emesent

THE MISSION PLANNING PROCESS

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Using this manual

Hovermap is a powerful system that can be used as a Lidar mapping payload but also as an advanced autopilot for drones. It is therefore recommended to read the user manual thoroughly to make use of all its capabilities in a safe and productive way.

Disclaimer and safety guidelines

This product is not a toy and must not be used by any person under the age of 18. It must be operated with caution, common sense, and in accordance with the instructions in the user manual. Failure to operate it in a safe and responsible manner could result in product loss or injury.
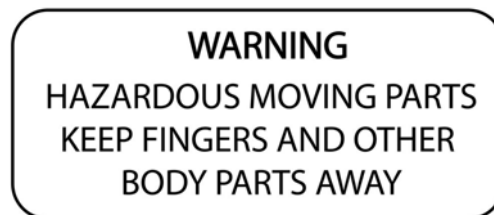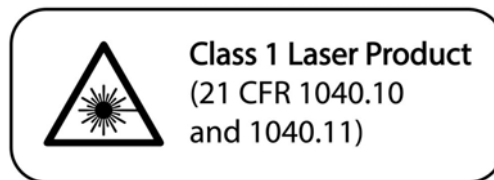
By using this product, you hereby agree that you are solely responsible for your own conduct while using it, and for any consequences thereof. You also agree to use this product only for purposes that are in accordance with all applicable laws, rules and regulations.

The use of Remotely Piloted Aircraft Systems (RPAS) may result in serious injury, death, or property damage if operated without proper training and due care. Before using an RPAS, you must ensure that you are suitably qualified, have received all necessary training, and read all relevant instructions, including the user manual. When using an RPAS, you must adopt safe practices and procedures at all times.

Warnings

- This document is legally privileged, confidential under applicable law and is intended only for the use of the individual or entity to whom it is addressed. If you have received this transmission in error, you are hereby notified that any use, dissemination, distribution or reproduction is strictly prohibited. If you are not the intended recipient, please notify the sender and delete the message from your system.

- Always be aware of moving objects that may cause serious injury, such as spinning propellers or other components. *Never* approach a drone while the propellers are spinning or attempt to catch an airborne drone.

Class 1 Laser Product
(21 CFR 1040.10
and 1040.11)

WARNING
HAZARDOUS MOVING PARTS
KEEP FINGERS AND OTHER
BODY PARTS AWAY

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Contents

Being confident and familiar with Hovermap can mean the difference between great results and a failed mission. Hovermap perceives the world differently from traditional LiDAR systems, and you will need to plan your mission effectively to maximize the quality of your results.

Some environments, such as large outdoor areas, can present a challenge for Hovermap, so preparation and planning can make all the difference.

If you lack the confidence to operate Hovermap as a payload in certain areas, performing a separate walking scan is a perfectly viable solution. The data from the walking scan can be merged with the overall data later on. Make sure that you only operate to your capabilities!

1.   The process

In this section, we will outline the process of planning your mission. In each step, we will provide you with a set of questions to help you set yourself up for success.

> ⊘ **Warning**
> Before you begin, make sure that you are aware of, and can comply with, all legal requirements when operating Hovermap and its associated platforms.

1.1   Step 1: Define your objective

The first and most important step is to define your objective. Keep this objective in mind as you plan and execute your mission. The following steps will help you work out *how* to achieve it.

Questions

- What am I hoping to achieve?

- What is my subject of interest?

- What capture method will I be using?
  For example, will it be a walking scan, a vehicle or drone-mounted scan, lowering Hovermap in a cage?
  Or a combination of these?

- What level of accuracy do I need?

- Do I need to use GCPs?
  (Refer to the *Georeferencing* section for more information.)

- What are my limitations?

- Are there accessibility limitations?

  - How much time do I have to do the job?

  - How many batteries do I have?

  - Are there any other equipment limitations?

- Do I want a colorized scan?
  (Refer to the *Colorization* section for more information.)

1.2   Step 2: Analyze your environment

Every environment is unique, and you will need to plan your mission accordingly. Make sure that you have a good understanding of how SLAM works and how environmental features affect your mission before you get started. Refer to the *What is SLAM?* section for more detailed information.

For more specific information on how to plan in some of the more common scenarios, refer to the *Common scenarios* section.

Questions

- Does the environment have enough features to provide a good quality scan?

- If not:

  - Can I add features to the environment to improve the scan quality?

  - Can I mitigate the lack of features in some areas by planning my mission path to account for this?

- Is there a good GPS signal available?

- Are there any moving objects?

- What is the best size scan for this environment?

- Do I need to break up my scan into multiple scans?

