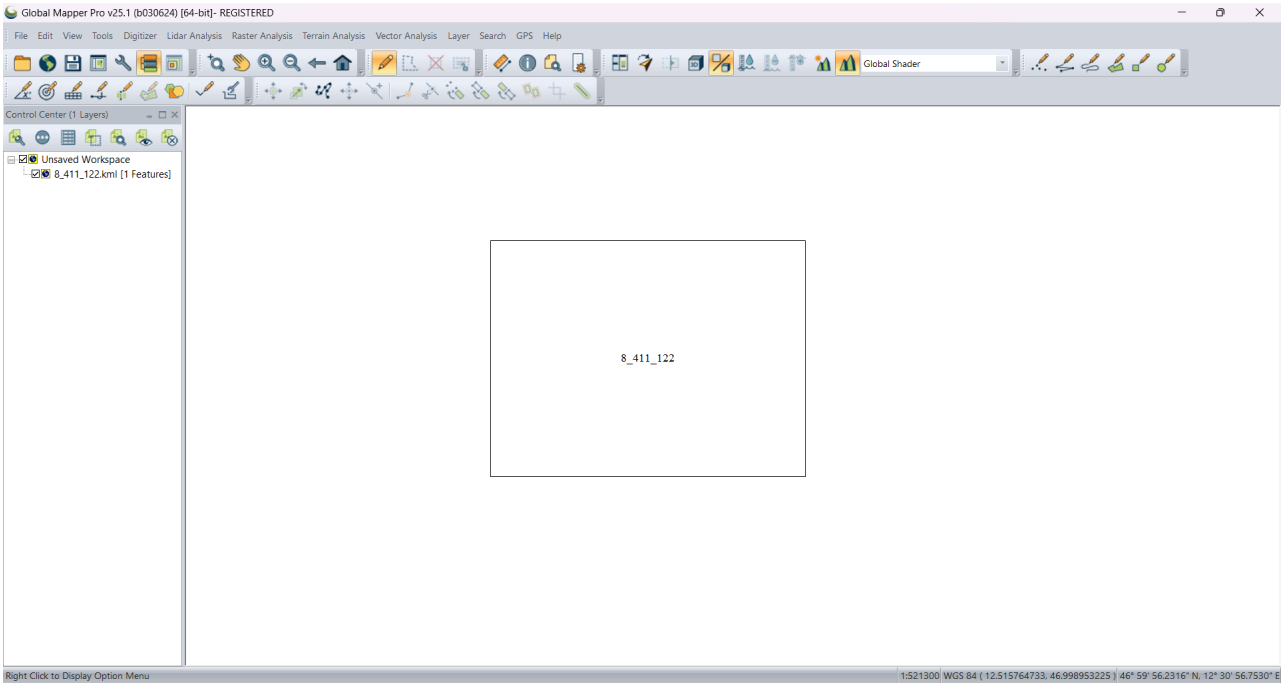
Step 1: Delimitation of the work area

To find out which sector to work in, we use the Calculate LOD tool in **FlySafe!**



You can copy or create a KML. The recommended KML file automatically creates a zone box with the correct name.

Step 2: We import the KML file generated by Calculate Lod into GlobalMapper.

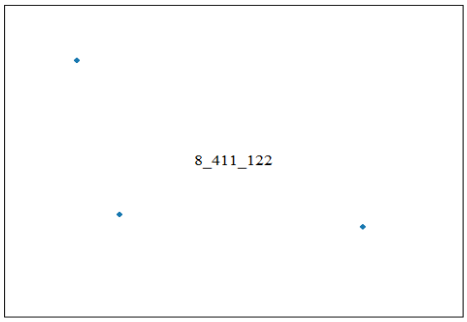


In this way, we defined the area where we would insert the obstacle data.

Step 3: We manually enter or import the points that identify obstacles.

