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Authors of the document

Authors of the document - Representatives of beneficiaries involved in the project		
Name/Beneficiary	Position/Title within the project	Date
Francesco Russo/TopView S.r.l.	TopView PoC	08/08/2025
Lorenzo Porricelli/TopView S.r.l.	TopView Researcher	08/08/2025
Mariano Iadaresta/TopView S.r.l.	TopView Researcher	08/08/2025
Graziano Gagliarde/TopView S.r.l.	TopView Researcher	08/08/2025
Gianluca Luisi/TopView S.r.l.	TopView Researcher	08/08/2025
Alberto Mennella/TopView S.r.l.	TopView Researcher	08/08/2025

Reviewers of the document

Appointed reviewers of the document - Representatives of beneficiaries involved in the project		
Name/Beneficiary	Position/Title within the project	Date
Théo Delferriere/CIRCOE	CIRCOE PoC	05/08/2025
Pedro Merino-Laso/ENSM	ENSM PoC	19/08/2025

Responsible for the document approval

List of people approving the document - Representatives of beneficiaries involved in the project		
Name/Beneficiary	Position/Title within the project	Date
Marco Pasciuto/IMAT	OVERHEAT Project Manager	31/08/2025
Valentina Lasco/IMAT	IMAT Researcher	31/08/2025
Vittorio Sangermano/ISSNOVA	ISSNOVA PoC	31/08/2025
Bartosz Dziugiel/ILOT	ILOT PoC	31/08/2025
Fabienne Vallee/ Port of Brest	Port of Brest PoC	31/08/2025
Théo Delferriere/CIRCOE	CIRCOE PoC	31/08/2025
Diego Cioce/AKKODIS	AKKODIS PoC	31/08/2025
Pedro Merino-Laso/ENSM	ENSM PoC	31/08/2025
Gunnar Tietze/SeaTopic	Seatopic PoC	31/08/2025
Massimo Capozza/Peopletrust	PeopleTrust PoC	31/08/2025
Simone Panfiglio/Caronte	Caronte PoC	31/08/2025

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ABSTRACT

This document constitutes Deliverable D4.2 – User Manual of the UAS Recharging Station Software, developed within the OVERHEAT project.

The manual is structured into three main sections. The first section outlines the design and specification of the mission planning software, detailing its operation from a remote host and providing an overview of the Software Interface specification (API) for integration with the OVERHEAT Control Room. The second section describes the artificial intelligence algorithm used for container detection and the identification of thermal anomalies, including the mechanism for triggering alerts to the Control Room. The third section covers flight procedures, presenting checklists for automated operations, manual control, and emergency procedures.

Please note that this document does not address the hardware aspects of the drone or its recharging station, which are instead covered in Deliverable D4.1 – User Manual of the UAS Recharging Station.

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ACRONYMS

ALT – Altitude

API – Application Programming Interface

ASL – Above Sea Level

C2 – Command and Control

GNSS – Global Navigation Satellite System

GSD – Ground Sample Distance

HTTPS – HyperText Transfer Protocol Secure

ID – Identifier

IOT – Internet of Things

IP – Ingress Protection

MQTT – Message Queuing Telemetry Transport

RTCM – Radio Technical Commission for Maritime

RTH – Return to Home

RTK – Real-Time Kinematics

UAS – Unmanned Aircraft System

INTRODUCTION

The OVERHEAT autonomous drone is an aerial system that integrates high-end industrial solutions with customized designs tailored specifically for maritime operations. The system is designed to ensure efficient and effective fire detection and firefighting support, both in port environments and on board the vessels.

The figure below shows the vessel segment architecture related to the connection between the operations on the vessel and ashore. In Figure 0-1, the OVERHEAT drone is highlighted in red.

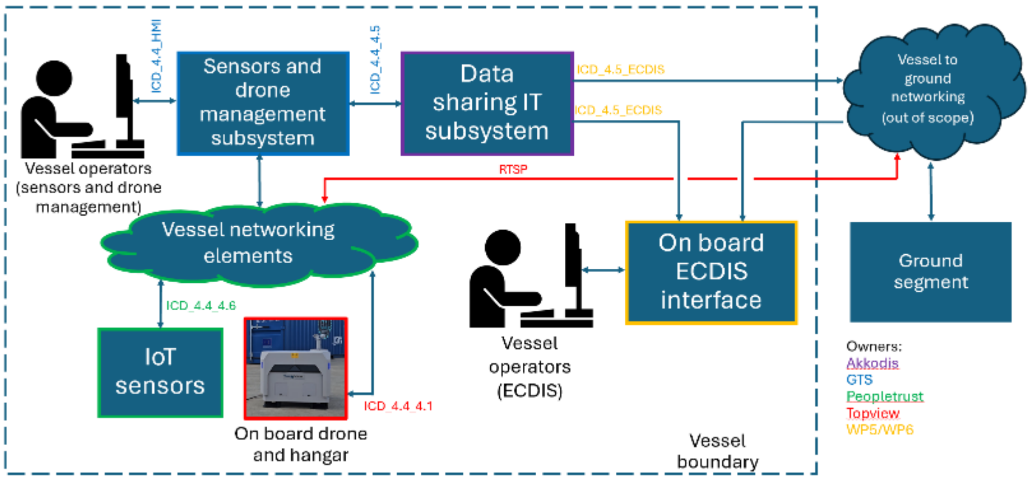


Figure 0-1 Vessel segment architecture

The Figure 0-2 shows the ground segment architecture. The OVERHEAT drone is highlighted in red.

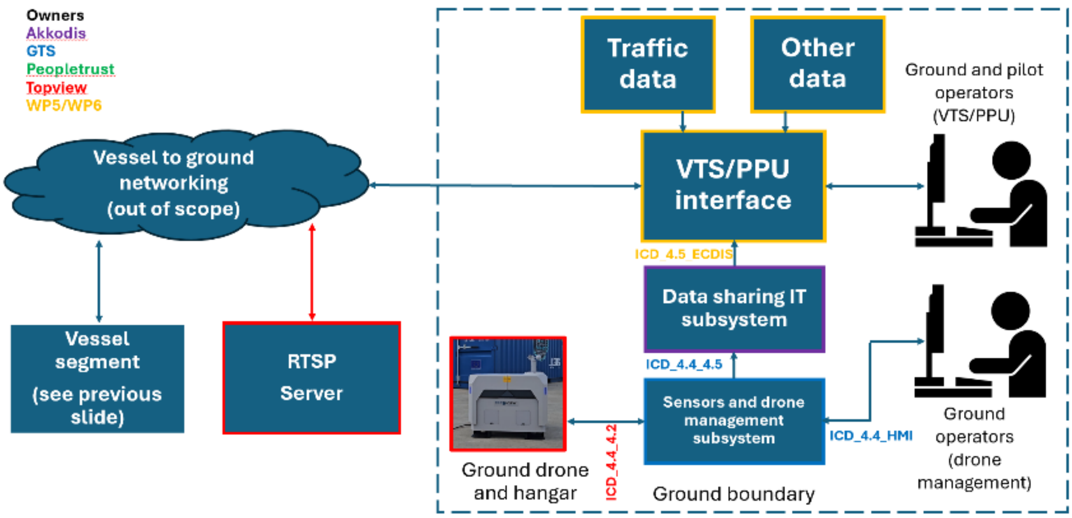


Figure 0-2 Ground segment architecture

The core of the system is the DJI Hangar 2: a high-performance, automated hangar that features a lightweight and compact design. This advanced hangaring station is engineered for rapid deployment, allowing two operators to carry and install it with ease. Its integrated body structure simplifies setup, reducing installation time and ensuring a hassle-free experience.

The drone itself, the DJI MATRICE™ 3TD, is a state of the art in autonomous aerial technology. This sophisticated aircraft boasts a six-directional vision system, providing comprehensive obstacle detection for enhanced flight safety. Additionally, its infrared sensing capabilities enable precise environmental awareness, making it well-suited for complex missions. The RTK (Real-Time Kinematics) system ensures highly accurate positioning, crucial for precision-based operations. With an IP54 protection level, the drone is resilient against dust and water, enabling reliable performance in various conditions.

Adding to its versatility, the vessel version of the system includes satellite-based internet connectivity via Starlink for Maritime. This ensures uninterrupted communication and seamless data transmission, allowing users to operate the drone remotely from virtually anywhere. With Starlink's reliable, high-speed internet, operators can conduct real-time flight task planning, remote aircraft controls, live site monitoring, and debugging, enabling efficient mission execution even in remote oceanic regions.

1. MISSION PLANNING SOFTWARE OVERVIEW

The Overheat mission planning software is a customized version of DJI FlightHub 2, offering users an advanced, cloud-based environment purpose-built for the dynamic needs of maritime drone operations. This web platform is engineered to streamline every aspect of autonomous aerial task management, providing powerful tools for planning, coordination, and oversight.