- If I need to split it up, how should I scan each different section?

1.3   Step 3: Plan your mission path

Your mission path will depend on the environment you are mapping. Make sure that you have read and understood the *Scan patterns* section before planning your mission path.

Questions

- Where is the best starting point?

- What scanning pattern will I use?

  - How will I close the loop?

  - Should I use lots of little loops?

  - Should I use a grid pattern?

  - If performing multiple scans, how will I ensure that there is at least 20% overlap between these scans?

- How will I keep features in front of Hovermap as I perform my scan?

- How close can I get to environmental features?

- Where do I need to place GCPs?

- Where should I place my rally point?
  (Set your rally point in an open space, within visual line of sight. For more information, refer to *The Hovermap App* section.)

- Where should I place my waypoints?
  (For more information, refer to *The Hovermap App* section).

- If you require a colorized scan:

  - How will I keep the GoPro within the 20 m range?

  - How will I keep the GoPro directly focused on the area of interest?

1.4   Step 4: Decide on your mission parameters

The height, speed, and scanning patterns that you need to follow will vary according to your environment. Make sure that you have read and understood the *Scanning techniques* section before you continue.

Questions

- What speed do I need to travel at?
(Remember, the slower, the better.)

- How high should I fly?
(The lower, the better.)

- Can I easily follow the terrain, keeping to a height of 40 m or less?

- How will I keep my scans as short as possible?

- What autonomy mode will I be using?

- What primary and secondary navigation methods should I choose?
(Refer to the *How does Hovermap navigate?* section for more information.)

- What is my turning technique?
(Remember to turn slowly, and to keep features within Hovermap's field of view while turning.)

1.5   Step 5: Prepare an emergency contingency plan

Always have an emergency plan in place in case of unexpected behavior. Be prepared to take over the drone or vehicle if required, especially if you are using Autonomous Waypoint mode. Make sure that you know how to handle your specific platform in an emergency situation.

Refer to the *Emergency procedures* section for more detailed information.

Questions

- What is my emergency contingency plan?

- How will I take over control of the drone if necessary?
(This will be platform-specific.)

- How can I abort the mission if necessary?

- How will I abort the mission if Hovermap is beyond visual line of sight?

- Do I need to think about protecting people, animals, or objects?

1.6 Step 6: Prepare your environment

To ensure the most efficient scan, make sure that your surroundings are prepared beforehand.

Questions

- Is my scan path unobstructed?

- Is my scan area free of people?

- Is my scan area free of other moving objects?

- Have I placed my GCPs around the area?

- If colorizing the scan, do I have suitable lighting to create a quality color scan?

1.7 Step 7: Perform your pre-mission checks

Perform the appropriate pre-mission checks before operating Hovermap. Our pre-mission checklists help you to ensure that you have chosen the correct settings and tested your equipment so that everything is in working order for your mission.

You can find the following pre-mission checklists in our Knowledge Base:

- Mapping mode

- Pilot Assist mode

- Autonomous Waypoint mode

Questions

- Have I set my primary and secondary navigation methods?

- Is **Auto-enable VESH on takeoff** turned on?
  (We recommend that this setting is always turned on. Refer to the *VESH settings* section for more information.)

- What is the best name for my scan?
  (Make sure that you name your scan clearly so that you can find it again for downloading and processing. Leave no doubt as to what the scan is.)

- Have I performed all other pre-mission checks?

1.8   Step 8: Perform your mission as planned

Perform your mission according to your chosen path and parameters.

As you go, make sure that you check the live point cloud to ensure that your data is being collected correctly.

You can do this in the Hovermap App. You can also do this by connecting to the Hovermap's Wi-Fi, opening a web browser (on any laptop or Android device), and then navigating to **hover.map:8082**.

1.9   Step 9: Download and process your data

Download your scan data off Hovermap and then process it using the Emesent Processing Software. Make sure that you download your data after each scan.

Questions

- Have I downloaded all the data collected?

- Do I have enough free space on Hovermap for the next mission?

- If something didn't go to plan, have I downloaded all relevant log files?

- Have I processed the scan using the **Standard** profile?
  (If your results are not as desired using this profile, you can then change the processing parameters. Refer to the *Common scenarios* section for more information about settings for specific environments.)

1.10   Step 10: Review your mission

Once your mission has been completed, we recommend that you perform a review to see how it went. This will help you to improve your scanning technique with each mission that you accomplish.

Questions

- What was successful?

- What was unsuccessful?

- What have I learned?

- What can I do better next time?

- Do I need to contact Customer Success (or my local reseller) for further assistance?

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