PROJECT: ECOLOGICAL AND INNOVATIVE TECHNOLOGIES FOR RECOVERING INDUSTRIAL AREAS FROM LCA AND ENERGY EFFICIENCY POINT OF VIEW

2020-1-RO01-KA203-080223

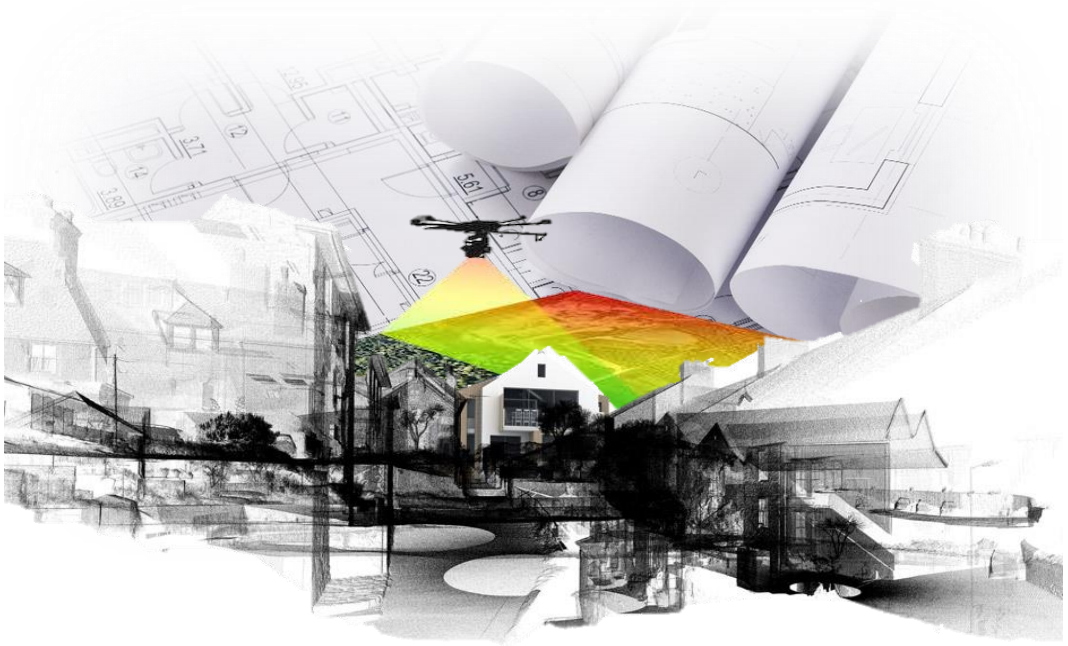
DRONES

Universitatea Transilvania din Brașov
Centro Tecnológico del mármol, piedra y materiales
Universidad de Sevilla
ROMANIA GREEN BUILDING COUNCIL
Politechnika Poznańska
FPIP CALIFICAT.RO
Rybaki17
Co-funded by the Erasmus+ Programme of the European Union

Co-funded by the Erasmus+ Programme of the European Union

GENERAL CONTENT

1. Presentation
2. Drone Legislation
3. Use of Drones
4. Drone Flight Applications
5. Practical application



DRONE

Co-funded by the Erasmus+ Programme of the European Union

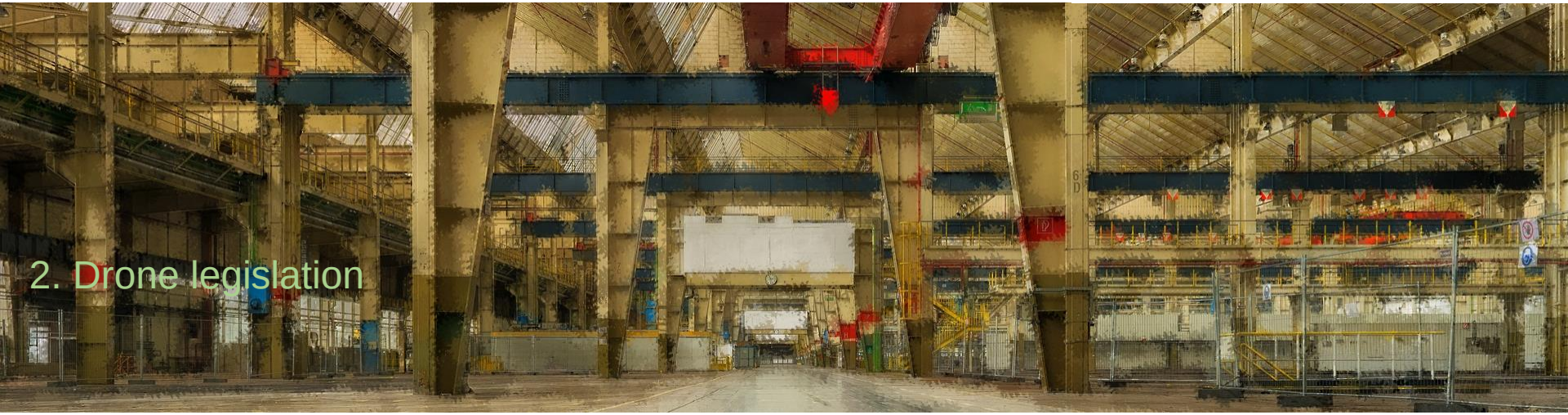
1. Presentation

A drone, also known as an unmanned aerial vehicle (UAV) or unmanned aerial system (UAS), is a flying machine that is controlled either by a remote pilot or by computers using special software

.

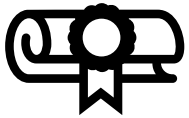
Drones are used in a variety of applications. The term drone is most often used in a military context, while UAV is a more widely used term in all applications.

The drone system usually consists of two or three parts: the drone itself, the system remote control system and the RTK mobile



2. Drone legislation

2.1. Before starting to fly...



-Follow the online courses for one of the sub-categories A1, A2 and A3 in the OPEN category on AACR (https://www.caa.ro/ro/).
- Follow the practical flight training for category A2
- Pass the exam for the chosen category.The OPEN category is divided into three "subcategories" to specify certain rules for different types of flying. The category you fall into depends on the type of drone and how you want to fly.

2. Drone legislation

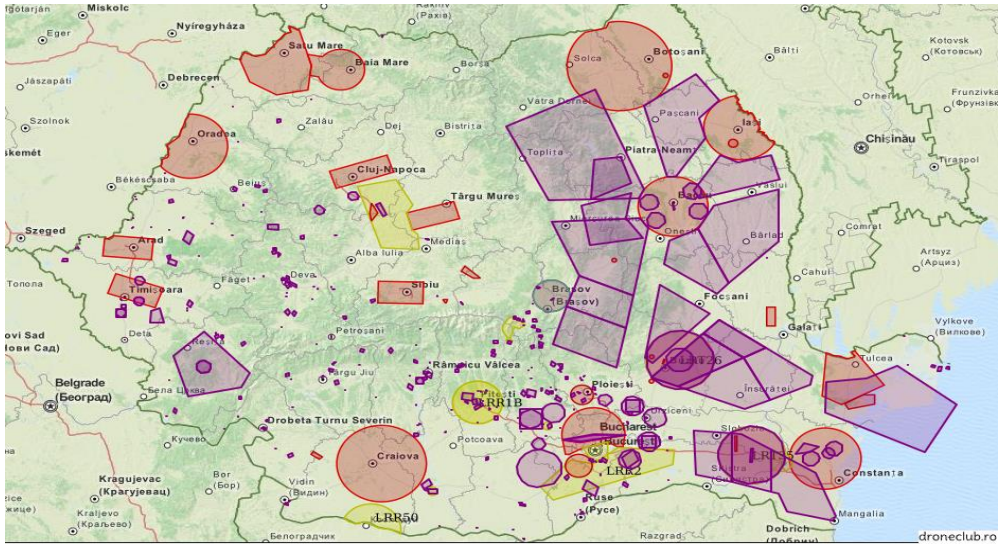
2.2. Make sure you comply with the common rules of the air...

1. The drone must weigh less than 25 kg;
2. The pilot must maintain visual contact with the drone;
3. The drone must not fly more than 120 metres from the nearest point on the ground;
4. The drone must be marked with the operator's registration number.
5. Before taking off you must make sure that it is allowed to fly in that area.

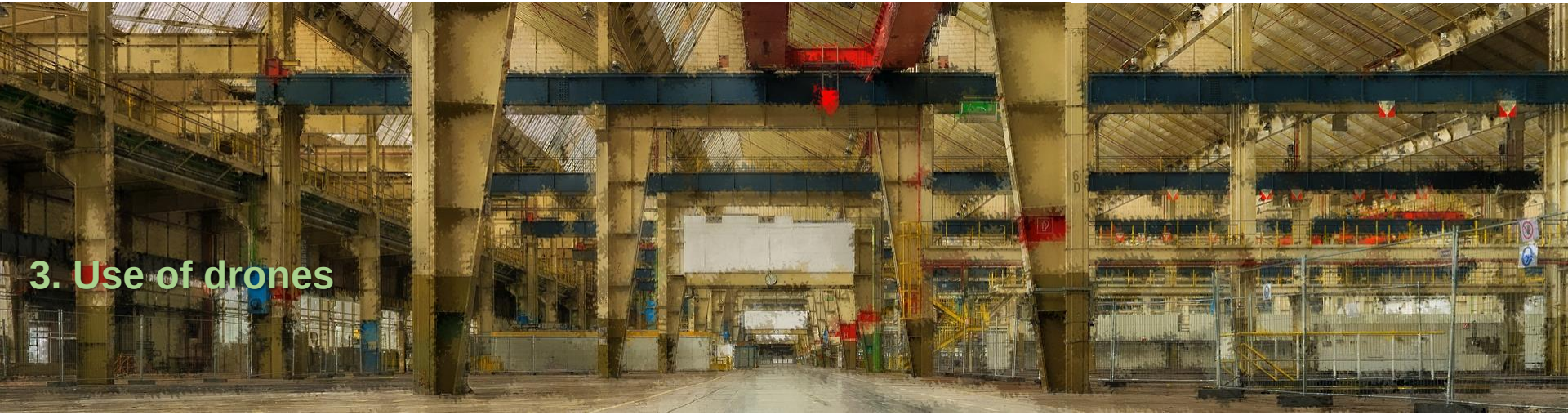
2. Drone legislation

2.3. Make sure you are not in these restricted areas when taking off ...

1. Within 5 km of airports;
2. Restricted airspace;
3. Some nature conservation areas;
4. Areas with sensor restrictions (photo/video);
5. Enclosures;
6. Embassies;
7. Military zones and naval vessels.
8. In areas with large gatherings of people.