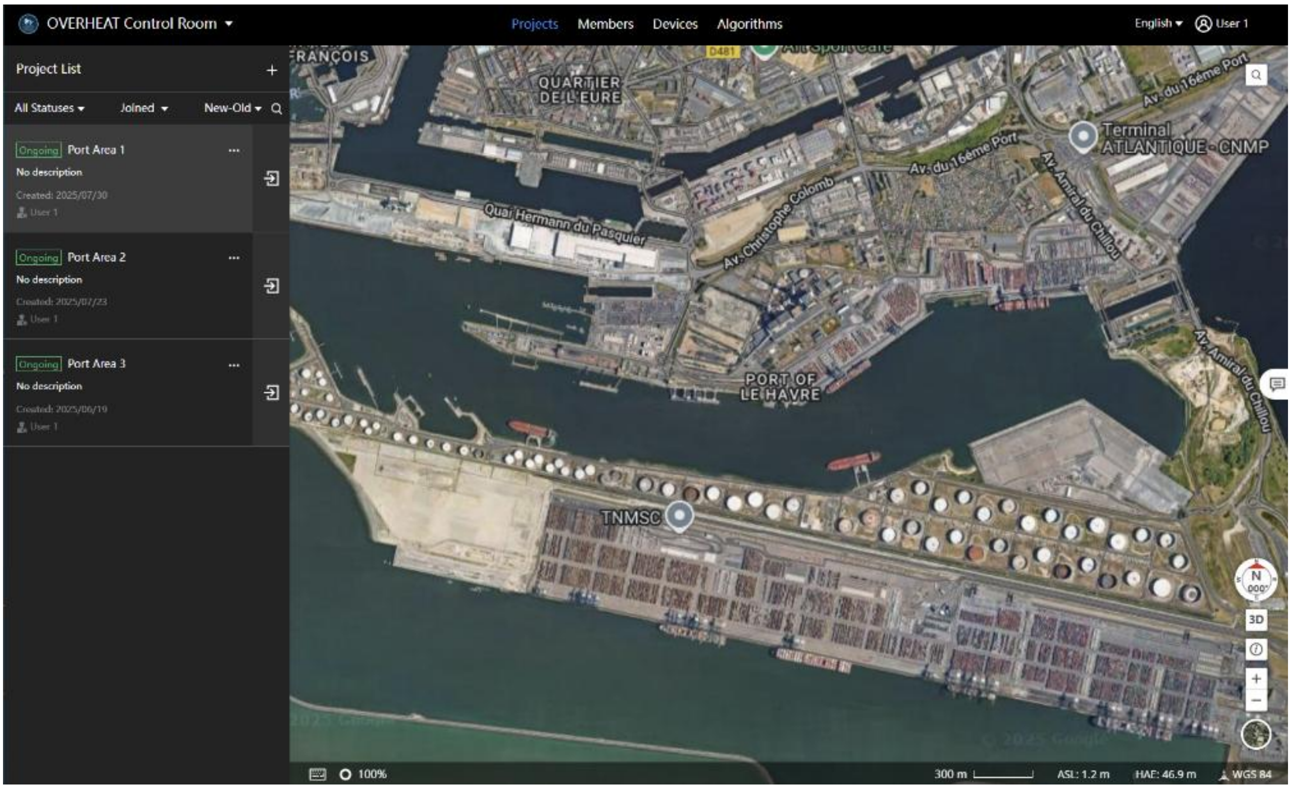


Figure 1-1 Home screen of OVERHEAT's drone mission planning software

By leveraging this software, operators gain access to a suite of functionalities that empower them to design precise flight routes, formulate comprehensive mission plans, and maintain a detailed repository of models and multimedia assets. In addition, the platform allows for seamless, real-time monitoring of all ongoing flight activities, ensuring that operators have immediate insight into mission progress and safety status at any given moment.

The Overheat mission planning software provides an interface and features designed to facilitate the management of drone operations. It supports situational awareness and operational efficiency for both routine and complex maritime missions.

The table below summarizes the main features of the platform.

Feature	**Description**
Organization overview	Displays team, device, and flight task information of the organization.
Map Photos	Users can manage all the photos that are overlaid on the map.
Data Synchronization	When the flight areas are updated, the data will be automatically synchronized to the idle hangar and aircraft.
Flight Route Library	Users can import or create flight routes, as well as edit flight route settings and waypoint actions in Flight Route Library. Users can also enter the FPV view to edit waypoints to achieve more accurate flight route planning.
Task Plan Library	Users can select the flight route and hangar and create task plans in Task Plan Library based on their actual needs. The aircraft will take off automatically according to the preset Plan Timer.
Media Files	Users can view and manage the uploaded media files. The media files (images and videos) can be automatically uploaded to the hangar after each flight task. The aircraft will automatically delete the file after it is uploaded to the hangar. The hangar will upload the received media files to the mission planning software. The hangar will automatically delete the file after it is uploaded to the mission planning software.

Table 1-1 Main features of OVERHEAT's mission planning software

1.1 Hangar status information

Users can access real-time status information of the hangar as shown in Figure 1-2.

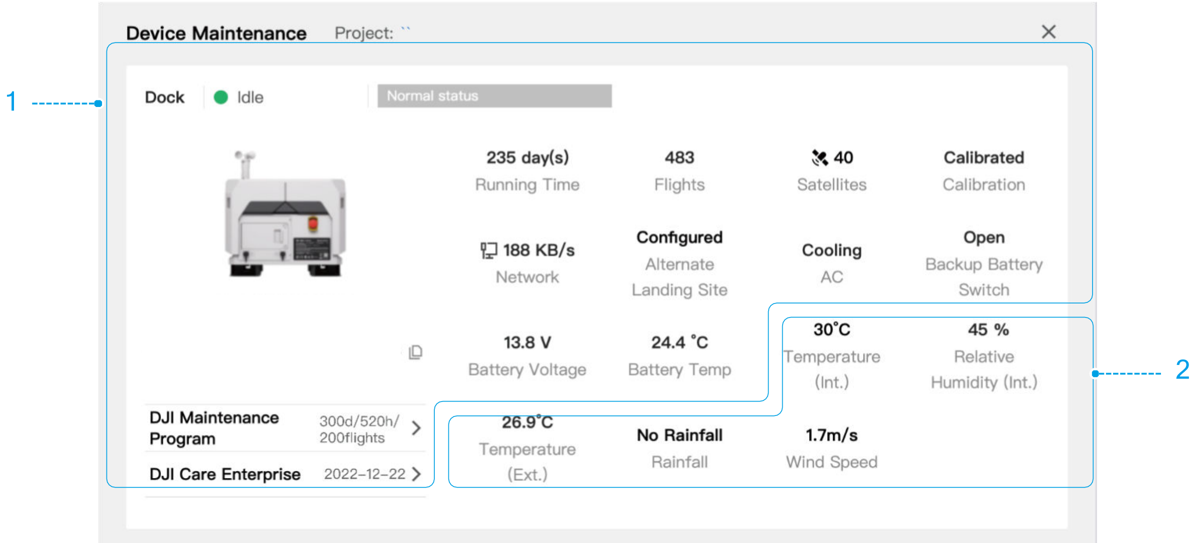


Figure 1-2 Hangar status information

	Category	**Information Available**
1	Hangar Information	hangar name, type, firmware version, SN, maintenance program and other status information
2	Hangar Environment Information	hangar temperature, rainfall, real-time wind speed, other environmental information

Table 1-2 Information available in the hangar's status information

1.2 Drone status information

Users can access real-time status information of the drone as shown in Figure 1-3.

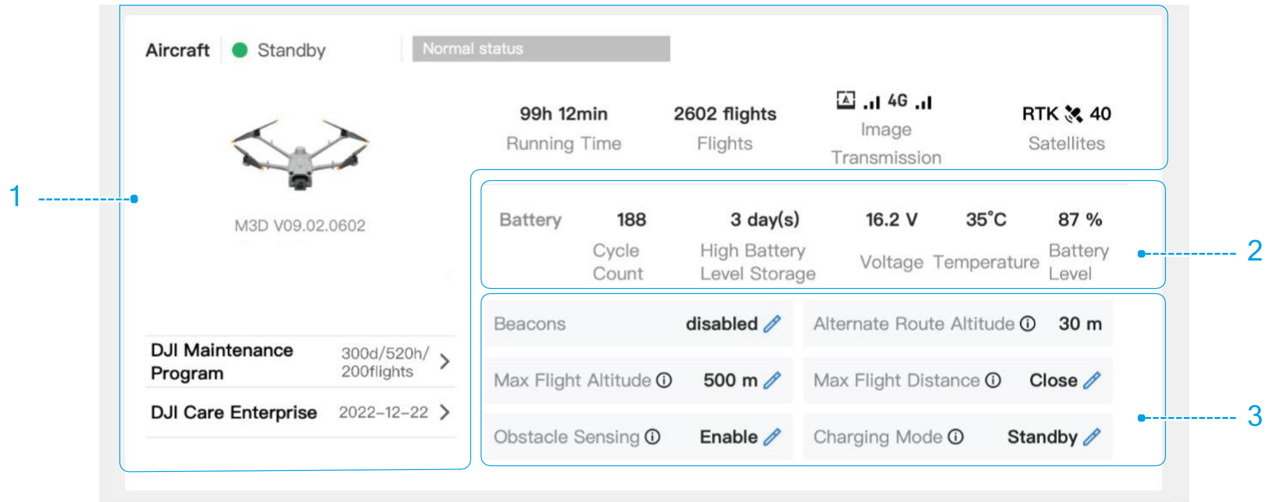


Figure 1-3 Drone status information

N	Category	Details
1	Aircraft Information	Users can view the aircraft name, type, firmware version, SN, maintenance program and other aircraft information.
2	Battery Information	Users can view the battery cycles, battery voltage, battery temperature, and battery level.
3	Aircraft Settings	Users can modify the beacon status, alternate route altitude, maximum flight altitude and distance, obstacle sensing status, and charging mode. Click to view the detailed descriptions for the settings.

Table 1-3 Information available in the Drone's status information

1.3 Vessel version-specific mission planning feature

A tailored mission planning feature has been developed to support vessel-based autonomous UAS operations.

Specifically tailored for maritime environments, this version of the software aims to integrate with a wide array of onboard IoT sensors and the drone management subsystem.

This integration empowers the vessel version of the UAS to respond dynamically to real-time alerts generated by IoT sensors strategically installed on containers. For example, when a sensor detects abnormal heat signatures or the presence of fire within a container (as detailed in section 2), the system can transmit this critical information directly to the drone management platform. In response, the drone can be automatically dispatched to the affected area, enabling rapid visual assessment and documentation of the incident.

This API acts as a robust developer interface, facilitating bidirectional communication between cloud-based control platforms and the drone or its hangar infrastructure. By supporting standard protocols such as MQTT, HTTPS, and WebSocket, this interface allows for secure and reliable exchange of commands, telemetry data, and media files.