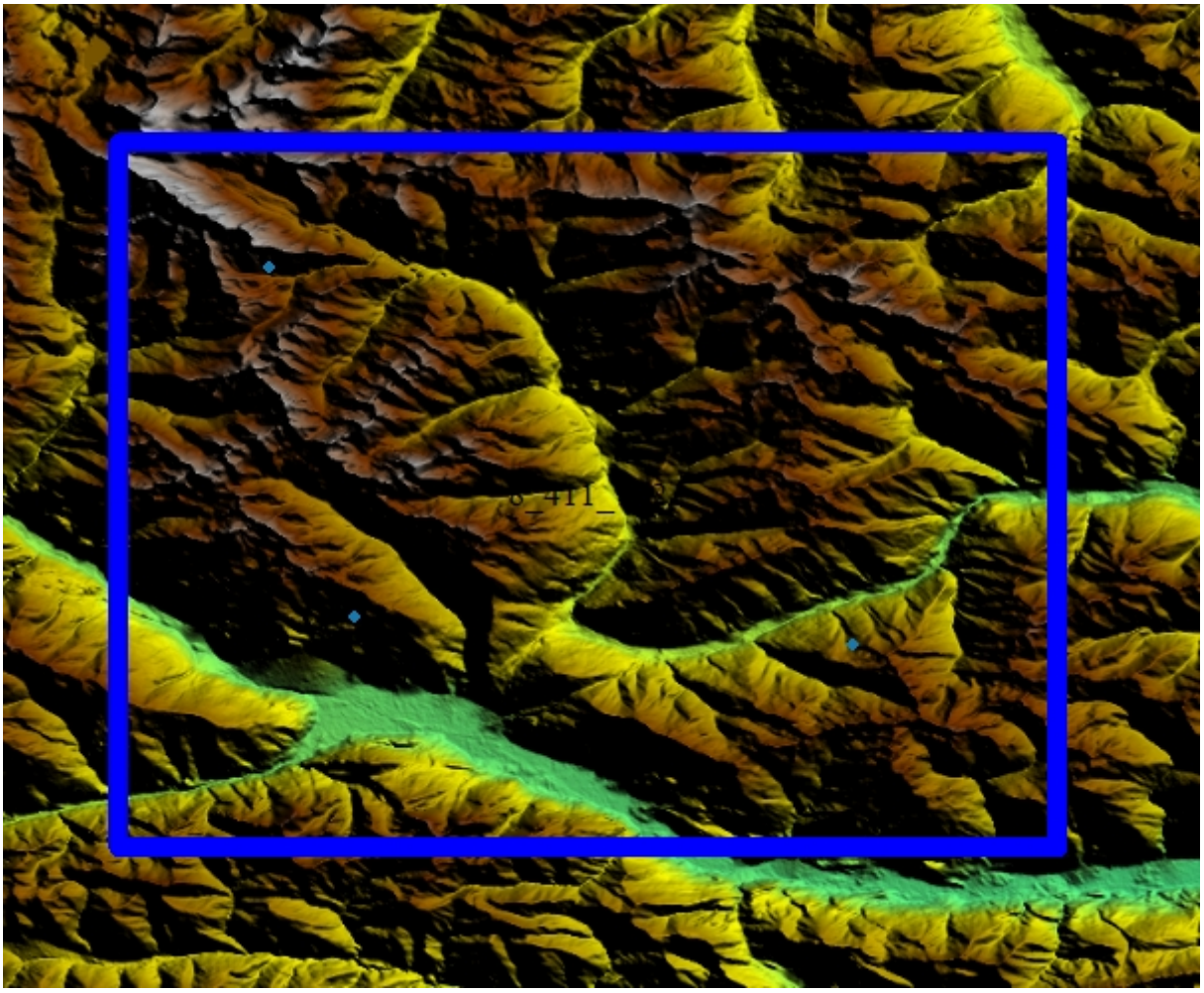
Important notes:

- Points entered manually in GlobalMapper are identified only by their coordinates and are devoid of altitude data.
- Points imported from an external database may already include ground altitude and/or summit altitude. In this case we will check the data, use only and proceed to create the KML file.