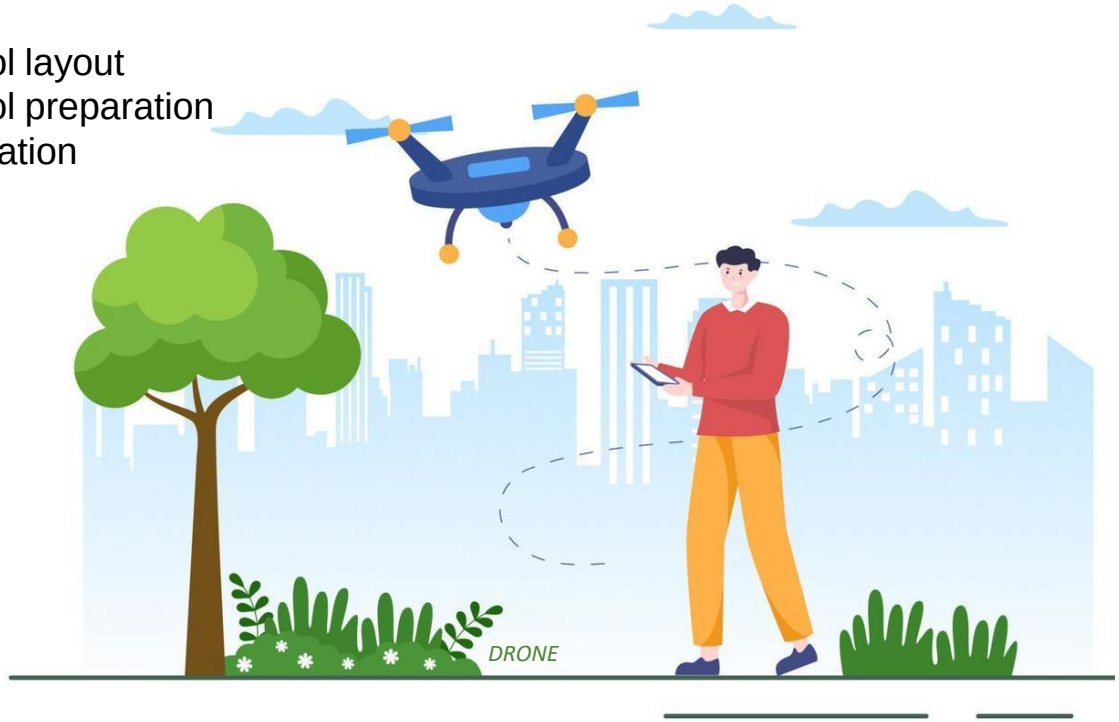


1.Red - Flight colour around airports (areas where aircraft are at low altitudes)
2.Yellow/Purple - Strategic targets (area where military bases are located)

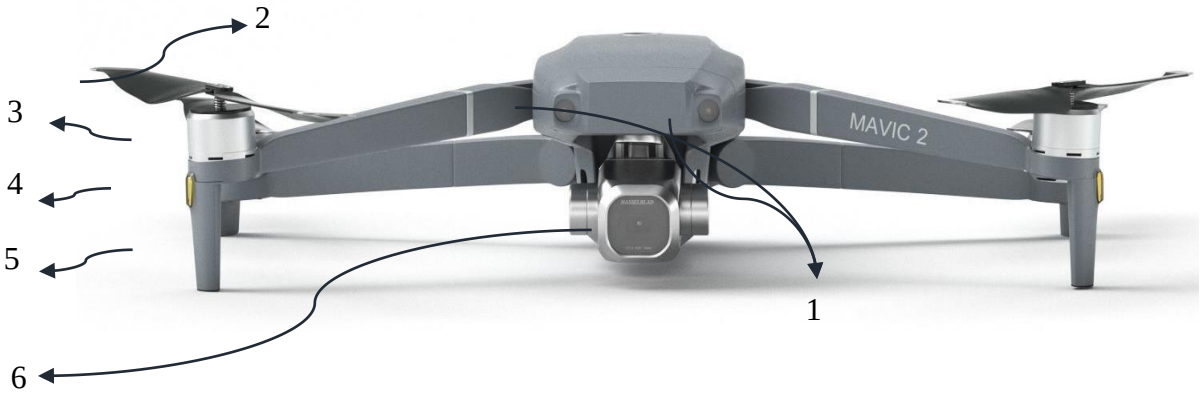


3. Use of drones

3.1. Aircraft layout
3.2. Remote control layout
3.3. Remote control preparation
3.4 Aircraft preparation



Co-funded by the Erasmus+ Programme of the European Union



DRONE

3.1. Aircraft layout

1.Front visibility system

2.Propeller

3.Engines

4.Front LEDs

5.Antennas

6.Gimball and camera

7.Rear vision system

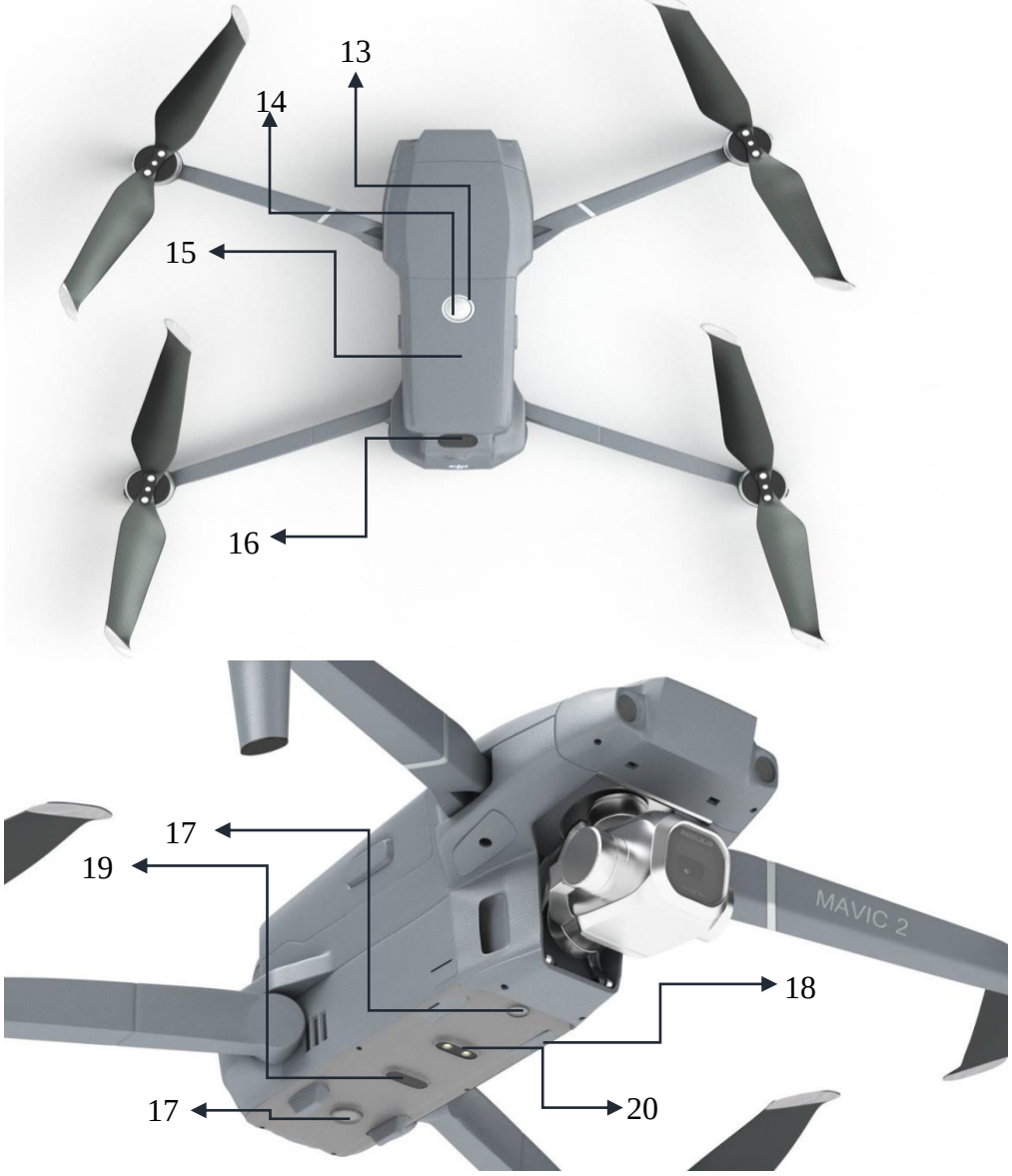
8.Aircraft status indicator

9.Side visibility system

10.USB-C port

11.Link button/link status indicator

Co-funded by the Erasmus+ Programme of the European Union



DRONE

3.1. Aircraft layout

13. Battery level LEDs
14. Power button
15. Intelligent flight battery
16. Upper infrared detection system
17. Lower vision system
18. MicroSD card slot
19. Lower infrared detection system
20. Auxiliary light

3.2. Schema telecomenzii

1.Antennas Transmits aircraft control signals and wireless video signals.

2. Return Home Button (RTH) Press and hold the button to initiate RTH.

3. LCD screen Displays the status of the aircraft and remote control system.

4. Control sticks

5.Flight pause button Press this button to make the aircraft brake and hover in place.

7.Mobile device clamps To securely mount your mobile device to the remote control.

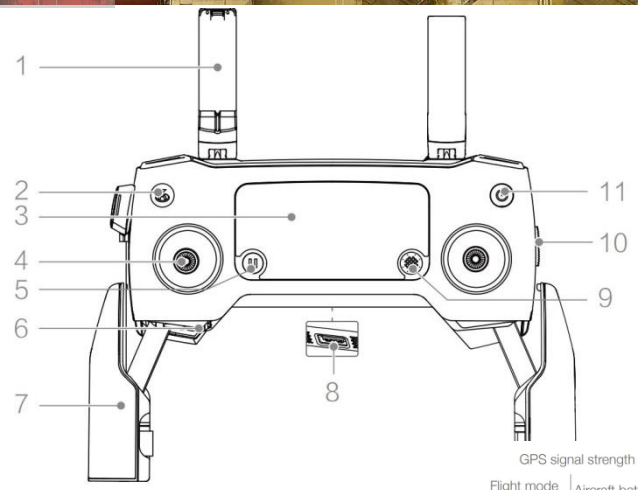
10. Flight mode switch Switches between S-mode, P-mode and T-mode.

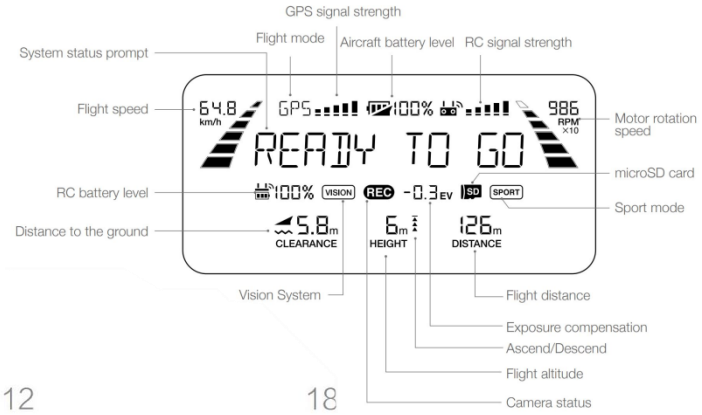
11. Power button Press once to check current battery level. Press once, then press and hold again to turn the remote on/off.

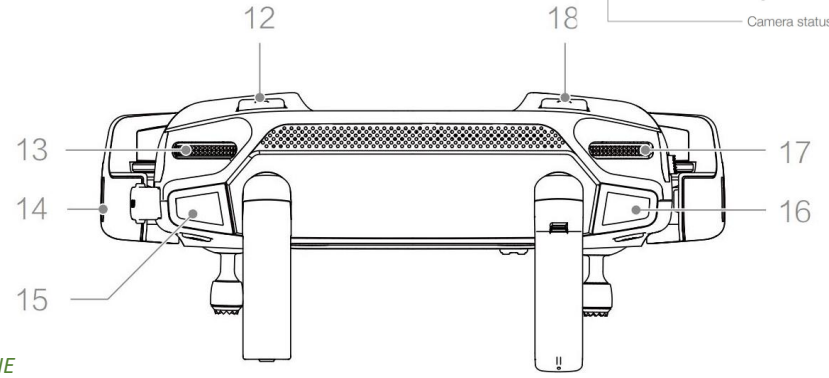
13. Dial Controls camera tilt.

14. Video-Downlink/Power port (micro USB) Connects to a mobile device for video connection via RC cable. Connect to the AC power adapter to charge the remote control battery.