The table below summarizes the main features of the API developed:

Feature	**Description**
Device Monitoring	Provide the current status of the hangar and drone, including battery level, temperature, wind conditions, and humidity.
Flight Management	Upload and execute autonomous flight routes
Live Flight Controls	Real-time control of drone movement, gimbal, and payload
Media Management	Syncs photos, videos, and RTCM data to cloud storage
Emergency Commands	Supports emergency landing, forced stop, and drone emergency stop

Table 1-4 Dedicated API features for OVERHEAT

The complete interface with API is described in ICD 4.4_4.1 for vessel segment and ICD 4.4_4.2 for ground segment

2. CONTAINERS’ THERMAL ANOMALIES DETECTION

This section outlines the artificial intelligence algorithms used for container detection and identification of thermal anomalies, including the triggering mechanism for alerting the OVERHEAT Control Room.

The following table details the automated operational procedure, describing each step from the initial IoT sensor alert through to fire detection and confirmation.

Step	Title	Description
S01	Anomaly Detection	The IoT sensor installed on the container detects an anomaly inside of it and sends the event to the cloud system
S02	Operator Notification	The OVERHEAT platform generates a real-time alert with event details (type, Containers location, timestamp).
S03	Flight Plan Selection	Operator selects a preconfigured flight plan.
S04	Mission Start	The drone autonomously activates, opens a live video streaming and flies to the Container
S05	Data Collection	The drone performs an oblique grid flight and captures thermal and visual images.
S06	Picture and parameters upload	The drone uploads in real-time the pictures acquired, and temperature parameters
S07	Thermal Anomalies detection	The algorithm processes the pictures and parameters and confirms the fire as soon the container is recognized, and the received parameter are above the predefined thresholds
S08	Media availability	Images and data are automatically synced to cloud storage and made available to the operator. The operator views the thermal images directly on the platform
S10	Mission Closure	Drone returns to Hangar for recharging; mission is archived with reports and metadata.

Table 2-1 Step for Containers’ Thermal Anomalies Detection

2.1 Algorithm description

Once the drone autonomously navigates to the designated container and then conducts an oblique grid flight pattern, the images and temperature parameters are transmitted in real-time, as they are acquired. The algorithm analyzes the received data, confirming the presence of fire when the container is detected and the measured values exceed predefined thresholds.

The Figure 2-1 illustrates the algorithm's steps for detecting both the container and the fire inside of it.

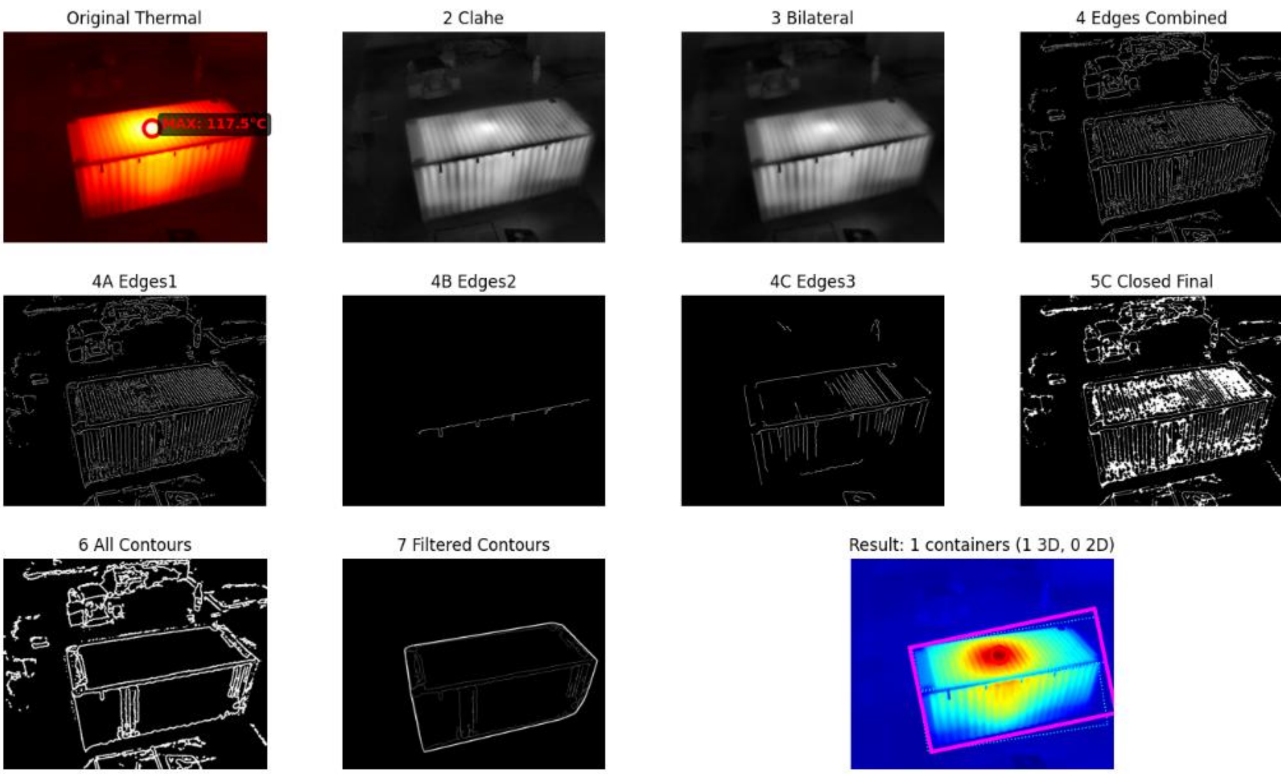


Figure 2-1 OVERHEAT's AI algorithm processing

In addition to the predefined threshold, the algorithm can analyse the exposed surfaces of the container, determining the hottest point.

These features enhance the algorithm's ability to recognise containers based on the assumption that a container heated internally will exhibit higher temperatures on all its surfaces.

Figure 2-2 illustrates an example of the algorithm's output using a picture from the topside of the container, confirming the presence of fire.

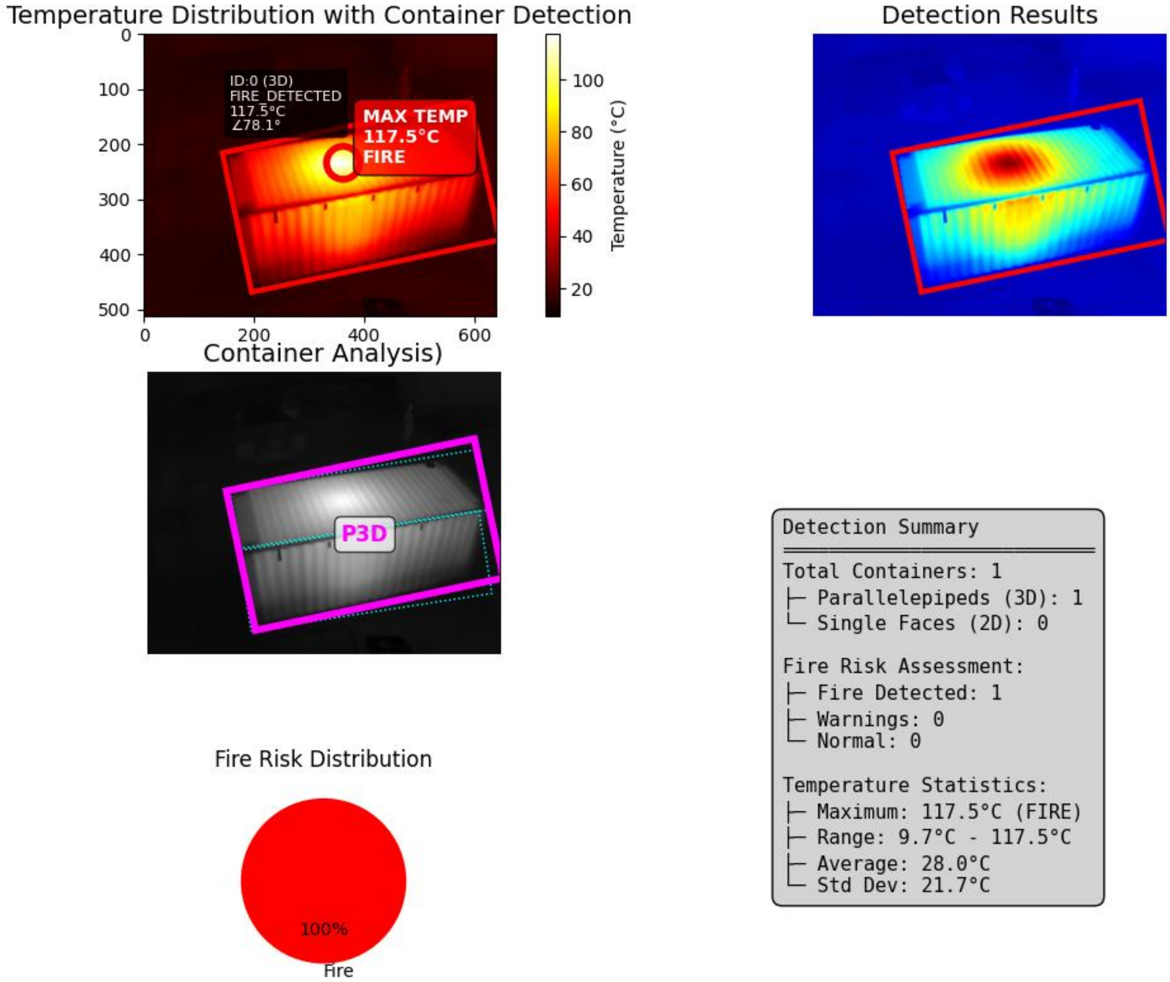


Figure 2-2 OVERHEAT's AI algorithm fire detection result using picture from the top-side

Figure 2-2 also shows the detection summary with contains the number of containers identified and analysed, the fire risk assessment which shows the result of fire detection (Yes=1, No=0) and the temperature statistics.

It must be noted that the processing described in this paragraph will be not shown to the operator which will only see the fire confirmation as the output of the detection process on the Overheat control panel.