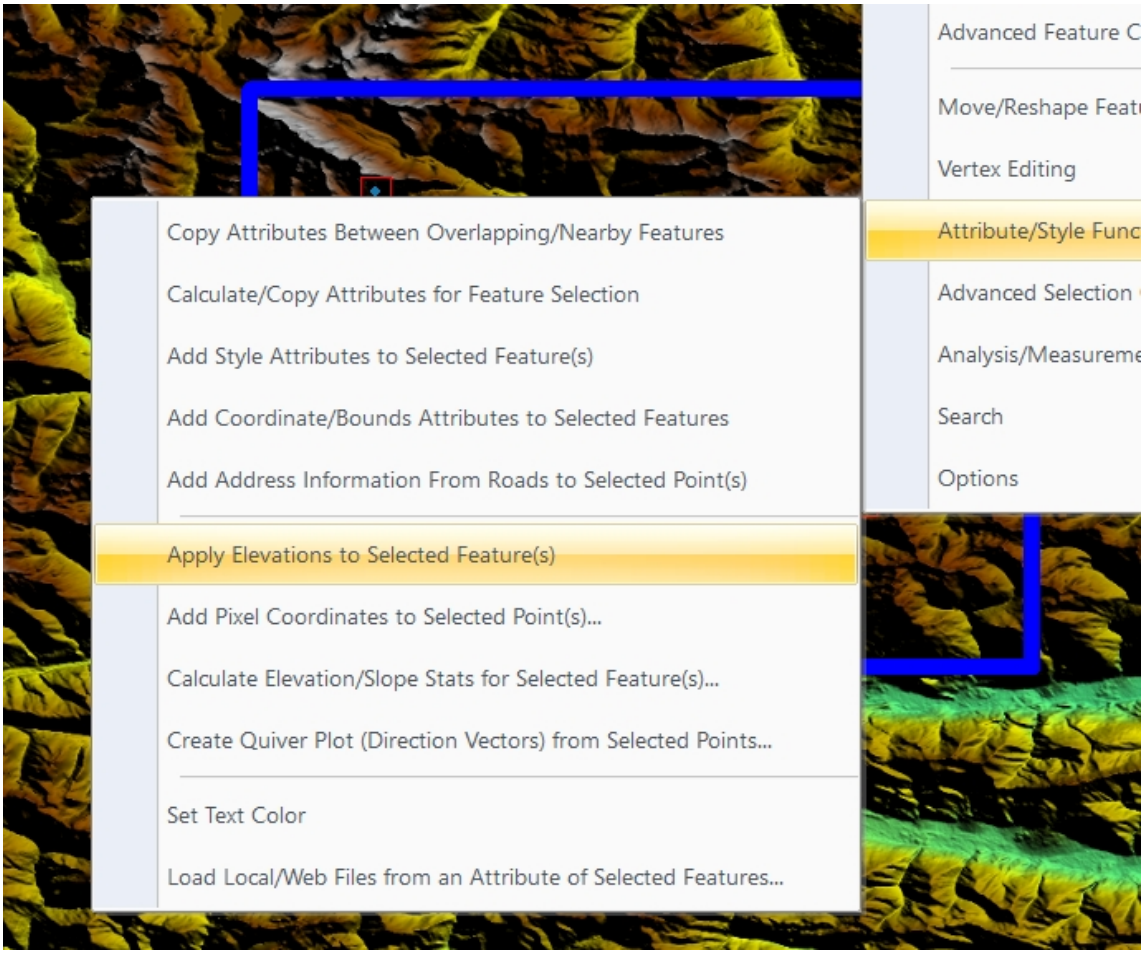


Step 4: Adding altitude to a point

To add altitude to a point or series of points, we need to import othermetric data using DTM (Digital Terrain Model) data.



We select the points and add the altitude automatically obtained from the DTM file.



Feature Attributes

Attribute Name	Attribute Value
ELEVATION	2481.1267

Add... Edit... Delete Add File Link(s)... Add Time Stamp

Add/Edit Notation...

Step 5: Creation of the KML

Note: I recommend creating or importing points in a separate layer for quick export.

We save the data in uncompressed KML format with the name of the zone. In our example, the file will be called '8_411_122.kml'.