16. Focus/Shutter button Press halfway down for auto focus. Press once to take pictures according to the mode selected in the DJI GO

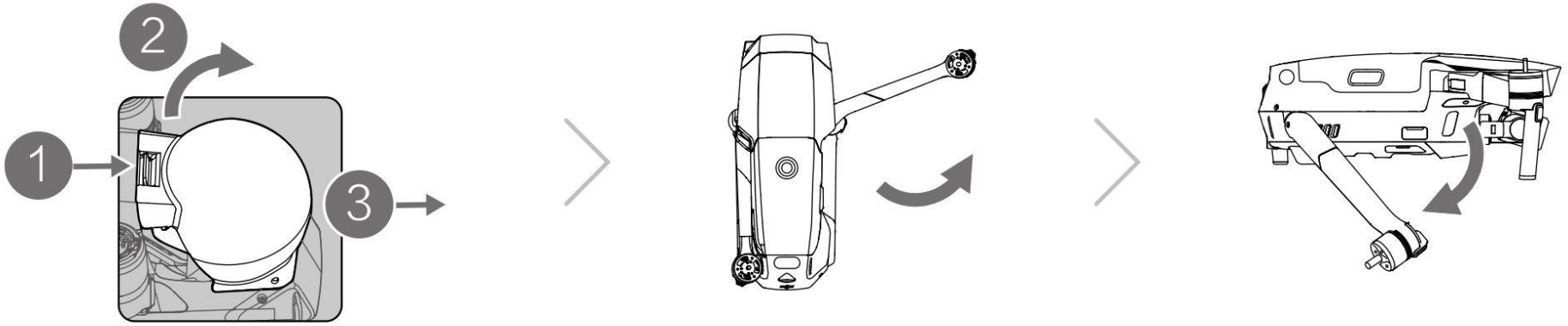




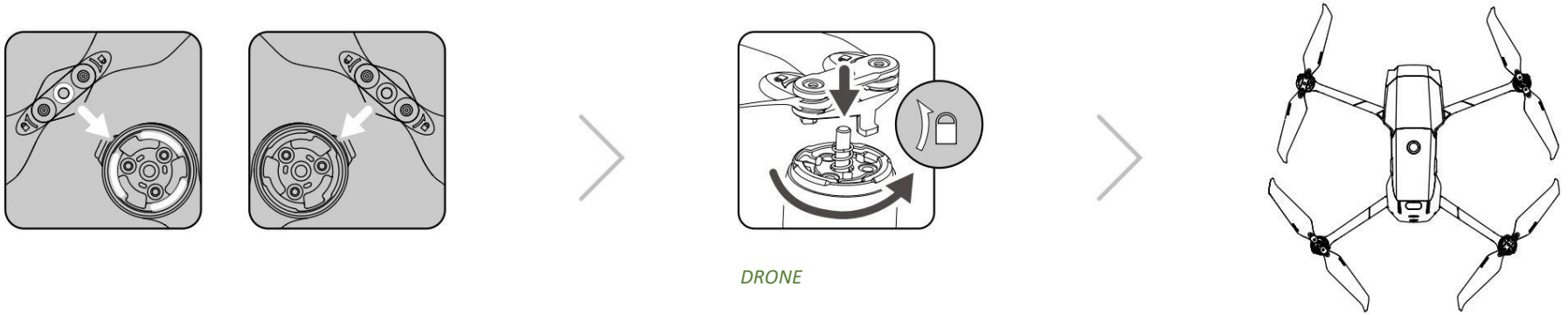


3.3. Aircraft preparation

1. Remove the camera cover.
2. Undo the front arms, then the rear arms.

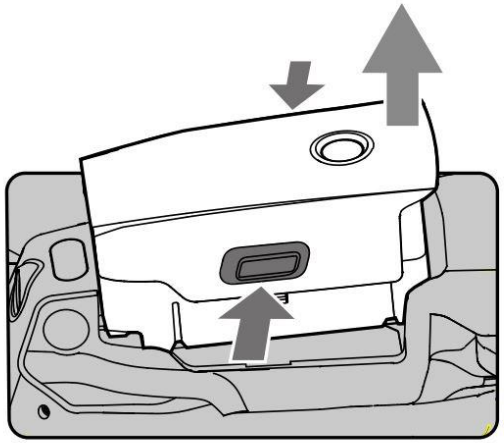


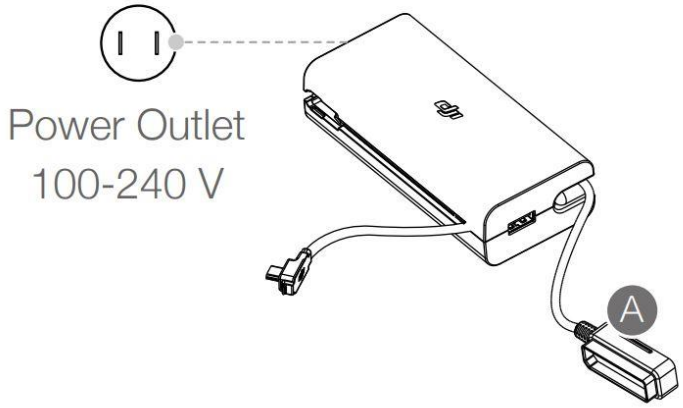
3. Attach the helices. (Attach white marked helices. to engines with white markings. Press the propeller onto the motors and rotate it until it is secured. Attach the other helices. to the unmarked motors. Unscrew all helices. blades.

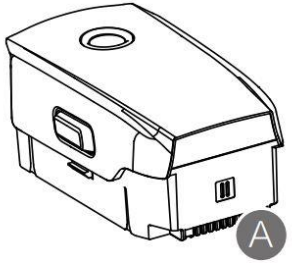


3.2. Aircraft preparation

4. Batteries must be fully charged to ensure safe flight. To charge an Intelligent Flight battery after flight, remove it from the aircraft and attach it to the AC power adapter[2].







Charging Time:
~1 hour 30 minutes

3.3. Remote control preparation

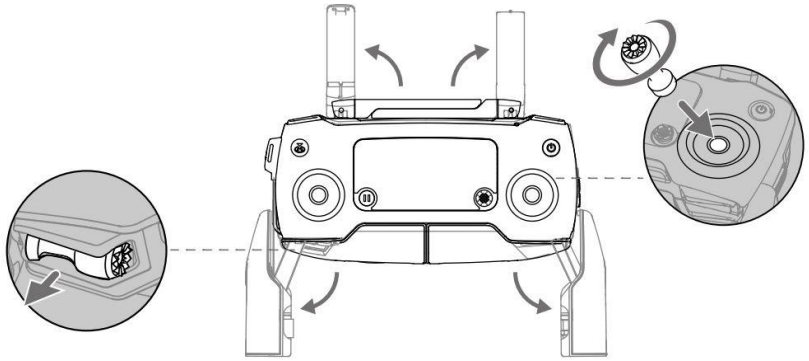
1. Release the clips and antennas of the mobile device.

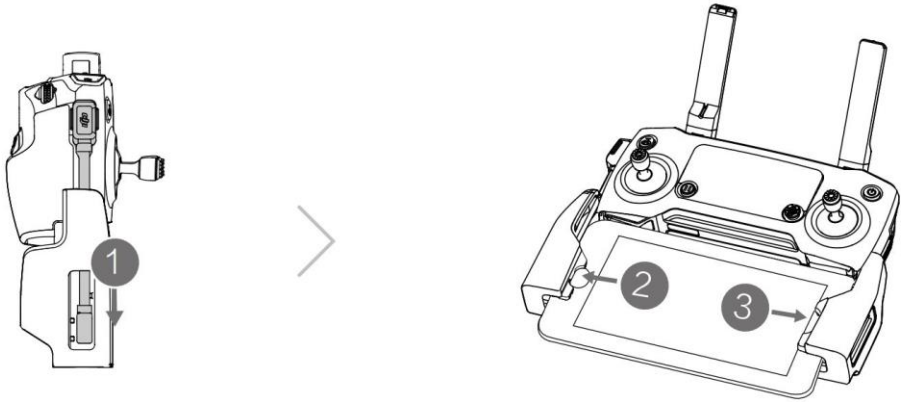
2.Remove the control sticks from the storage locations on the remote control and screw them into place.

3.Choose a suitable RC cable depending on the type of mobile device.

4.Connect the end of the RC cable to your mobile device.

5.Secure your mobile device by pushing both clips inwards[2].





4. Flight application

1.Applications that can be used for aircraft control:

-Dji Pilot
-Drone Deploy
-Pix4Dcapture

2.Applications for reading and using data:

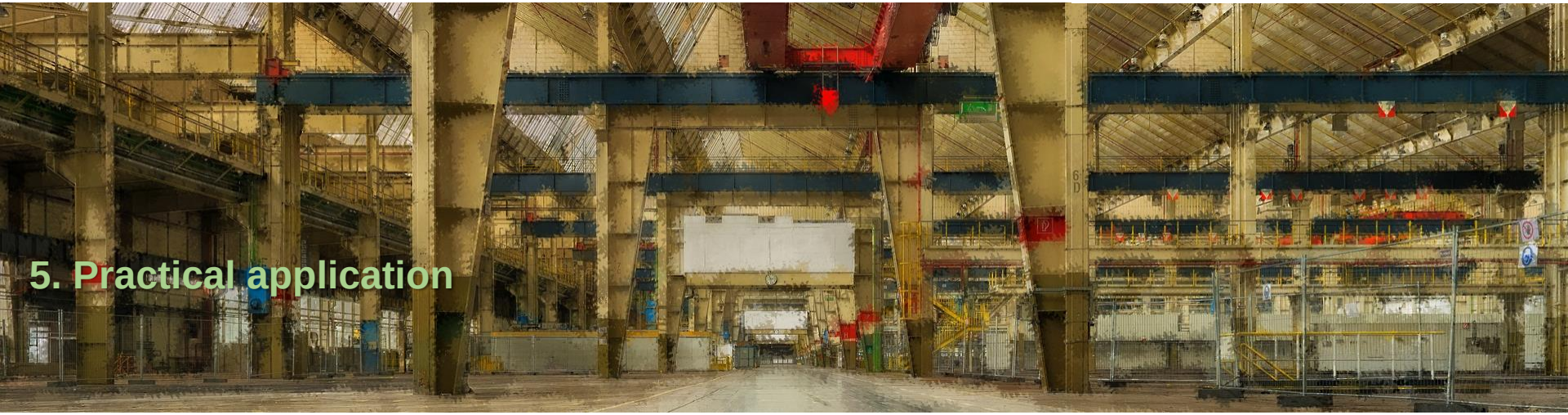
-Agisoft metashape
-Pix4Dmapper
-Reality Capture, etc.

5. Practical application

- The hall is located in the industrial area of Brasov and was built in the 60s. It is part of a larger building.
- It is to be renovated and will have a new use.
- Architectural and resistance plans are needed. These will not be obtained in the traditional way, but will use modern working methods: photogrammetry made by drone.