Figure 2-3 shows an example of the algorithm's output using a picture from the side with result of "no-fire".

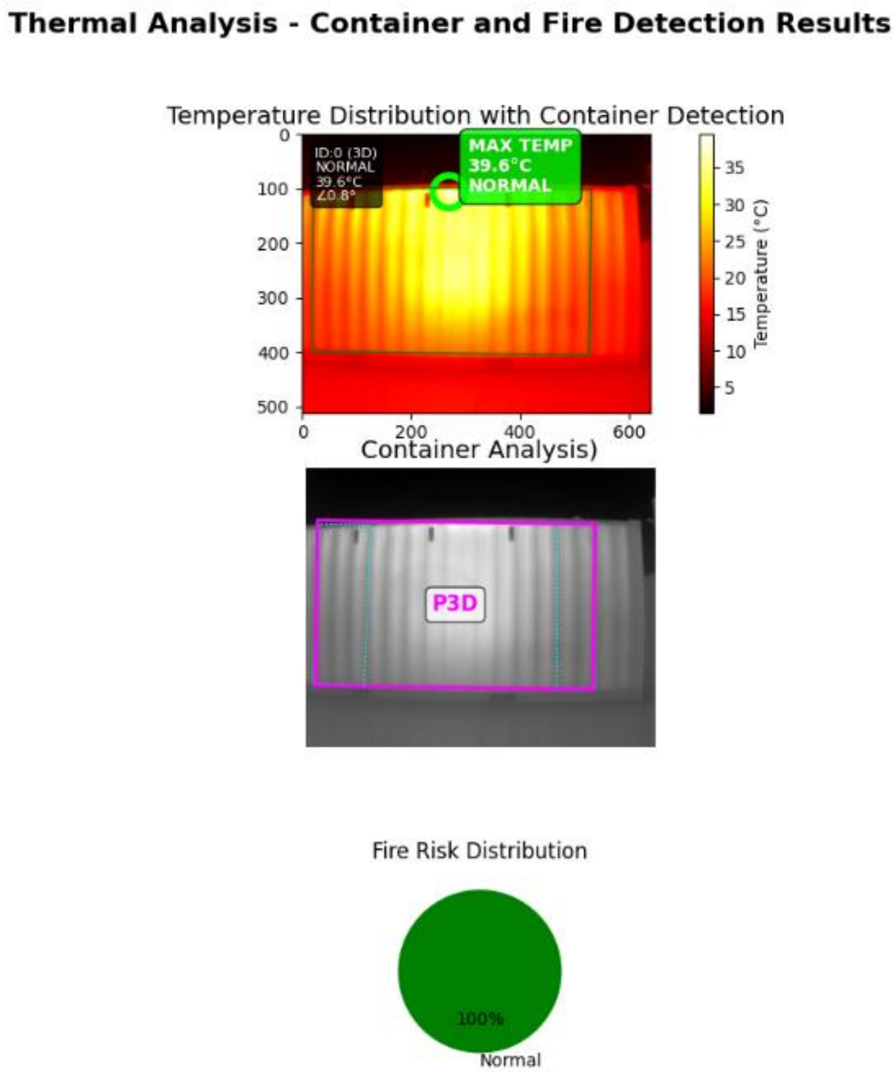


Figure 2-3 OVERHEAT's AI algorithm detection with no-fire

3 AUTOMATED FLIGHT PROCEDURES

The operating procedure in Overheat's mission planning software and the automated flight procedure of the hangar and the aircraft are slightly different between the vessel and the port version of the drone.

The automated flight procedure of vessel version must be adapted for the interfacing with IoT sensors for fire detection.

The figure 3-1 shows automated procedure of port version.

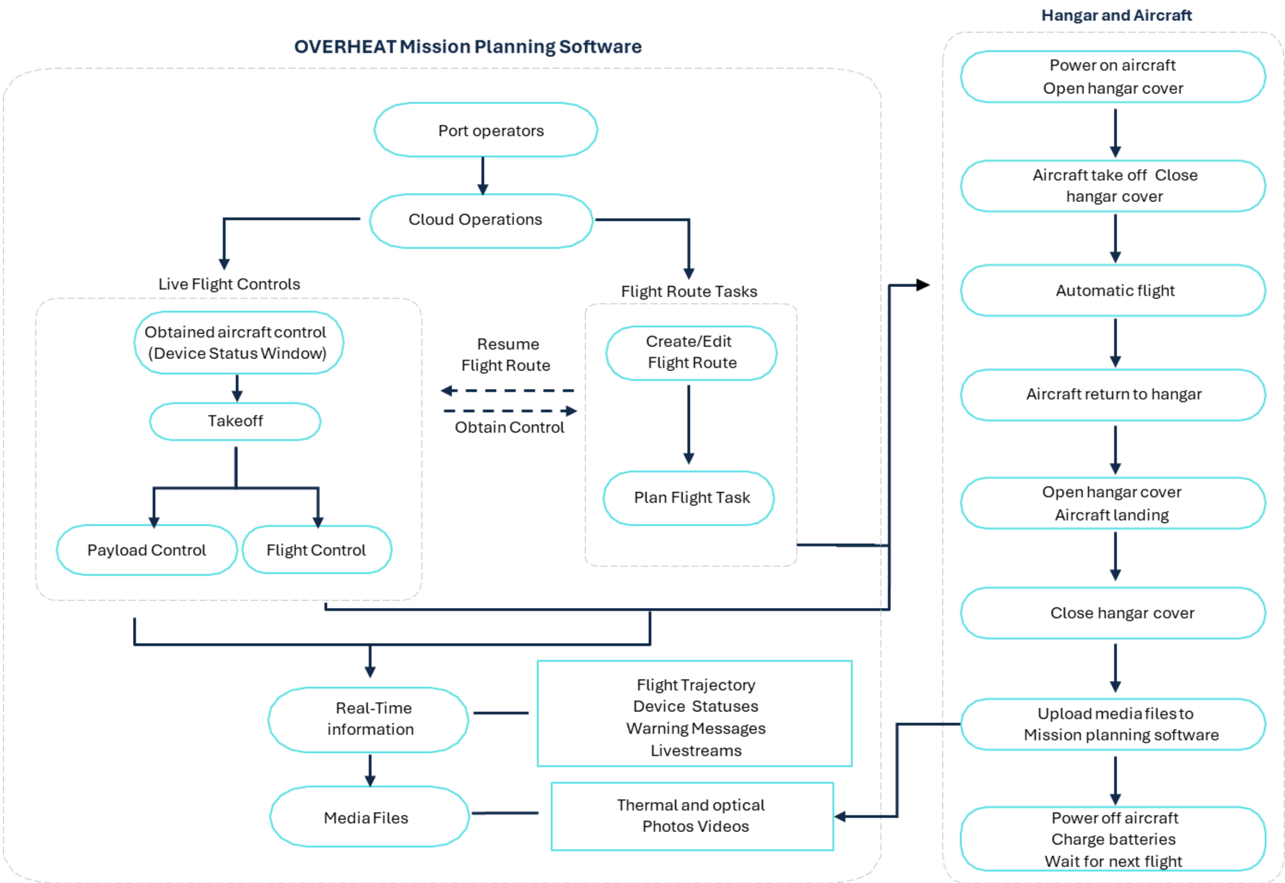


Figure 3-1 Automated flight procedure of port version

The figure 3-2 shows automated procedure of vessel version which includes the creation of the pre-defined flight path process, activated by the alert from IoT sensors and the algorithm for container's fire detection.

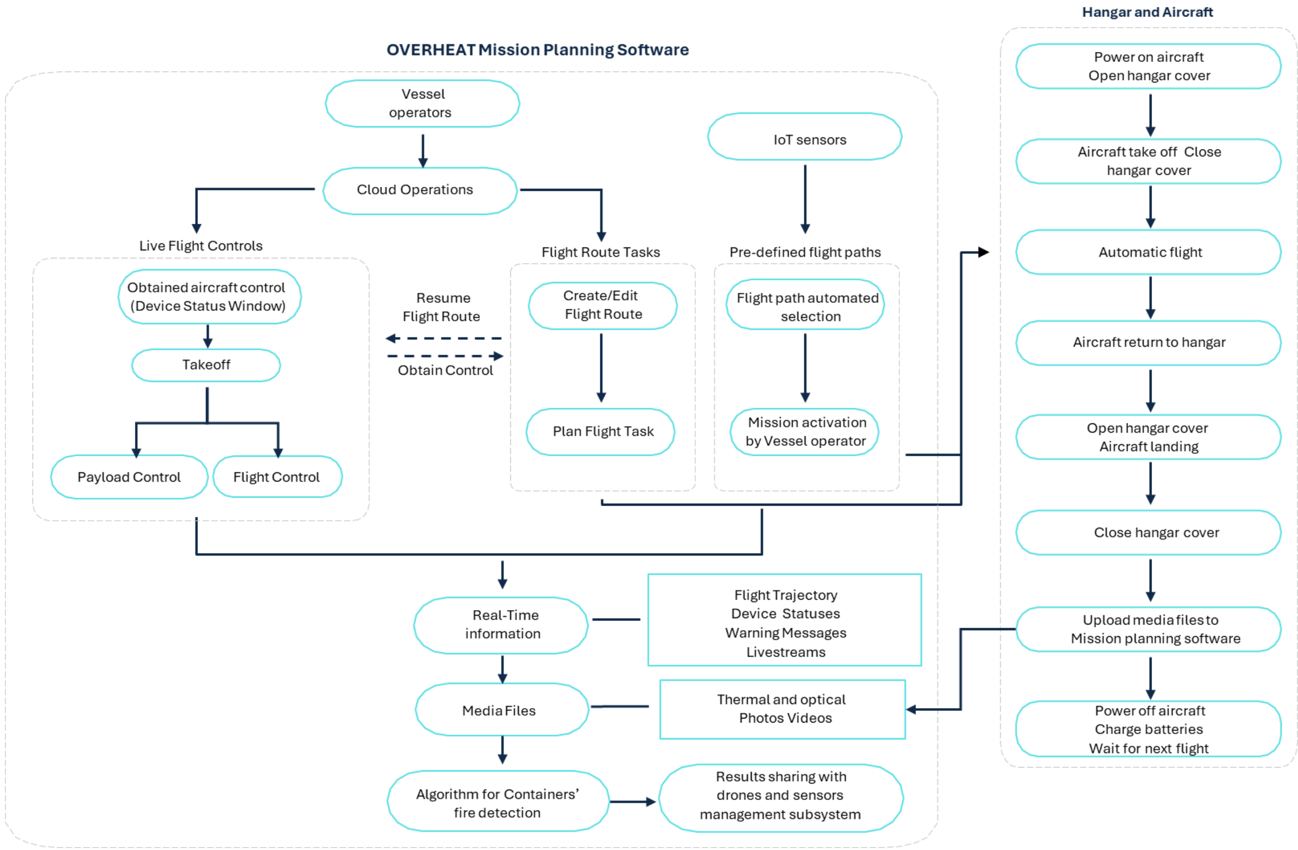


Figure 3-2 Automated flight procedure of vessel version

3.1 Plan flight routes

The user clicks "+" in the upper right corner of the flight route list and fill in the information below to create a flight route.