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2" xmlns:gx="http://www.google.com/kml/ext/2.2" xmlns:globalmapper="https://www.bluemarblegeo.com/globalmapper">
<Document>
  <!-- Begin Style Definitions -->
  <Style id="point1">
        <IconStyle><Icon><href>kml_symbol_dot_custom_3_24_120_176_0.png</href></Icon></IconStyle>
  </Style>
    <Placemark>
      <description>Unknown Point Feature</description>
      <styleUrl>#point1</styleUrl>
      <Point>
        <altitudeMode>clampToGround</altitudeMode>
        <extrude>0</extrude>
        <coordinates>12.731830934,47.046527435,2481.1267</coordinates>
      </Point>
    </Placemark>
    <Placemark>
      <description>Unknown Point Feature</description>
      <styleUrl>#point1</styleUrl>
      <Point>
        <altitudeMode>clampToGround</altitudeMode>
        <extrude>0</extrude>
```

```
        <coordinates>13.023222967,46.858212856,1878.5559</coordinates>
      </Point>
    </Placemark>
    <Placemark>
      <description>Unknown Point Feature</description>
      <styleUrl>#point1</styleUrl>
      <Point>
        <altitudeMode>clampToGround</altitudeMode>
        <extrude>0</extrude>
        <coordinates>12.774449496,46.872088667,1854.6816</coordinates>
      </Point>
    </Placemark>
</Document>
</kml>
```

Each point is identified by its coordinates and altitude in the terrain. **FlySafe!** then manages the altitude of the obstacles.

The next step is to rename the generated KML file to TXT and save it on the server at the address entered in the app.

Already populated areas of obstacle points are available on request for quick modification and additions.

How to request zones: send an e-mail to daniele@flysafety.it with the zone codes.

Acknowledgements

First and foremost, **Masha Biksha**, who believed in this project from its inception back in 2016;

Mauro Saviane, helicopter pilot and tester. His ideas and suggestions contributed to the development of **FlySafe!**

Commanders **Marco Abbagnale** and **Marco Cosentino** of the Trento Province Helicopter Unit.

My daughter **Diana** for her patience.

My father **Dino**.

The maps used in **FlySafe!** are from the **MapBox** tools.

Obstacle data are processed with **GlobalMapper**.

FlySafe! was developed with **Flutter** and **Xcode**.

Contact

https://www.flysafety.it

daniele@flysafety.it

Important notes

1. **Manual version**
   This manual is updated to version 7.1. Any updates or revisions will be made available through official **FlySafe!** channels.
2. **Changes and updates**
   The content of this manual is subject to change without notice to reflect technical updates and improvements in functionality. We recommend that you check the availability of each updated version of **FlySafe!**
3. **Purpose of the manual**
   This document is for information purposes only and is intended to support the use of the **FlySafe!** app. It in no way constitutes an official aeronautical navigation guide.
4. **User responsibility**
   The user is responsible for ensuring that the settings, data and functions of **FlySafe!** are correctly configured before use. Failure to follow these instructions may impair the effectiveness of the application.
5. **Data limitations**
   Please note that the obstacle database may not be complete or up-to-date in some geographical areas. It is advisable to use the app in combination with other reliable sources to ensure maximum safety during the flight.

System Requirements

- **Device compatibility:**
  FlySafe! requires iOS 15 or higher, 60 MB of free space.
- **Internet connection:**
  FlySafe! requires an Internet connection and location tracking authorisation.

Security and disclaimers

- **Legal restrictions:**
  FlySafe! is not a navigation tool and cannot be used as the sole source for flight management.

Support Section

- **Contact for assistance:**
  For reports or technical support requests, please contact daniele@flysafety.it .

Data and privacy policies

- **Personal data management:**
  The data entered for the profile is saved locally and not shared with third parties.

- **Using GPS data:**
  The user's location is not stored and/or shared.

Emergency Procedures

- **What to do if the app malfunctions:**
  If the app does not respond, make sure the GPS is active and try closing and reopening **FlySafe!**

Helicopter crashes due to impact against cables

1983 – 2012

Introduction