DRONE

Co-funded by the Erasmus+ Programme of the European Union



5. Practical application

Project steps

In the field

5.1. Inspection of the area
5.2. Equipment preparation
5.3. High-flying
5.4. Applications for optimal flight planning
5.5. Making the optimal flight

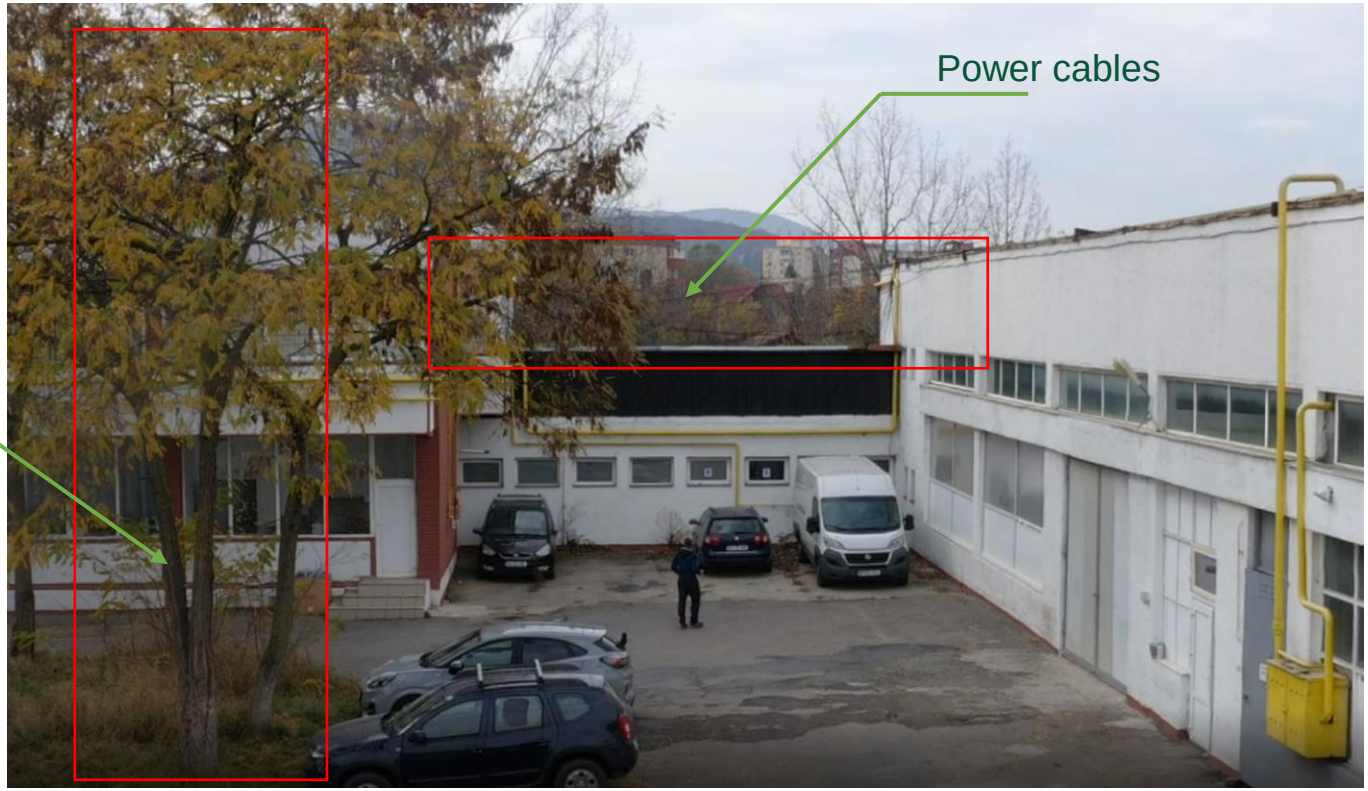
In the office

5.6. Processing the data obtained

Co-funded by the Erasmus+ Programme of the European Union

5.1. Inspection of the area

It is performed by the user before lifting the drone off the ground for flight.
It is done to be able to identify dangerous objects or areas that the drone might collide with during flight.



5.2. Equipment preparation

1.Check the condition of the drone, batteries and propellers and their correct positioning.
2.Connect the tablet to the remote control and link it to the drone.
3.Start the drone control application.
With one battery you can take around 300 photos. On average it takes between 1000 and 3000 photos to get a quality model (it depends very much on the size of the lens being studied. You must make sure you have enough batteries to make the flight.




5.3. High-flying

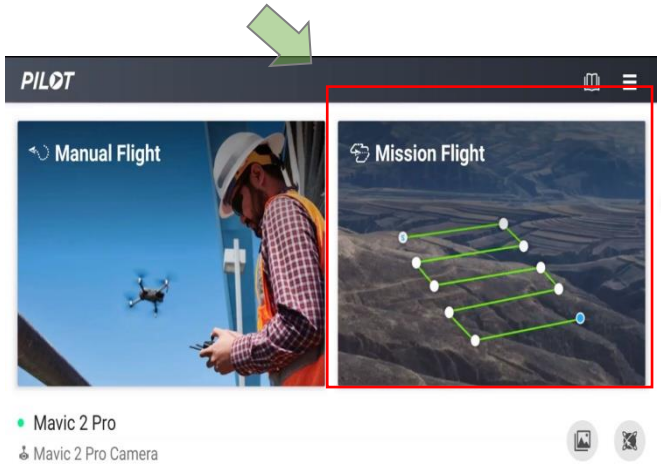
1. Open the flight app (DjiPilt, DrodeDeploy, Pix4Dcapture, etc.)
2. Select the flight device with which we will take the photos
3. Mark in the app the area of interest where we will take the flight.
4. Make settings for (height, camera, flight time, angle and aircraft position.
5. Perform the necessary data collection tasks
6. Transfer the obtained data to the desktop application for processing.

5.3. High-flying

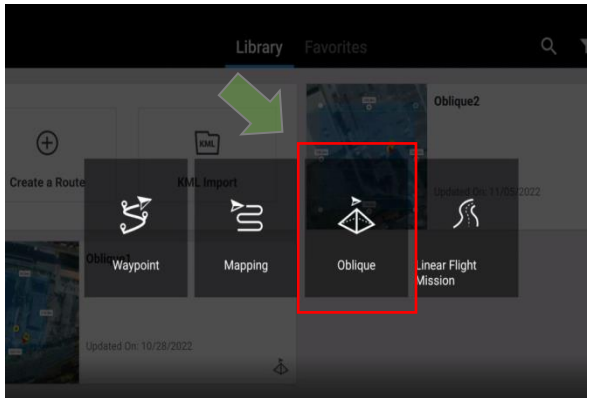
It is done automatically with the help of the automated application and allows data retrieval for optimal flight planning.

1. DJI PILOT

2.

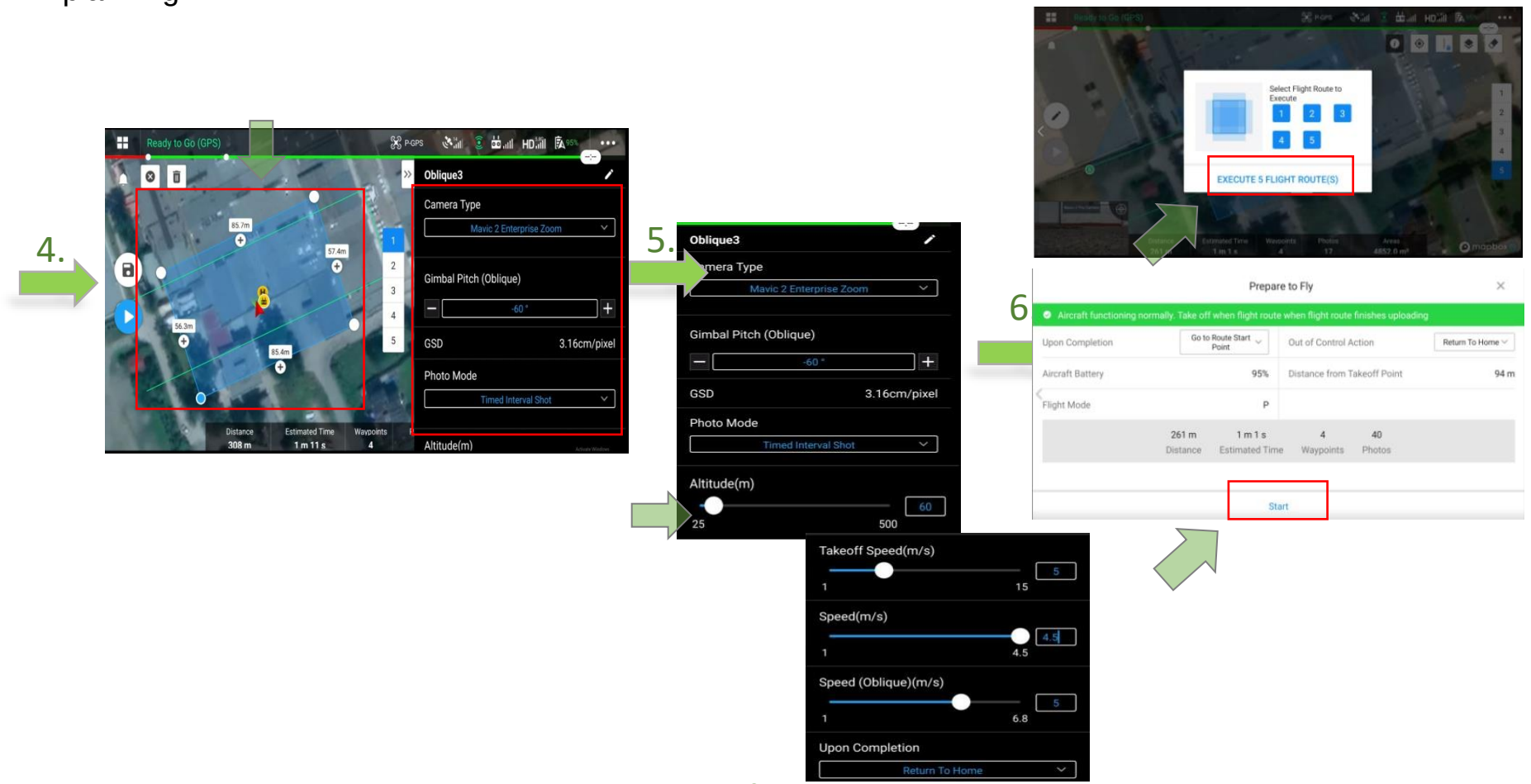


3.



5.3. High-flying

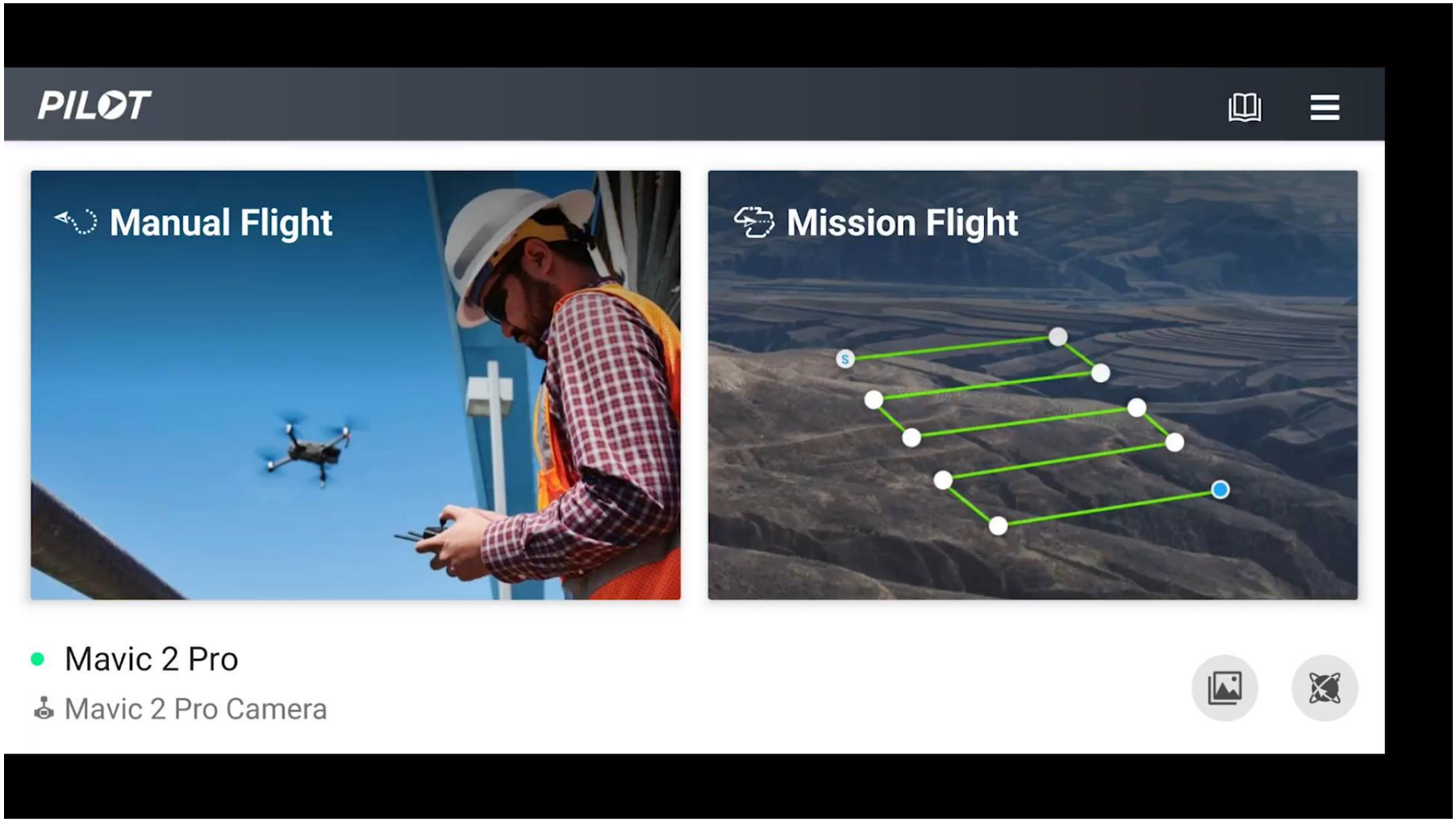
It is done automatically with the help of the automated application and allows data retrieval for optimal flight planning.