Step	Description
S01	**Route Type** Waypoint, area, slope, and geometric routes are supported.
S02	**Select Aircraft** Choose DJI Matrice 3TD
S03	**Select Model** Users should select the correct aircraft model before planning the task.
S04	**Route Name** The route name is required and should be within 60 characters.
S05	Click OK to create the flight route.

Table 3-1 Flight route tasks creation steps

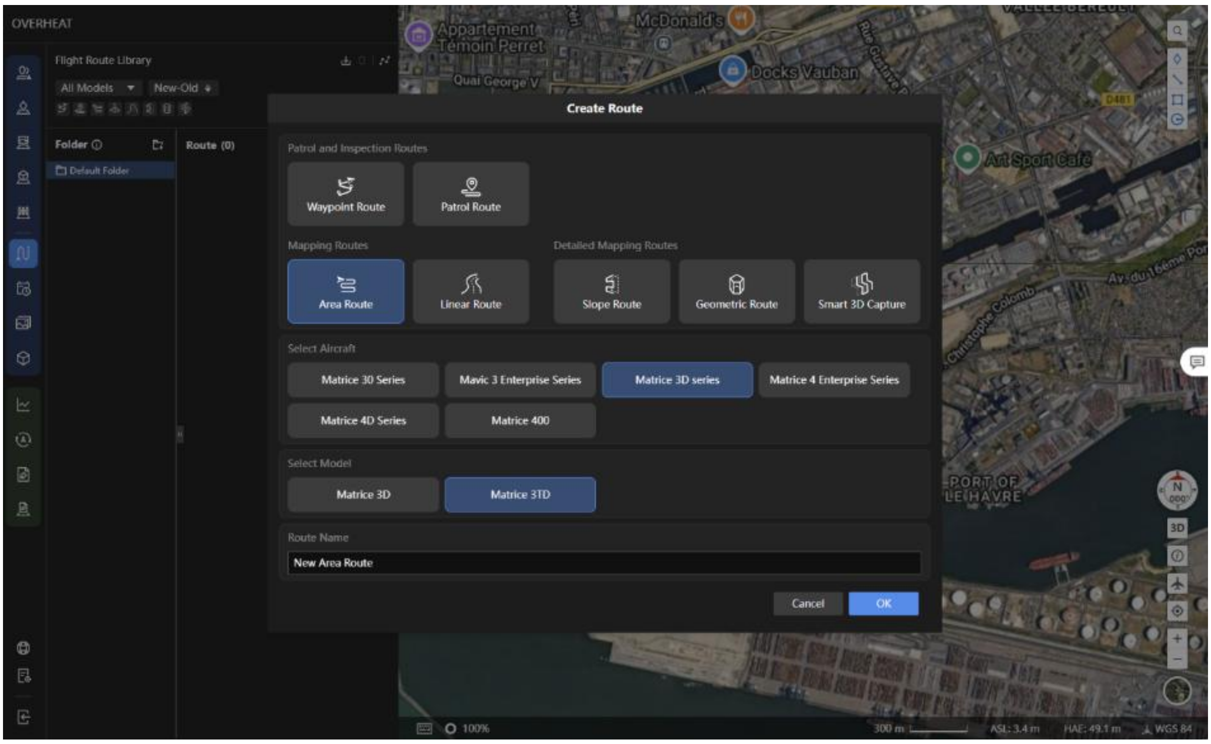


Figure 3-3 Route type selection

After creating an “Area Route” mission, the user must select the drone’s hangar as a reference take-off point and draw the effective mapping area.

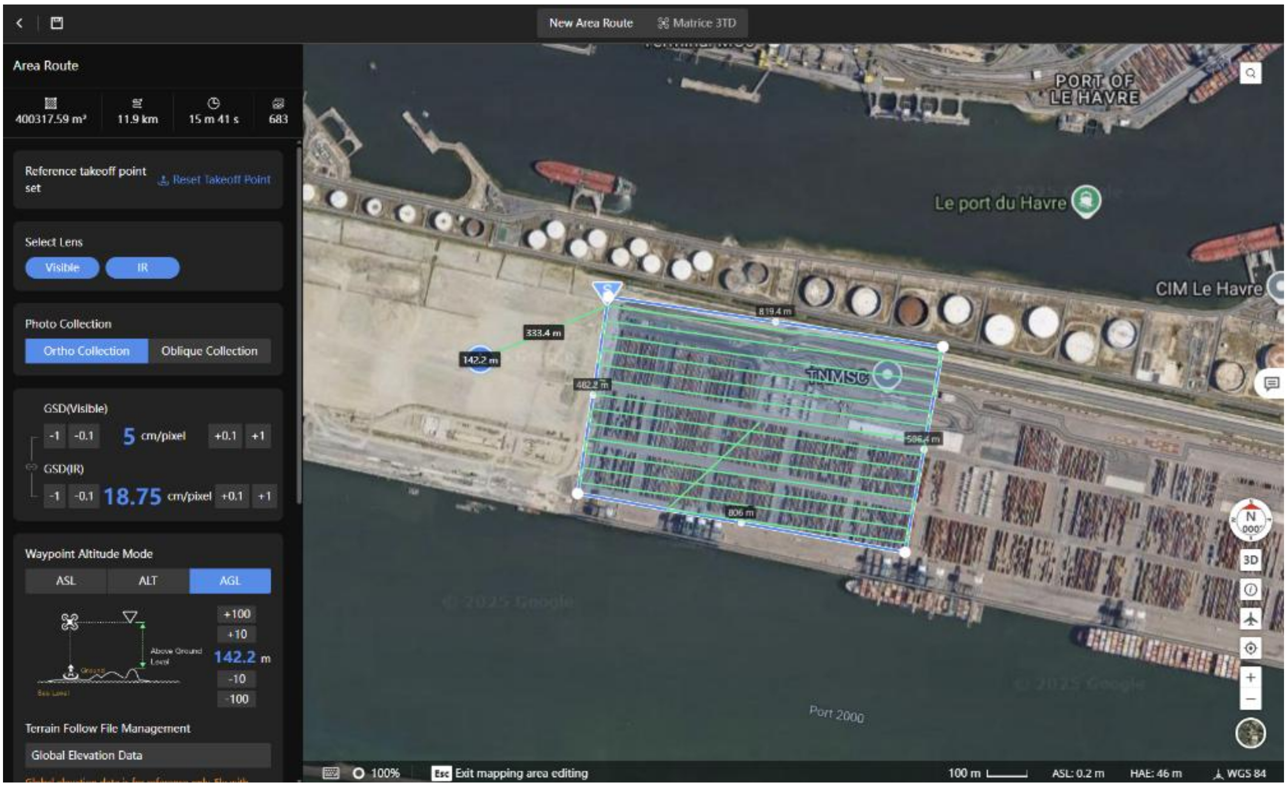


Figure 3-4 Mapping area and flight parameters

The table below summarize the key settings and features from the Area Route Editor page:

Setting / Feature	Description
Basic Information	Displays area size, route distance, estimated flight time, and photo count.
Reference Takeoff Point	Set on the map; hangar is recommended.
Lens Selection	Choose lens if aircraft supports multiple.
Collection Method	Ortho (with elevation optimization) or Oblique (for 3D models).

GSD (Ground Sample Distance)	Smaller GSD = higher resolution; affects flight altitude.
Safe Takeoff Altitude	Aircraft adjusts altitude based on waypoint height.
Altitude Mode	ASL, ALT, or AGL; uses elevation data from models or global sources.
Terrain Follow	Real-time terrain tracking using aircraft sensors; requires elevation data loaded on map.
Global Flight Speed	Recommended: 15 m/s for efficient photo collection.
Course Angle	Adjust route angle; default settings recommended.
Elevation Optimization	Captures tilt-angle photos post-route to improve elevation accuracy.
Upon Completion	Recommended: Return to Home.
Advanced Settings	Includes overlap rates, margin, photo mode, custom camera angle, route start points.
Obstacle Bypassing	Real-time bypassing of temporary obstacles; limited distance.
Flight Task Execution	Distribute via plan library; enable “Resume Flight from Breakpoint.”
Photo Mapping	After photo capture, start 2D or 3D mapping.

Table 3-2 Key settings and features from the Area Route Editor page

3.2 Device in-flight status monitor

During flight operations, the mission planning software presents real-time device information such as task status, designated flight route (indicated in green), aircraft trajectory (displayed in blue), and live video feeds. Users can access comprehensive device details within the device status window, even when managing multiple hangar tasks simultaneously.