Helicopter accidents caused by impact against cables are one of the main causes of death and serious injury in aviation. These accidents can occur under different circumstances, such as during maintenance or installation work on power lines, or during transport or rescue flights in areas with a high density of cables. In this brief overview, we will describe helicopter accidents caused by impact against cables, the main causes of such accidents and the effects on the helicopter and passengers. In addition, information will be provided on preventive measures to avoid future accidents and on flight technologies and techniques that can improve helicopter safety in these situations.

Helicopter crashes due to impact against cables

Helicopter accidents caused by impact against cables have been documented worldwide. According to the International Civil Aviation Organisation (ICAO), 5% of fatal helicopter accidents are caused by collisions with obstacles, including cables. In addition, research conducted by Cranfield University found that 60 per cent of helicopter accidents that occurred due to impact against cables were fatal.

The main causes of these accidents are related to the difficulty of locating cables, especially in poor visibility conditions, and the lack of proper signalling of the cables themselves. In some cases, cables may be hidden by vegetation or snow, making them difficult to detect even with advanced technologies such as infrared sensors. In other cases, cables may be poorly or unevenly marked, causing confusion among the helicopter crew.

Effects on the helicopter and passengers

The effects of a helicopter crashing into a cable depend on the position of the impact, the speed of the helicopter and the strength of the cable itself. In general, impact against a cable can cause significant damage to the helicopter, including the breaking of main rotor blades and loss of control of the aircraft. In addition, the impact can cause serious injury or death to passengers on board.

Preventive measures and flight technology

In order to avoid helicopter accidents caused by impact against cables, various preventive measures and flight technologies have been developed. Among them, most airlines and helicopter operators have adopted specific flight protocols to minimise the risks of collision with cables. In addition, advanced technologies such as infrared sensors and collision warning systems have been developed to help the crew detect cables more accurately. However, these technologies are not enough.

Conclusions

Helicopter accidents caused by impact against cables are one of the main causes of death and serious injuries in aviation. However, preventive

measures and available flight technology can help reduce the risks of such accidents. Helicopter operators, airlines and civil aviation regulators must continue to work together to improve the safety of helicopter flights and reduce the number of accidents caused by impact against cables.

ACCIDENTS REPORTED HELICOPTER SERVICES IN ITALY

1979 - 2011

Unfortunately, over all these years the Italian HEMS services have paid a high toll in human lives due to accidents that occurred during missions.

Incidents from 1984 to 22 July 2012				
Accidents	Deceased	Injuries	Uninjured	People involved
40	32 (18%)	49 (28%)	94 (54%)	175

ACCIDENTS DUE TO IMPACT AGAINST CABLES

YEAR	PLACE	HELICOPTER	BASE HEMS	CAUSE	DECEASED	INJURIES	UNINJURED
1983	Eppurel di Cogne	AS 350	Aosta	Impatto teleferica	4	0	0
1987	Bolzano	SA 316 Alouette III	Croce Bianca Bolzano	Impatto teleferica	0	3	0
1988 [1]	Cassolnovo	Agusta A109	HEMS Niguarda	Impatto tralicci	0	4	0
1988	Monti Pezzornie	Agusta A109	HEMS Parma	Impatto cavi	0	0	4
1993	Bologna	Agusta A109	HEMS Parma	Impatto cavi	0	0	4
1996	Roma	AB 412	VV FF Roma	Impatto pilone luce	0	0	5
1996	Val Sarentina	BK 117	HEMS Bolzano	Impatto teleferica	0	0	4
1998	Genova	AB 412	HEMS Genova	Impatto cavi	0	0	6
1999	Fanano	BK 117	HEMS Bologna	Impatto cavi	0	0	4
2000	Forcelle	AB 412	VV FF Roma	Impatto cavi	5	0	0
2008	Brescia	BK 117	HEMS Brescia	Impatto teleferica	0	0	4
2009[2]	Monte Cristallo	Agusta A109S Grand Power	HEMS Pieve di Cadore (BL)	Impatto cavi	4	0	0
2009	Ravenna	EC 145	HEMS Ravenna	Impatto cavi	0	0	4
2012	Morbegno	EC 145	HEMS Bergamo	Impatto cavi	0	2	0
				Persone coinvolte	**13**	9	35

Foto incidenti

In the first months of 2023, other cases of helicopters crashing into cables were recorded: Bolzano, Ravenna, Sassofortino (Grosseto) with a toll of two injured.