DRONE

Co-funded by the Erasmus+ Programme of the European Union

5.3. High-flying (video)

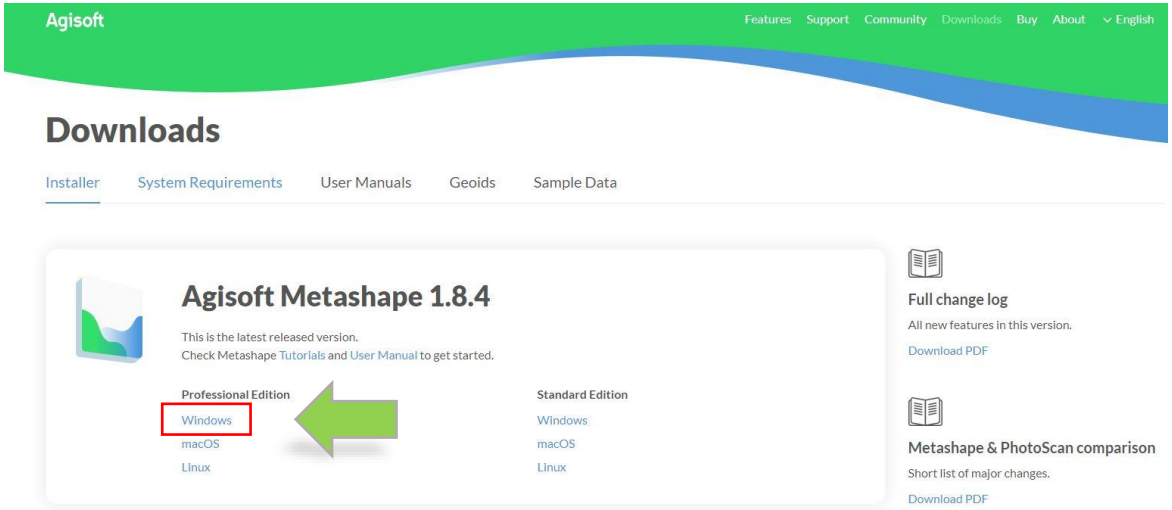


5. Practical application

5.4. Applications for optimal flight planning

You can use the Agisoft Metashape app, trial for 31 days or get an educational license.

Download the application at www.agisoft.com



Educational License

Educational licenses (rehostable node-locked) and Educational Floating licenses are available exclusively to accredited educational institutions, their employees and students of such institutions. Only officially accredited educational institutions are eligible to obtain Agisoft Metashape educational licenses. This includes: universities, colleges, junior colleges, scientific and technical schools, vocational schools, and correspondence schools. Educational or Educational Floating licenses can also be purchased by students and officially employed teaching and research staff of officially accredited educational institutions. Any educational license prohibits all commercial uses of the software. Educational / Educational Floating and Node-Locked / Floating licenses differ legally but are technically identical.

DRONE

5. Practical application

5.4. Applications for optimal flight planning

In order to use the application in optimal conditions ensure the minimum operating requirements of the program.

RAM

In most cases the maximum project size that can be processed on a machine is limited by the amount of RAM available. Therefore, it is important to select a platform allowing to install the amount of RAM required for the projects to be processed. See Memory Requirements article for information on typical RAM consumption at common processing steps.

CPU

Complex geometry reconstruction algorithms of the photogrammetric software require a significant amount of computational resources for optimal data processing. Hence, a high speed multi core CPU (6+ cores, 3 GHz+) is recommended.

GPU

Agisoft Metashape supports GPU acceleration for most resource-intensive processing steps, thanks to this it is possible to speed up the processing using high-end OpenCL or CUDA compatible graphics cards with high number of unified shaders (CUDA cores or shader processor units).

Basic Configuration

up to 32 GB RAM (Laptop or Desktop)

CPU: 4 - 12 core Intel, AMD or Apple M1/M2 processor, 2.0+ GHz

RAM: 16 - 32 GB

GPU: NVIDIA or AMD GPU with 1024+ unified shaders
(For example: GeForce RTX 2060 or Radeon RX 5600M)

Advanced Configuration

up to 128 GB RAM (Desktop or Workstation)

CPU: 6 - 32 core Intel or AMD processor, 3.0+ GHz
(For example: Intel i7 / i9 or AMD Ryzen 7 / Ryzen 9 / Threadripper)

RAM: 32 - 128 GB

GPU: 1 - 2 NVIDIA or AMD GPUs with 1920+ unified shaders
(For example: GeForce RTX 3080 or Radeon RX 6800 XT)

Extreme Configuration

128+ GB RAM (Server)

For processing of extremely large data sets a dual-socket Intel Xeon or AMD EPYC based servers (3.0+ GHz) with Quadro, Tesla, Radeon Pro or Instinct GPUs can be used.

5.4. Applications for optimal flight planning

This planning technique is used to create a flight plan that determines where each drone will take off, fly and land.

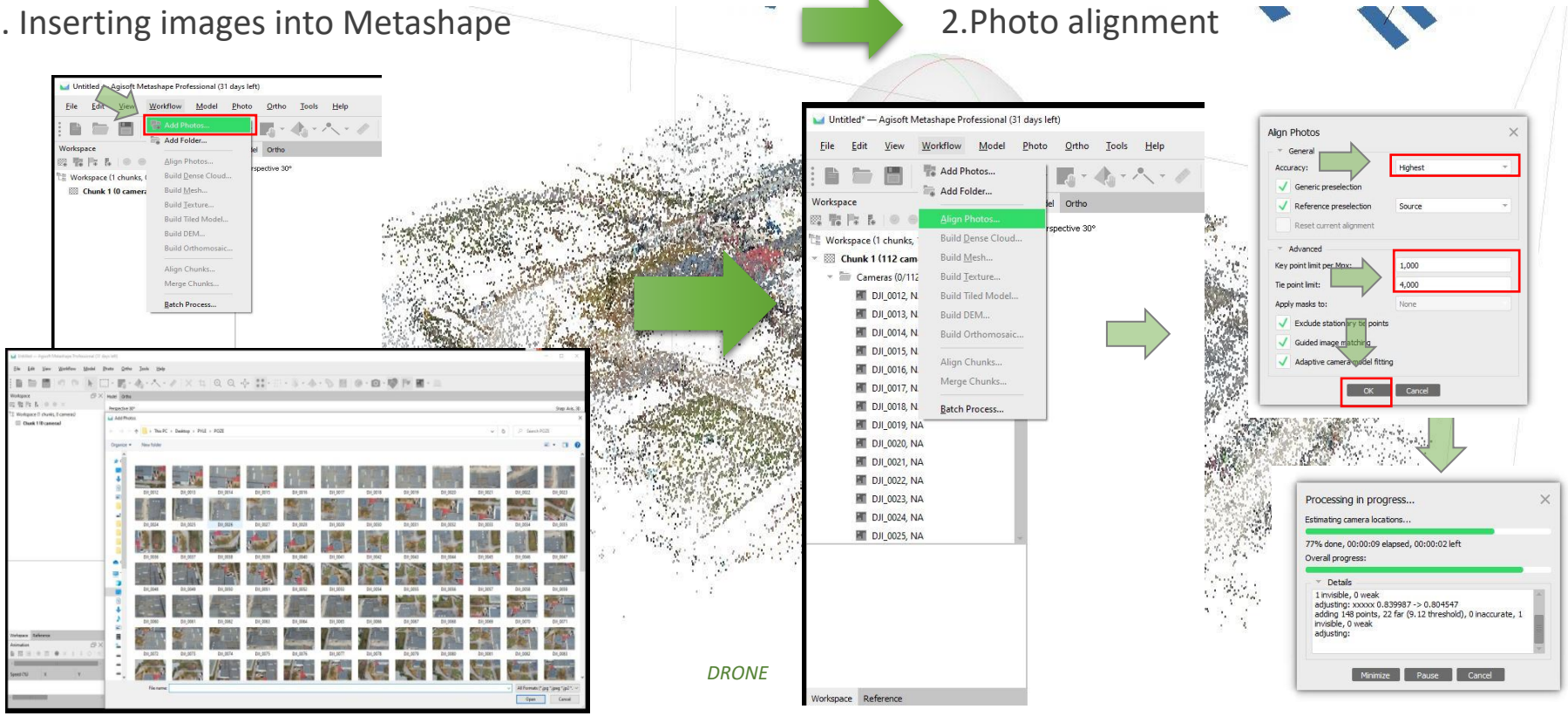
Automatic planning ensures complete coverage of an area, so the drone will not fly outside the planned area.

Automatic planning also allows drones to avoid obstacles such as trees, power lines and other buildings.

The flight plan allows the drone to automatically schedule missions around the target to take pictures.

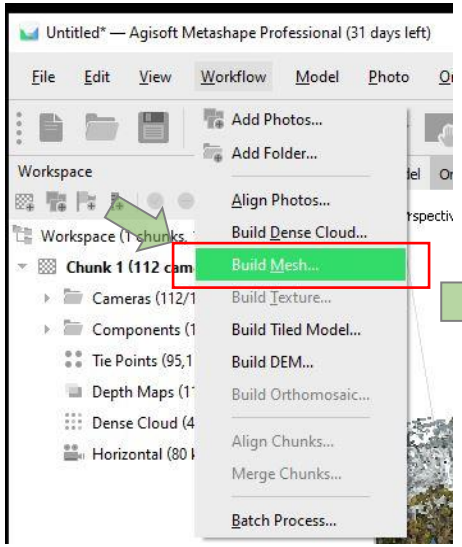
1. Inserting images into Metashape

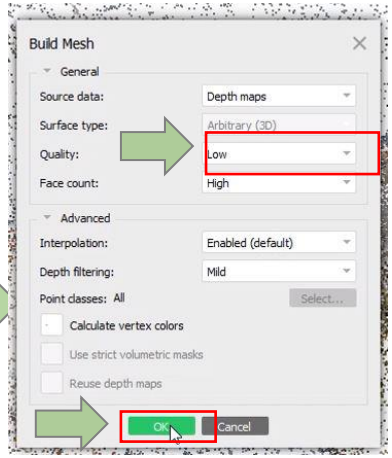
2.Photo alignment

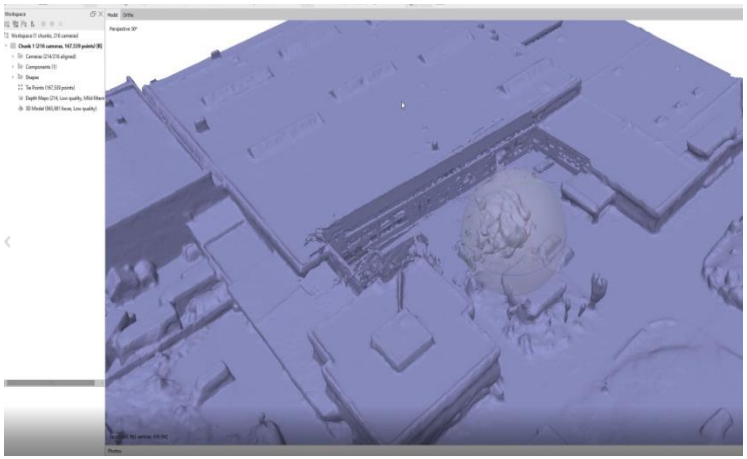


5.4. Applications for optimal flight planning

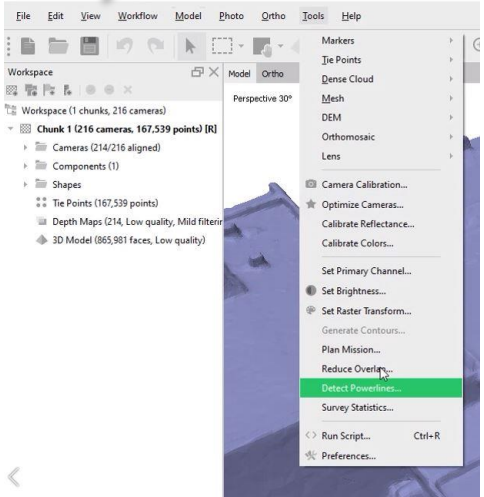
3. The construction of the mesh (3D polygonal) is based on the photographs obtained in the first flight stage (5.3).