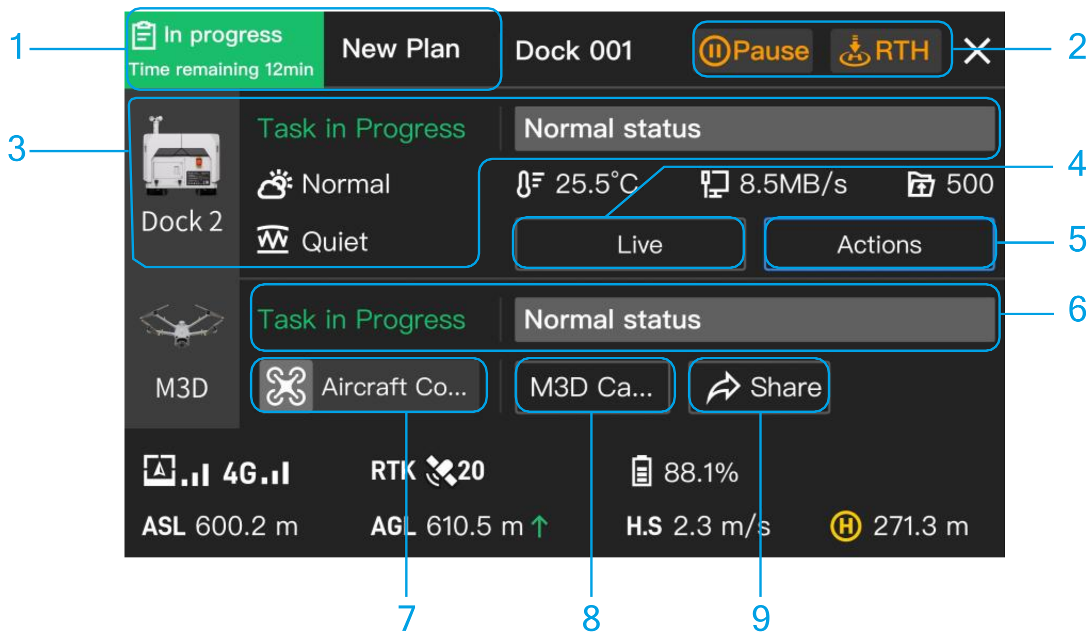


Figure 3-5 Device in-flight status monitor

N	Feature	Description
1	Flight Task Status	Indicates the flight task status of the selected hangar, includes task plan status and live flight controls status. Click to view all flight tasks of the hangar on that day.
2	Pause/RTH	Click to pause the flight task or trigger RTH. The flight task can be resumed.
3	Hangar Information	View hangar flight task status, hangar status, wind speed, ambient temperature, rainfall, internet speed, media file upload status. Warning messages appear in the system status bar. Tap to view the message.

4	Live	Click to view the hangar livestream. Switch between camera views to check inside or outside the hangar.
5	Actions	View more information about the hangar and aircraft, change aircraft settings, perform remote debugging.
6	Aircraft Information	View aircraft flight task status, device warnings, transmission signal strength, satellite connection status, battery status, aircraft altitude. If disconnected, last recorded time and coordinates are displayed. Click to center aircraft location and right-click to create a PinPoint. Info not displayed after re-connection.
7	Aircraft Control	Project administrators can remotely operate the aircraft.
8	Aircraft Livestream	Click to view aircraft livestream. Switch between camera views. Click to start recording during livestream; video stored to Media Files automatically.
9	Share	Click to share the livestream view to other users and customize the sharing settings.

Table 3-3 Information available in the Device in-flight status monitor

3.3 On-site pre-flight checklist

After adding a new flight route or changing the flight route settings, it is recommended to perform an on-site flight test to ensure normal hangar operation.

Step	Description	Checked
S01	Ensure there is no foreign matter in the battery port of the aircraft.	[ ]
S02	Confirm the battery is firmly installed, buckles are clicked into place, and battery locking arms are secure.	[ ]
S03	Verify the propellers are securely mounted, undamaged, and free from foreign matter; check motors for obstructions.	[ ]
S04	Check that all vision system lenses, gimbal cameras, infrared sensor glass, and auxiliary lights are clean and unobstructed.	[ ]
S05	Ensure the covers for the microSD card slot, USB-C assistant port (E-Port Lite), and E-Port are properly closed.	[ ]
S06	Check that the wind speed gauge rotates normally and the rainfall gauge surface is clean.	[ ]
S07	Confirm the landing pad surface is free of dirt or foreign objects.	[ ]
S08	Ensure the temperature and humidity sensor inside the hangar cover is not blocked.	[ ]
S09	Make sure the aircraft is correctly placed on the landing pad and aligned with the arrow mark; ensure no obstacles within 5m of the hangar.	[ ]
S10	Verify that the emergency stop button is released.	[ ]
S11	Adjust aircraft settings as needed using the remote controller; check obstacle braking distance, warning distance, and gimbal camera settings in DJI Pilot 2.	[ ]

Table 3-4 On-site pre-flight checklist

3.4 Mission planning software pre-flight checklist

Step	Description	Checked
S01	Ensure the hangar status is Idle, and the aircraft status is in Standby or Powering Off.	[ ]

S02	Confirm wind speed, temperature, and rainfall are within safe limits, and the hangar network is stable.	[ ]
S03	Click Live to view the hangar livestream. Verify the hangar cover surface is clear of obstacles, snow, or ice.	[ ]
S04	Click Action to check device status. Ensure hangar RTK is calibrated/converged, satellite signal is strong, device storage is sufficient.	[ ]
S05	Enable aircraft obstacle sensing and the beacon at night. Set max flight altitude, max distance, and alternate route altitude appropriately.	[ ]
S06	Ensure hangar and aircraft firmware are updated to latest version in Devices page.	[ ]
S07	Verify that an alternate landing site is set.	[ ]
S08	Check that flight route does not pass through GEO Zones and stays at least 20 m away horizontally from them.	[ ]
S09	Review takeoff point, altitude mode, and flight altitude. For nearby GEO Zones, set altitude at least 5 m below the maximum allowed in Altitude Zone.	[ ]
S10	When creating a task plan, set RTH altitude at least 5 m lower than maximum allowed in Altitude Zone.	[ ]
S11	Monitor flight altitude, speed, battery level, and other flight parameters during flight test.	[ ]
S12	If RTH or takeoff altitude is less than 15 m, note elevated flight risk and select RTK for task accuracy. Prioritize flight safety.	[ ]
S13	Divide airspace for simultaneous multi-aircraft operation to avoid mid-air collisions.	[ ]
S14	Check that Remote ID is current and operational.	[ ]

Table 3-5 Mission planning software pre-flight checklist

4 MANUAL FLIGHT PROCEDURES

The OVERHEAT's DJI M3TD is a versatile drone equipped with a powerful thermal camera, allowing users to perform thermal inspections, fire detection, and other critical tasks. When paired with the DJI Pilot software, operators can unlock advanced features for planning, monitoring, and recording thermal data. This section provides step-by-step instructions and best practices for using the DJI M3TD's thermal camera with DJI Pilot.

To fly manually the user needs the DJI RC Pro Enterprise remote controller which can be linked to the aircraft as controller B, as alternative to the hangar.

During on-site flight, the remote controller can take over control and manually control flight.

4.1 Using the manual controller

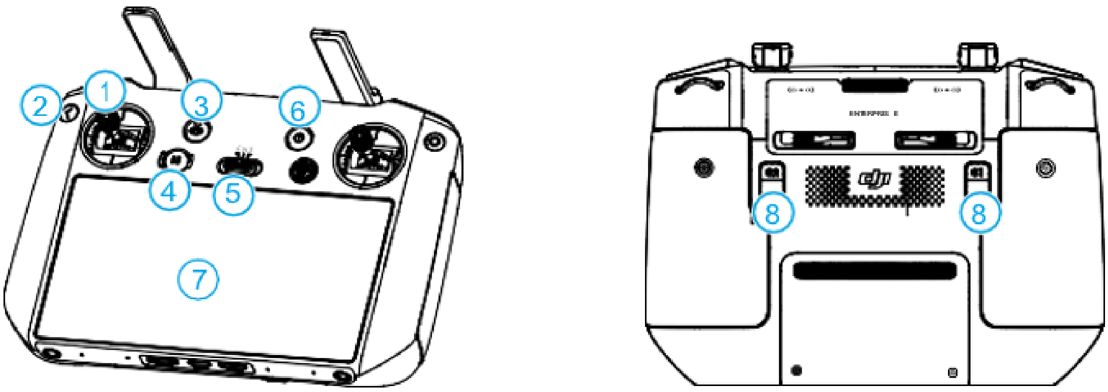


Figure 4-1 Remote controller components

No.	Component	Description
1	Control Sticks	Control the aircraft movement after gaining the aircraft control on the remote controller.
2	Back/Function Button	Press once to return to the previous screen. Press twice to return to the home screen.

3	RTH Button	Press and hold the button until the remote controller beeps to start RTH. The aircraft will fly to the last updated Home Point. Press again to cancel RTH.
4	Flight Pause Button	Press once to make the aircraft brake and hover in place (only when GNSS or vision system is available).
5	Flight Mode Switch	Flight modes include N-mode (Normal), S-mode (Sport), and F-mode (Function). F-mode can be set to A-mode (Attitude) or T-mode (Tripod) in DJI Pilot 2. DJI Matrice 3D series aircraft flies in N-mode (Normal) by default.
6	Power Button	Press once to check the current battery level. Press, then press and hold to power the remote controller on or off. When the remote controller is powered on, press once to turn the touchscreen on or off.
7	Touchscreen	Touch the screen to operate the remote controller. Note that the touchscreen is not waterproof. Operate with caution.
8	Customizable C1/C2 Buttons	C1 button is used to switch the wide-angle camera and zoom camera view by default. C2 button is used to switch the map and camera view by default.

Table 4-1 RC components description

4.2 Power on and LEDs checks

To power the remote controller on or off, press the power button once, then press and hold it for two seconds.