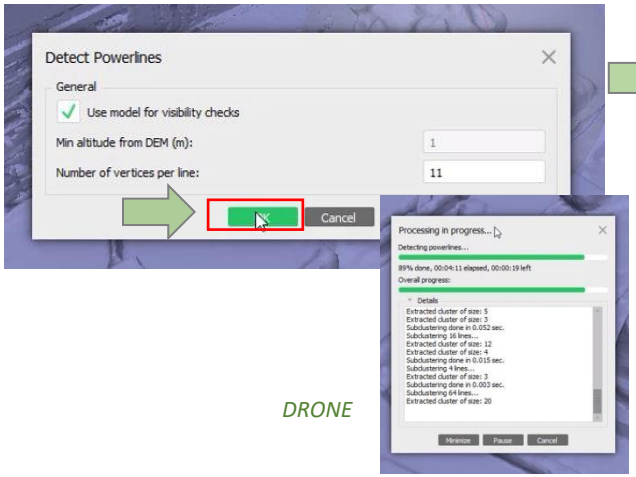


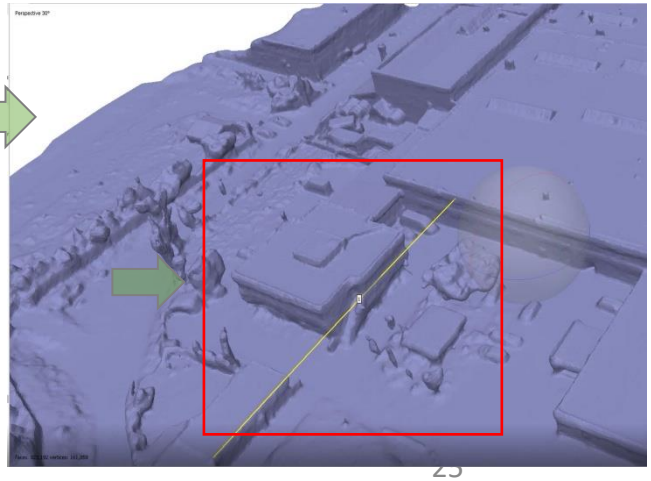




4. Automatic detection of power lines





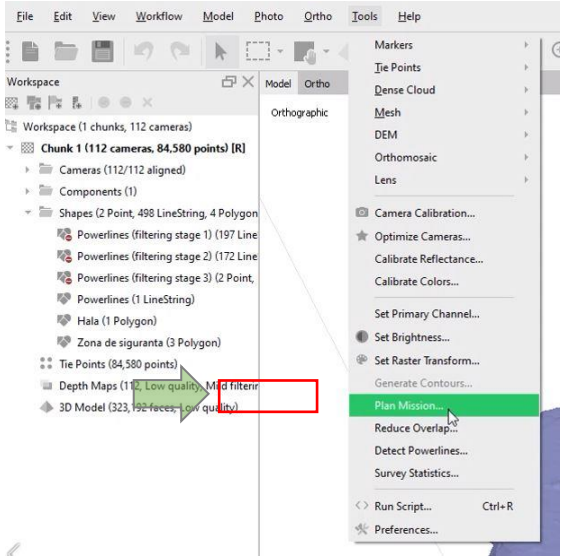


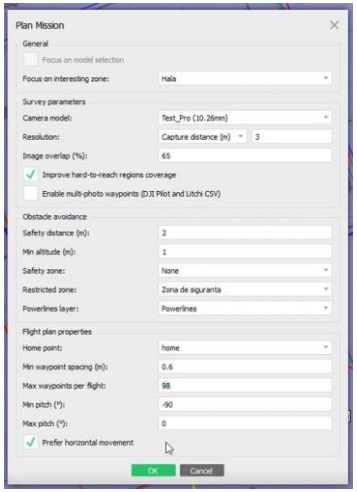
DRONE

5.4. Applications for optimal flight planning

5. Definition of the flight plan (point of interest, safety zone, power lines, landing point)

6. Planning flight missions

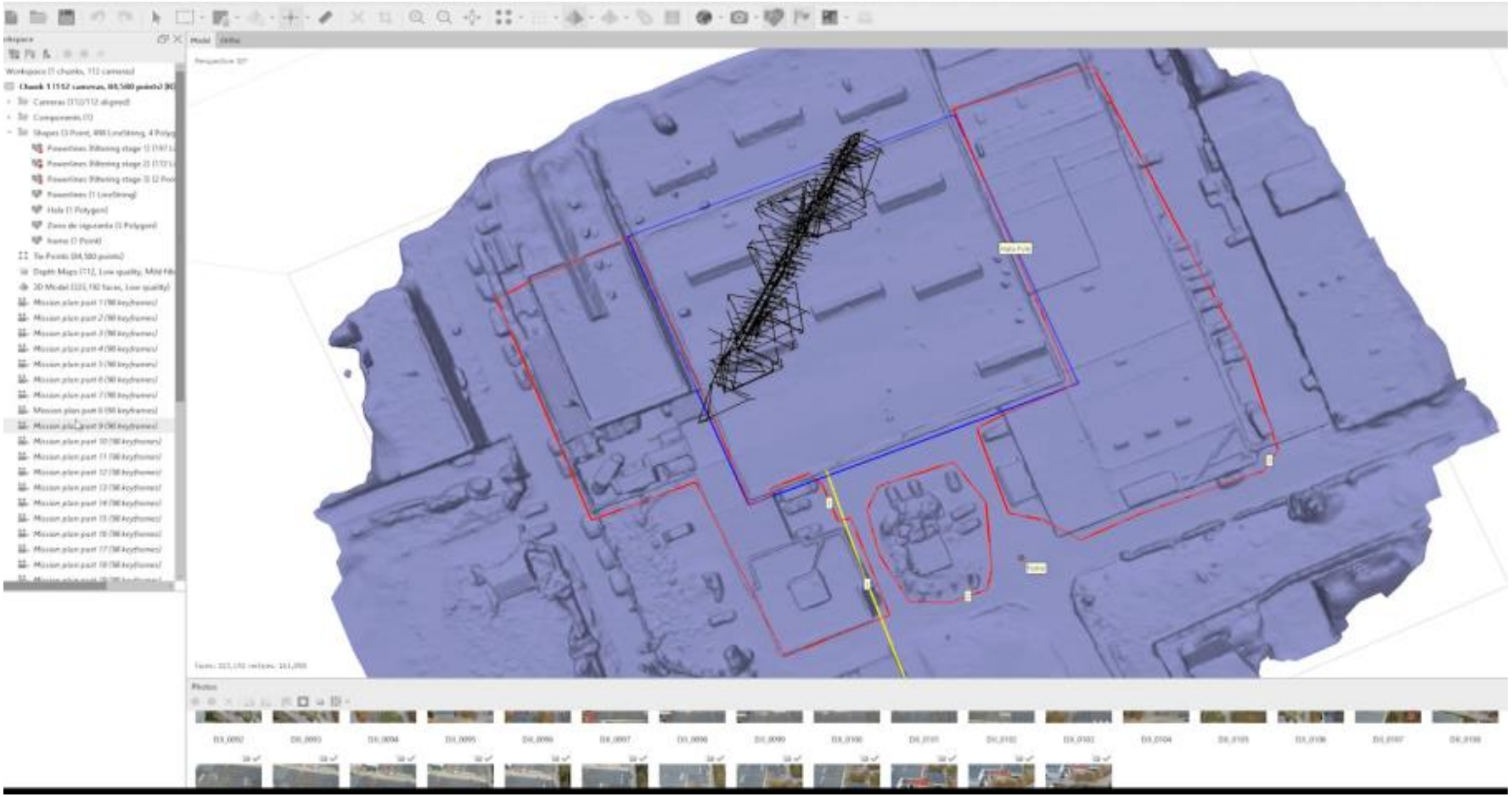




DRONE

5.4. Applications for optimal flight planning

6. Planning flight missions (video)

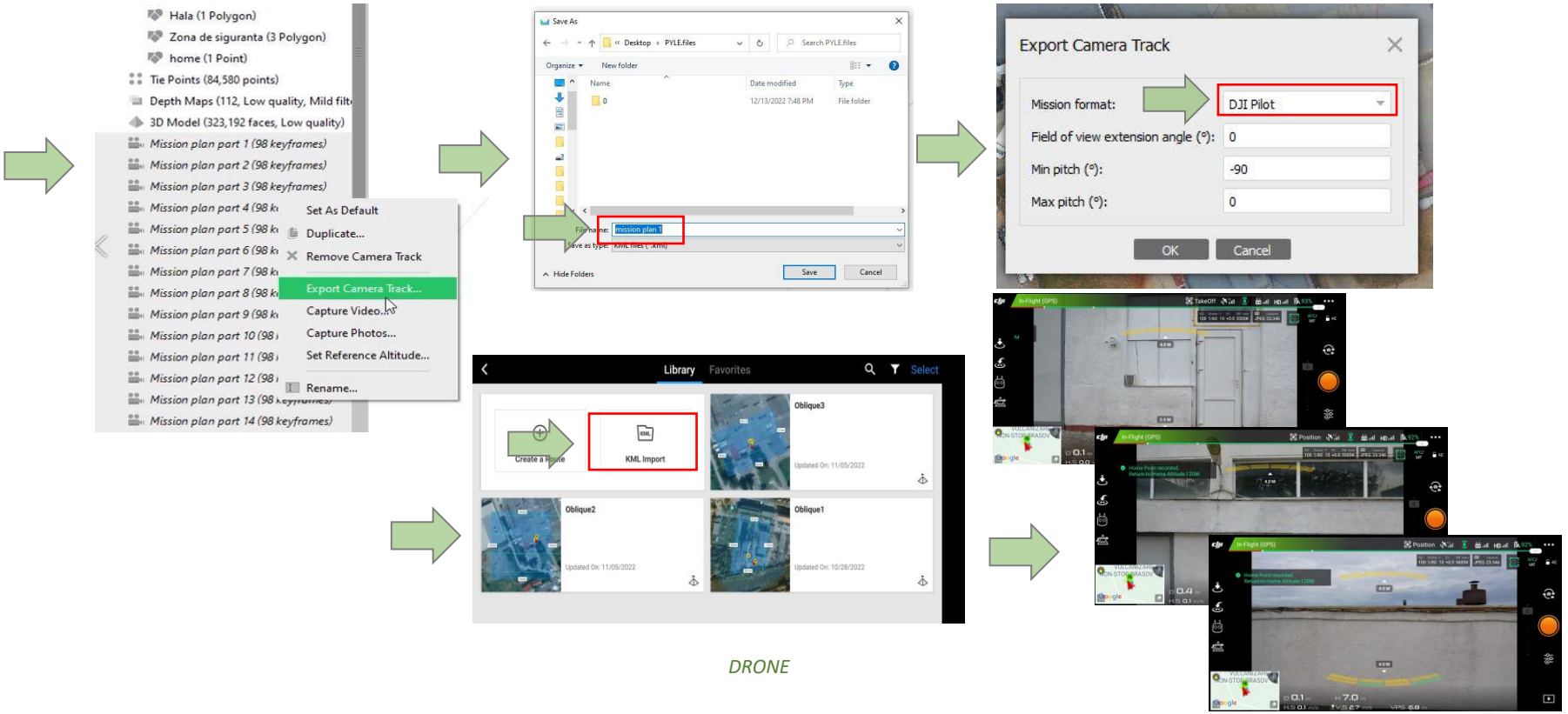


5.5. Optimal flight planning

Thumbnails are imported into the drone control application and taken in turn to take photos.