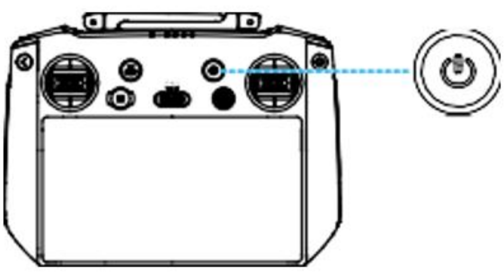


Figure 4-2 Remote controller power button

To check the current battery level, press the power button once and check the LED and the topside of the controller.

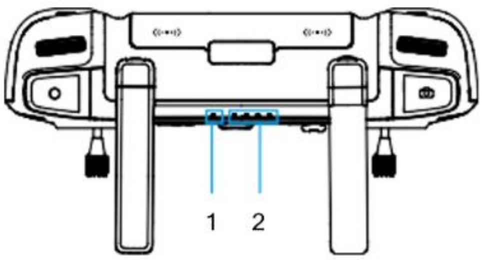


Figure 4-3 Remote controller LEDs

1. Status LED
2. Battery Level LEDs

Status LEDs states		
LED Colour	LED Colour Frequency	Description
	Solid red	Aircraft disconnected
	Blinks red	The temperature of the remote controller is too high, or the battery level of the aircraft is low
	Solid green	Connected with the aircraft
	Blinks Blue	The remote controller is linking to an aircraft
	Blinks yellow	The battery level of the remote controller is low
	Blinks Cyan	Control stick not centered

Table 4-2 RC Status LEDs

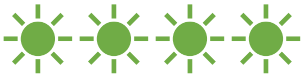
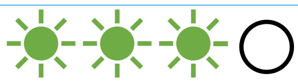
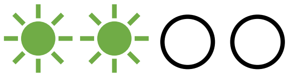
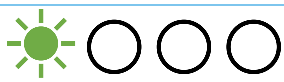
Battery LEDs	
LED Colour	Battery level
	76%-100%
	51%-75%
	26%-50%
	0%-25%

Table 4-3 RC battery levels

4.3 Take off and landing

Perform a Combination Stick Command (CSC) as shown below to start the motors.

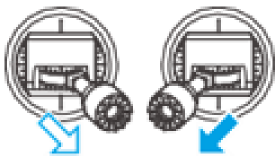


Figure 4-4 Stick combination to turn on the motors

Once the motors have started spinning, release both sticks simultaneously. Gently push the throttle stick up to take off.

Take off immediately once the motors are spinning. Otherwise, the aircraft may lose balance, drift, or even take off by itself which may risk causing damage or injury.

To land, push the throttle stick down to descend until the aircraft touches the ground. When the aircraft has landed, push the throttle stick down and hold until the motors stop.

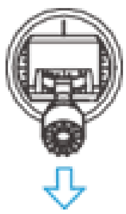


Figure 4-5 Pull down the left stick to land

4.4 Manual flight modes

The remote controller can be used to control the aircraft manually during on-site flight tests after gaining aircraft control. The control sticks can be operated in Mode 1, Mode 2, or Mode 3.

The default control stick mode of the remote controller is Mode 2.

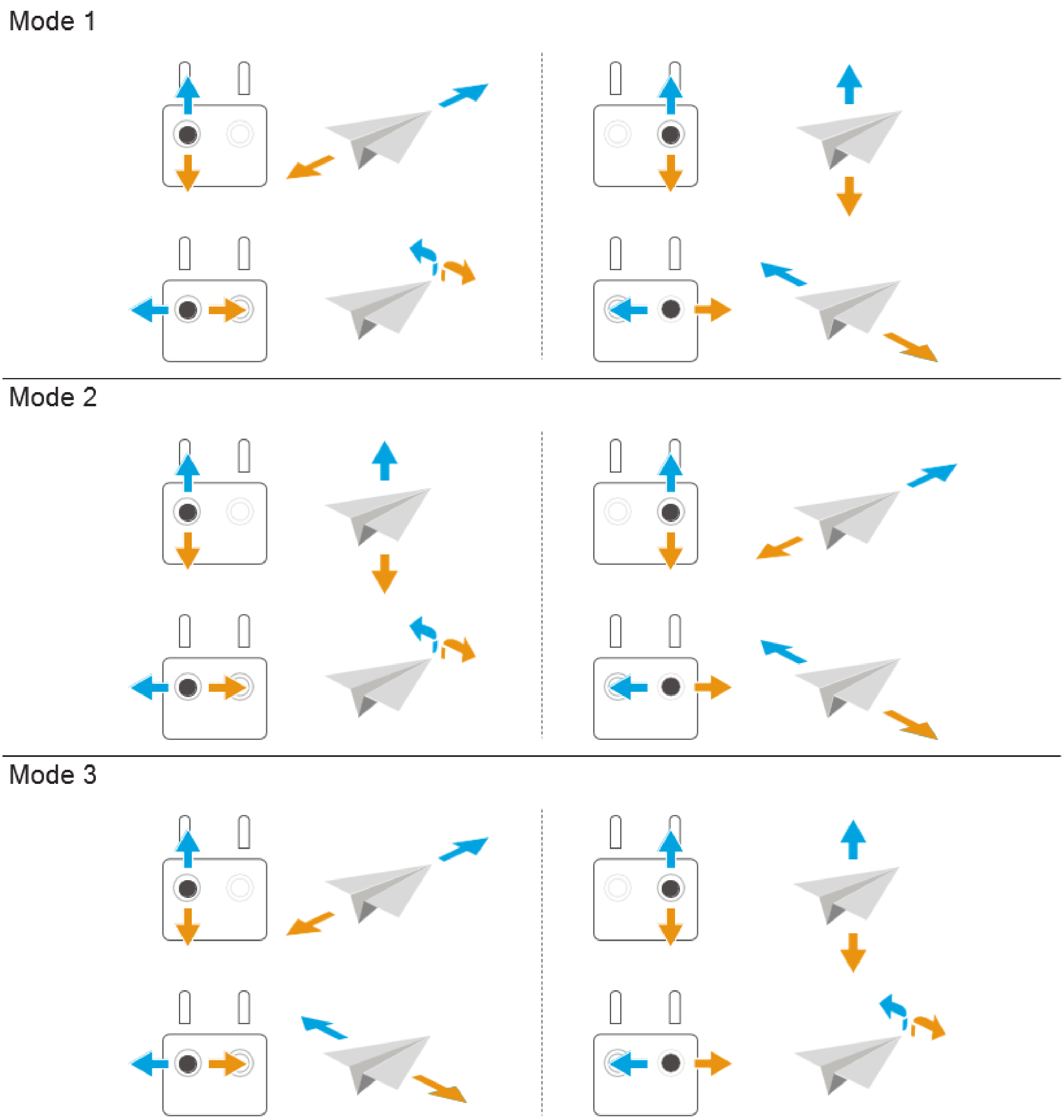


Figure 4-6 RC flight mode

4.5 Pre-flight checklist

Before each mission, please follow this checklist.

Step	Details	Checked
S01	Check drone Ensure your DJI M3TD drone is fully charged and in good working condition. See the D4.1 document	[ ]
S02	Powering On and Connecting • Power on the aircraft and the remote controller. • Launch the DJI Pilot app; the drone and all connected devices should appear on the home screen.	[ ]
S03	Selecting the Thermal Camera View • On the main interface, switch between visible (RGB) and thermal imaging by tapping the camera options on the screen. • Select “Thermal” to activate the thermal camera live view.	[ ]
S04	Configuring Thermal Settings • In the camera settings menu, adjust thermal parameters such as: • Color palettes (e.g., White Hot, Black Hot, Rainbow, etc.) • Temperature measurement units (°C or °F) • Enable temperature spot metering to focus on a particular area or use area measurement for broader regions.	[ ]

Table 4-4 Pre-flight checkilst

4.6 Performing a manual flight for thermal inspection

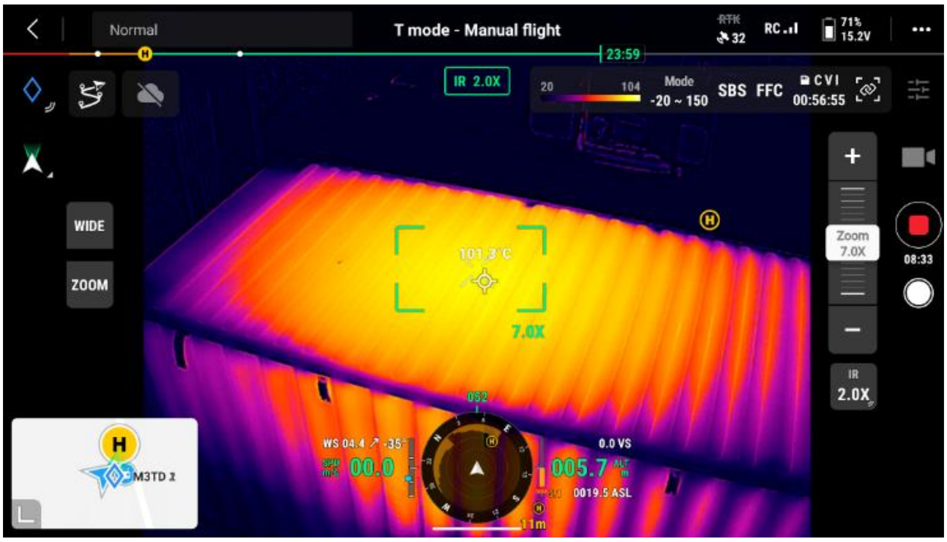


Figure 4-7 Thermal inspection software on the manual RC

The pilot can follow these flights procedures:

1. Manual Flight and Observation
   - Manually control the drone using the remote controller
   - Fly around the area of interest, focusing on surfaces suspected to retain heat or show abnormal temperature patterns.
2. Planning an Automated Flight
   - Use DJI Pilot's mission planning features to set waypoints and automate flight paths for systematic thermal inspection.
   - Configure altitude, speed, and camera actions for each waypoint to optimize coverage and image quality.
3. Capturing and Reviewing Thermal Data
   - During the flight, use the on-screen capture button to take thermal images or record video as needed.
   - Review captured data in real time or after the flight within the DJI Pilot app's media gallery.
   - Export images or video for further analysis or reporting.

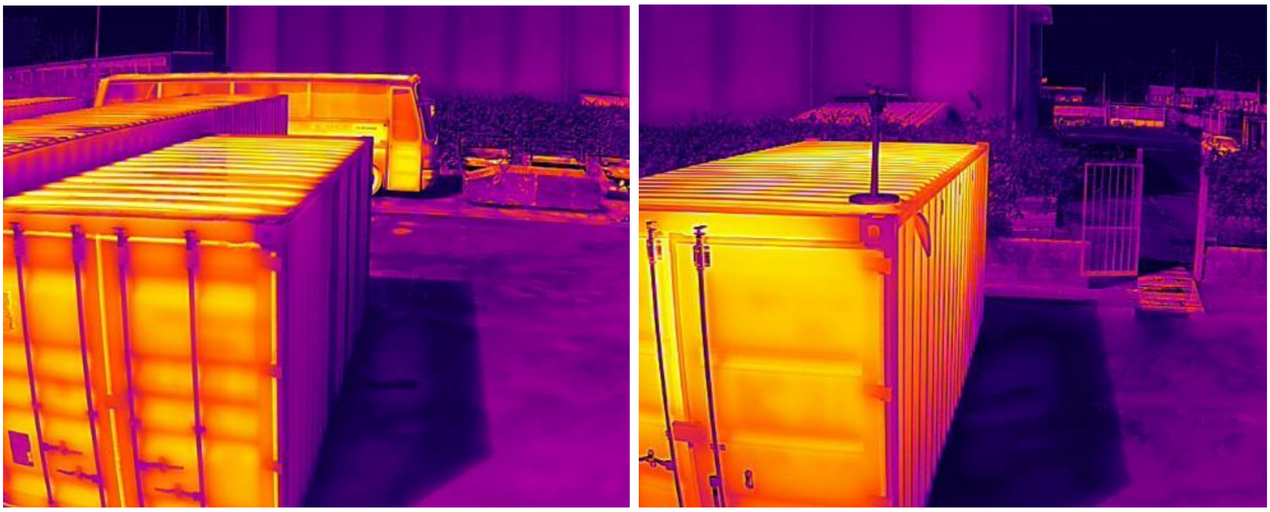


Figure 4-8 Difference between container heated by the sun and by fire inside

As Consider environmental factors such as sun heating: sunlight can cause surfaces to appear hotter, so compare sunlit and shaded areas for accurate detection as shown in Figure 4-2.

For fire detection inside containers, observe that containers involved in a fire will radiate heat that is detectable even in shaded areas. A flight path circling the container may help reveal heat patterns more thoroughly.

Adjust your flight altitude and distance for the optimal thermal perspective, ensuring the target area fills a significant part of the frame.

5 EMERGENCY FLIGHT PROCEDURES

This section describes how to handle the aircraft, the hangar or the software during emergency situations.

5.1 Loss of Control Signal

The signal lost action can be set in the mission planning software:

- In Live Flight Control: Open the device status window, click Flight Settings > On Signal Lost to set the signal lost action to Return to Home, Hover, or Continue.
- In Flight Route Task: Open the Task Plan Library and click Create Plan to set the signal lost action during a flight route task to Return to Home or Continue Tak.

When the signal lost action is set to RTH, the GNSS signal is strong, the Home Point was successfully recorded, and the compass is functioning normally, RTH automatically activates after the control signal is lost for six seconds or above.

When the lighting is sufficient and the vision system is working normally, the mission planning software will display the RTH path that was generated by the aircraft before the control signal was lost and return to home using Advanced RTH according to the RTH settings. The aircraft will remain in RTH even if the control signal is restored. The mission planning software will update the RTH path accordingly.

When the lighting is insufficient and the vision system is not available, the aircraft will perform the Original Route RTH procedure. The aircraft will enter or remain in Preset RTH path if the signal is restored during RTH. The Original Route RTH procedure is as follows:

1. The aircraft brakes and hovers in place.
2. When RTH begins:
   a. If the RTH distance (the horizontal distance between the aircraft and the Home Point) is farther than 50 m, the aircraft adjusts its orientation and flies backward for 50 m on its original flight route before entering Preset RTH path.
   b. If the RTH distance is farther than 5 m but less than 50 m, it adjusts its orientation and flies to the Home Point in a straight line at the current altitude.
   c. The aircraft lands immediately if it is less than 5 m from the Home Point when RTH begins.
3. The aircraft lands and the motors stop after reaching the Home Point.

5.2 Return to Home function

The Return to Home function returns the aircraft back to the hangar or the alternate landing site when the GNSS signal is strong. Alternate Landing will be triggered if the hangar is not suitable for landing. In this case, the aircraft will fly to and land at the alternate landing site.

Flight tasks will be interrupted and RTH will be triggered if any of these situations occur:

- The aircraft approaches the GEO Zones, or the flight distance approaches the maximum distance.
- The GNSS signal becomes weak during a flight route task.
- The user actively triggers RTH in the mission planning software.
- The Intelligent Flight Battery level is too low.
- If the control signal is lost, Signal Lost Action (Return to Home or Continue Task) will be triggered.
- There is strong wind during a flight route task.
- RTH will be triggered if the motors are overloaded or overheated. Auto landing will be triggered if there is critical motor overheating warning.
- When performing RTK flight tasks, if the flight distance is too far, RTK positioning accuracy may decrease. To ensure flight safety, the flight route task will be interrupted and RTH will be triggered.
- During flight, RTH will be triggered if the hangar network connection fails.

5.2.1 Alternate landing site

If the hangar is determined unsuitable for landing, alternate landing will be triggered. The aircraft will ascend to the alternate route altitude, then fly to the alternate landing site for landing.

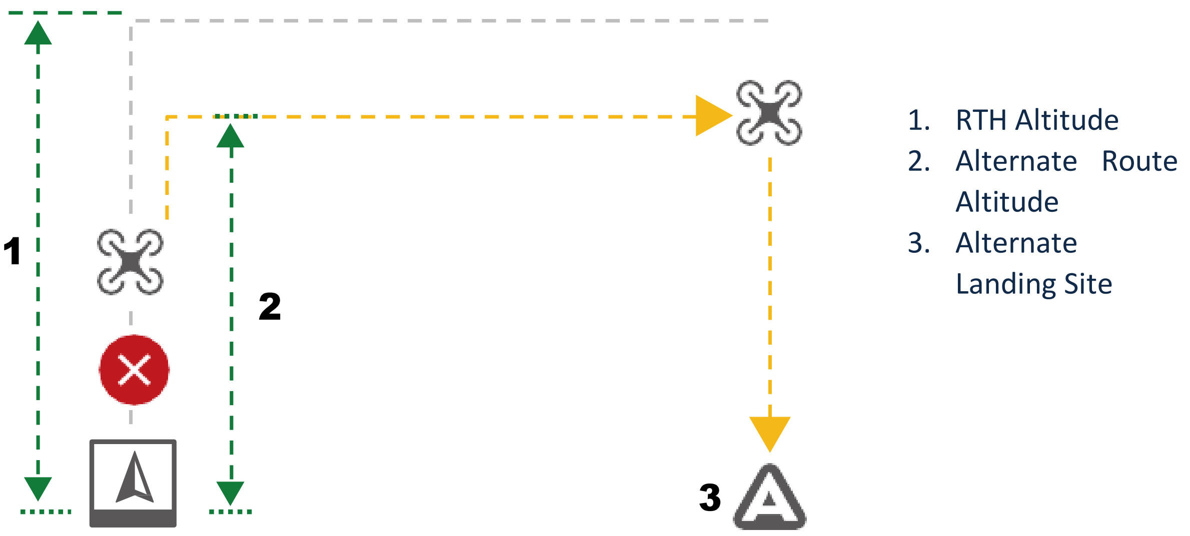


Figure 5-1 Alternate landing illustration

5.3 Mission planning software failure

If the mission planning software failure crashes during automatic operations while the control signal is normal, the C2 link between the aircraft and the control station is still in good condition, so the aircraft will continue performing the current operation until RTH is triggered by low battery level.

5.4 Emergency stop button

The hangar has one emergency stop button. In an emergency, press the emergency stop button to stop all hangar movements when operating or maintaining the hangar. The status indicators blink red and yellow alternatively after pressing the emergency stop button.

If the aircraft is powered on but the motors are not running, the aircraft cannot take off after pressing the emergency stop button. If the emergency stop button is pressed when the aircraft is performing a flight task, the aircraft will fly to the alternate landing site after completing the flight task.

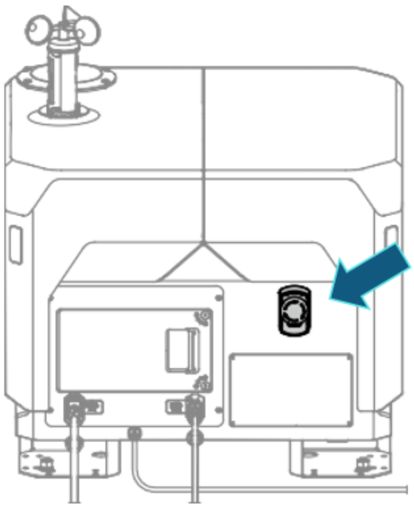


Figure 5-2 Emergency stop button placing on the hangar

REFERENCES

1. D4.1 - User Manual of the UAS Recharging Station
2. DJI Hangar 2 User Manual V2.02
3. DJI FLIGHT HUB 2 User Manual
4. DJI FLIGHT HUB 2 OPEN API documentation
5. DJI CLOUD API documentation

OVERHEAT
INNOVATIVE STRATEGIES FOR CONTAINERSHIP FIRES PREVENTION AND MANAGEMENT

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