All the while you maintain visual contact with the drone to ensure the flight is safe.

Replace the batteries when they are discharged and continue the mission from where they left off.



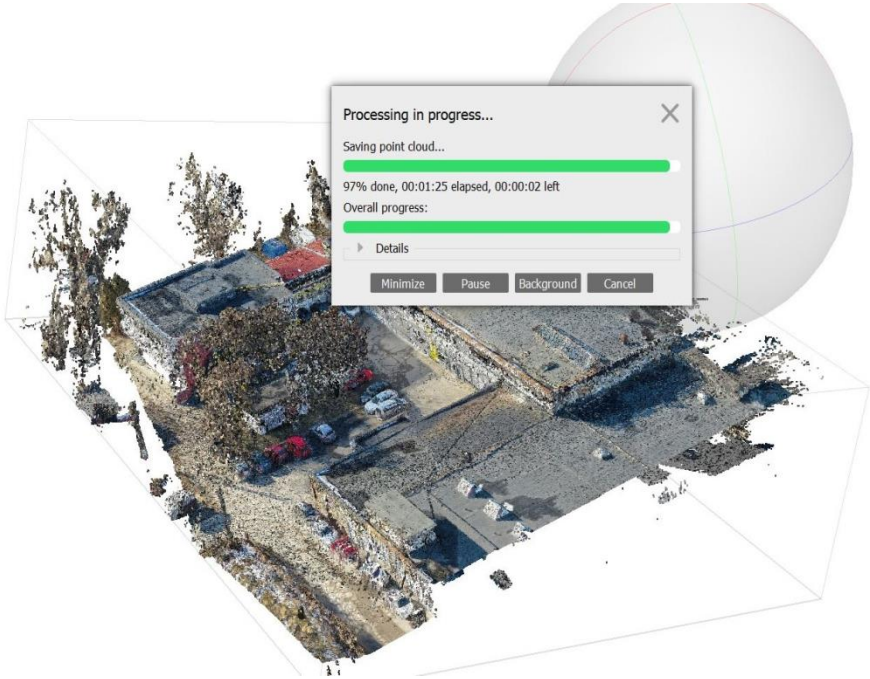
DRONE

5. Practical application

5.6. Processing of the data obtained

Image processing with Metashape includes the following main steps:

- Inserting images into the Metashape program
- Aligning the photos;
- Constructing the point cloud;
- Mesh construction (3D polygonal model);
- Texture generation;

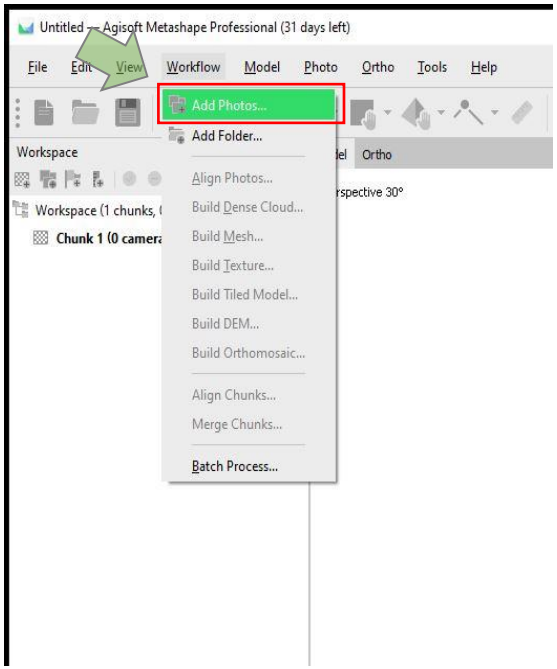


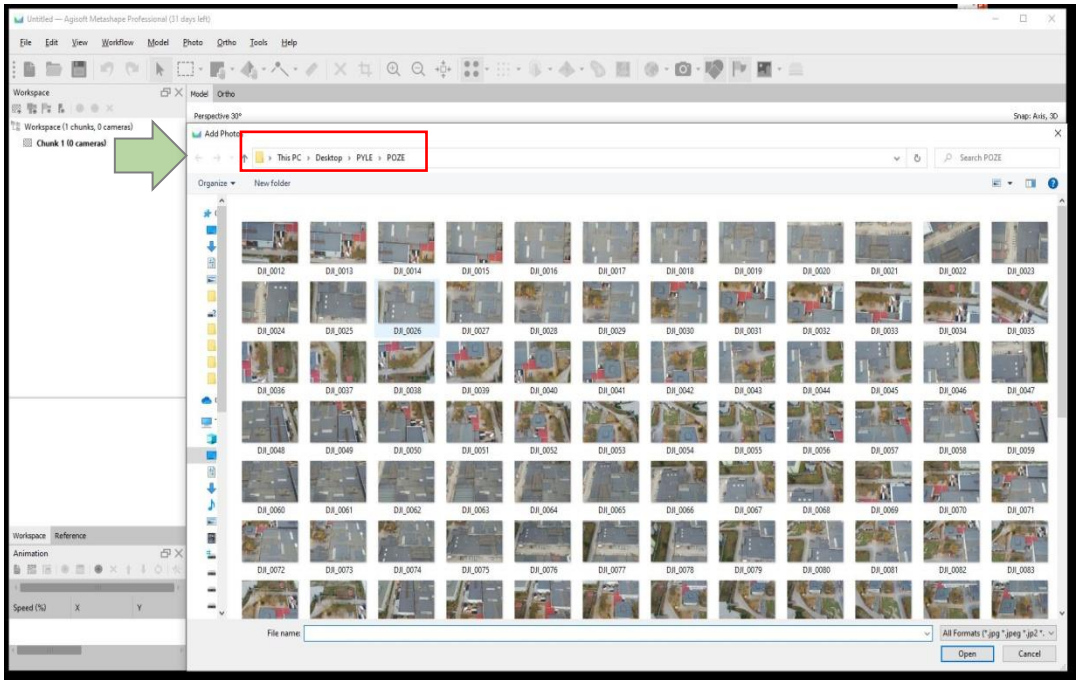
5. Practical application

5.6. Processing of the data obtained

Image processing with Metashape includes the following main steps:

- Inserting images into the Metashape program

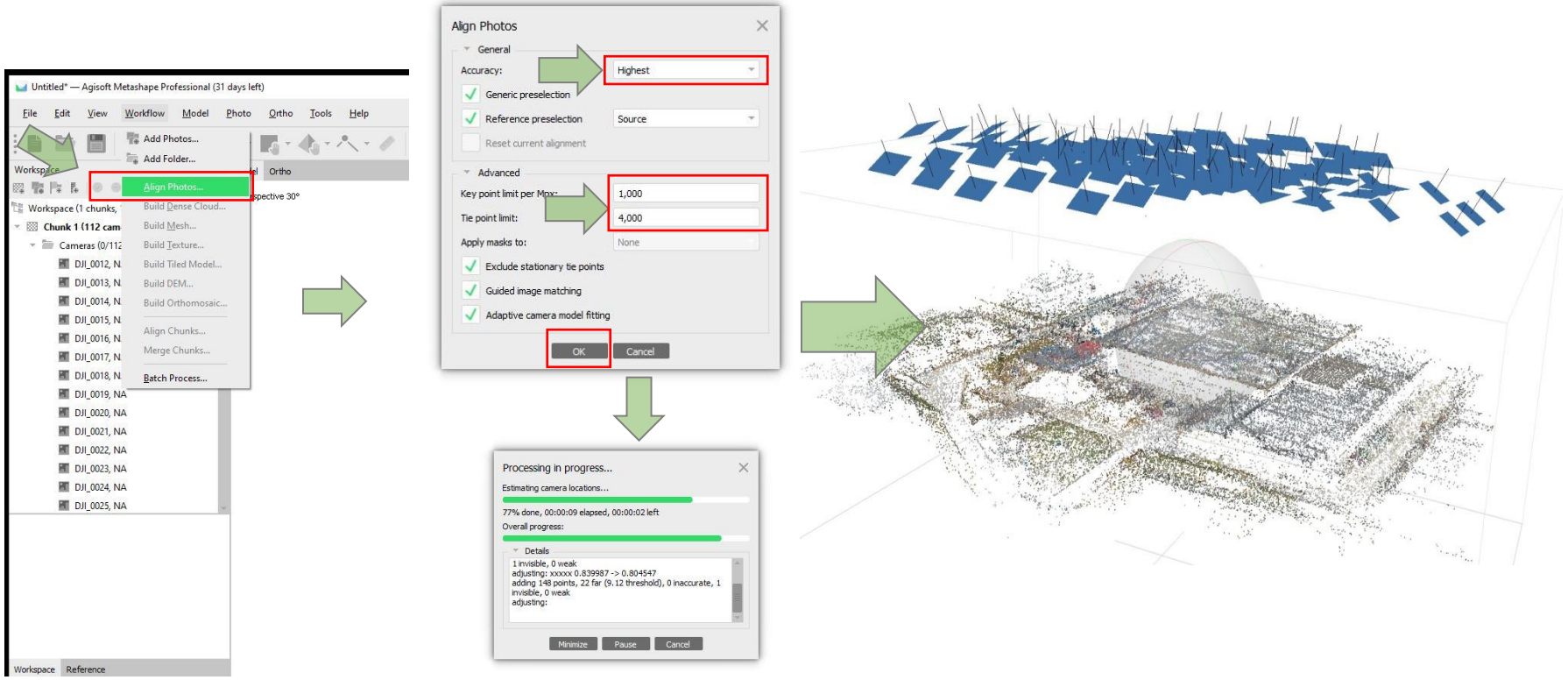




5. Practical application

5.6. Processing of the data obtained

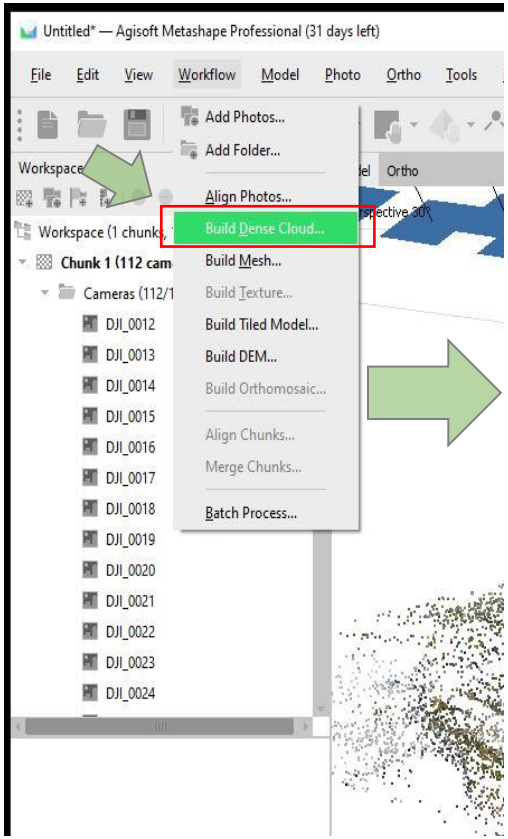
- Photo alignment;

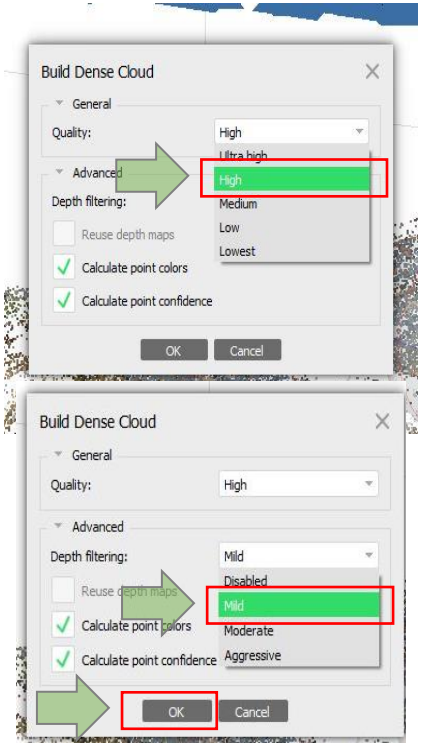


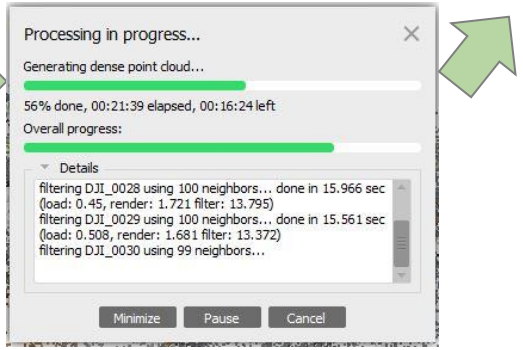
5. Practical application

5.6. Processing of the data obtained

- Point cloud construction;







Co-funded by the Erasmus+ Programme of the European Union

5. Practical application

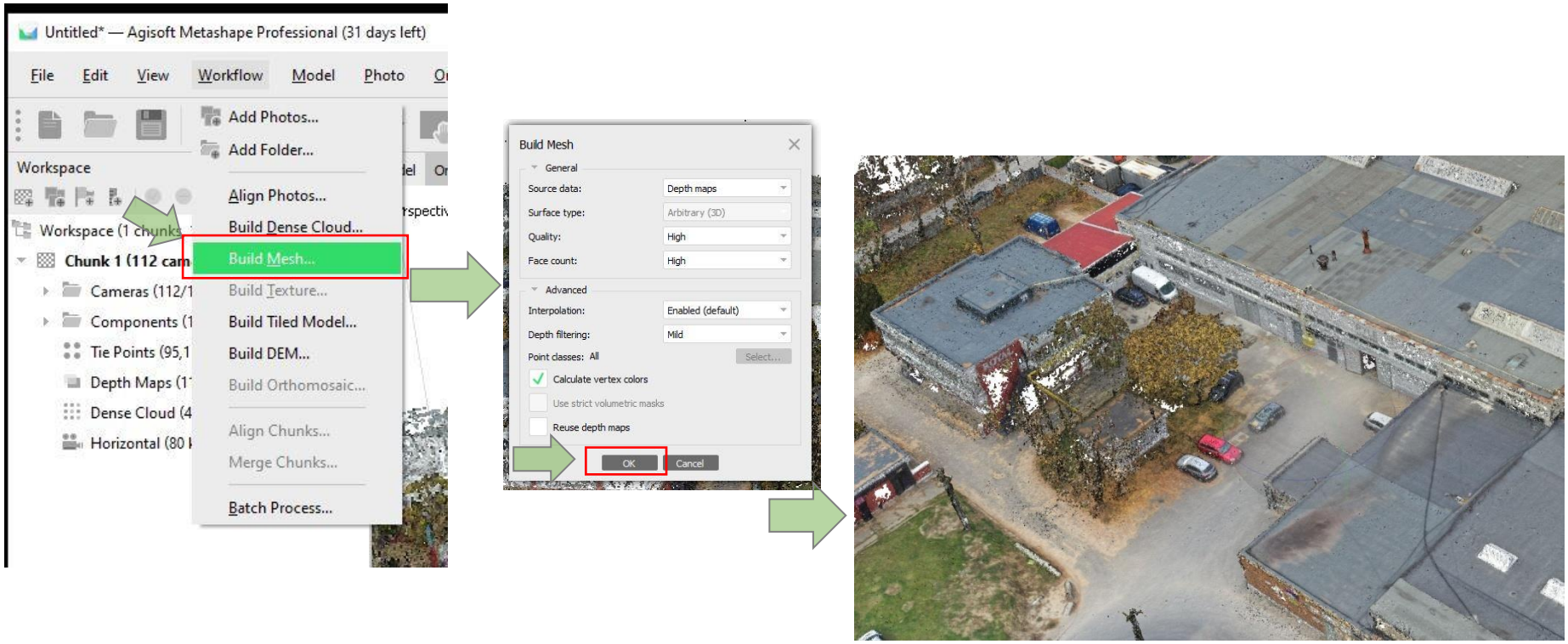
5.6. Processing of the data obtained (- video - Point cloud construction)

DRONE

5. Practical application

5.6. Processing of the data obtained

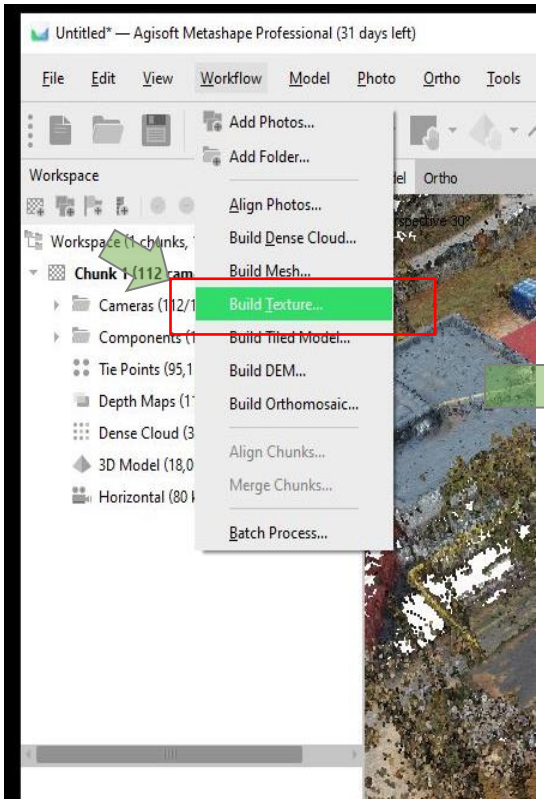
- Mesh construction (3D polygonal model);

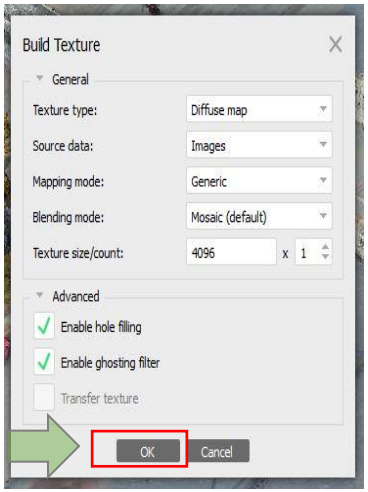


5. Practical application

5.6. Processing of the data obtained

- Texture generation;





5. Practical application

5.6. Processing of the data obtained

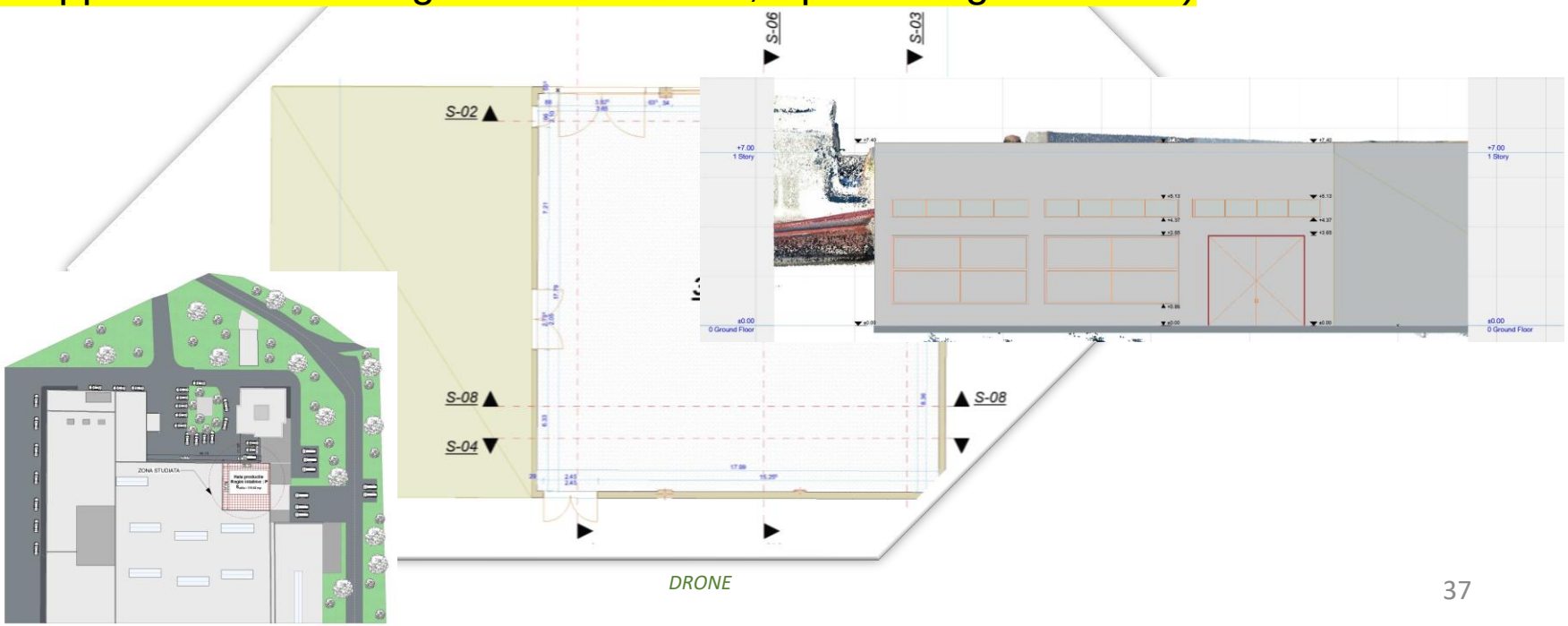
- Texture generation;(Video)

DRONE

. Practical application

5.6. Processing of the data obtained

The deliverables that can be obtained by point cloud processing are:
-D2 elevation, level plane, facades, sections, slope plane
-Verticality of pillars,
-3D model, mesh with texture.To achieve these actions, there are several software available: Arhicad, Revit, Sketchup, Autocad, Tekla. (here we can put the link to the application of colleagues from Poland, Spain fotogrammetria)



DRONE

REFERENCE

[1] https://www.agisoft.com

[2] https://drones-pro.com/wp-content/uploads/2022/06/Mavic_2_Pro_User_Manual.pdf

[3] https://www.caa.ro/ro/pages/drone

[4] https://www.cgtrader.com/3d-models/electronics/other/dji-mavic-pro-2-and-smart-controller

Co-funded by the
Erasmus+ Programme
of the European Union

ECOLOGICAL AND INNOVATIVE TECHNOLOGIES FOR RECOVERING INDUSTRIAL AREAS FROM LCA AND ENERGY EFFICIENCY POINT OF VIEW

2020-1-RO01-KA203-080223

CONTACT

www.recoverind.eu

RecoverIND

Erasmus+