SWARMSHIELD

User Manual

V1.0

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Introduction

SwarmShield is a perimeter security solution based on an autonomous intelligent drone swarm developed by DeepMAV.ai.

It provides a complete solution for implementing a mobile, drone-based, video surveillance system with automatic threat detection and alerting in a closed-circuit environment.

Main applications include securing a perimeter around an estate, tactical security support on field missions, video surveillance of remote outdoor areas, and AI-enhanced support for security forces and personnel.

SwarmShield comes with an intuitive interface for configuring and commanding missions that requires minimal training and setup. Each SwarmShield drone swarm is designed to be operated by a single person in command (aka. commander). While the SwarmShield system operates autonomously, the commander is responsible for the mission operation, including oversight, reviewing the intelligence events, control over the mission planning, commencement, and completion, and if required manually controlling mission and navigation objectives.

SwarmShield can integrate seamlessly into your existing video surveillance systems, allowing you to extend your existing static security solutions with a new AI-enhanced drone-based technology.

Disclaimer:

By purchasing SwarmShield, you agree to release DeepMAV.ai from any and all responsibilities for damages to you or third parties, property damage, or financial and legal repercussions caused by operating the SwarmShield system. You agree to operate SwarmShield in accordance with its intended use and instructions. You agree to operate SwarmShield in accordance with your local Remote Piloted Aircraft Systems regulations.

Hardware Requirements

Drone Hardware Equipment

SwarmShield requires one or more compatible DJI drones.

Following is a list of DJI drone models compatible with SwarmShield, as of December 2023:

- DJI Mini 3
- DJI Mini 3 Pro
- DJI Mavic 3M
- DJI Mavic 3 Enterprise Series
- Matrice 30 Series
- Matrice 350 RTK
- Matrice 300 RTK

Each DJI drone comes with a separate RC. Compatible DJI RC models include:

- DJI RC Plus
- DJI RC N1
- DJI RC Pro
- DJI RC Pro Enterprise

Not every drone model is compatible with every RC model. Please refer to DJI website for details on offered combinations.

Device Hardware Equipment

When using an RC that does not come with a compute device built-in, an external Android hardware device is required for each RC as the drone controller.

Following DJI RC models require an Android drone controller device:

- DJI RC N1

Following DJI RC models do not support an external Android drone controller device:

- DJI RC Plus
- DJI RC Pro
- DJI RC Pro Enterprise

An external drone controller Android device is recommended as it provides a more powerful compute platform than built-in DJI RC devices. Hardware and software requirements for the drone controller Android device:

- Android O/S 10 or higher
- Quad-core or better CPU with Arm64 architecture
- Wi-Fi a/b/g/n/x

SwarmShield Command Center requires a compatible Android device (separate from the drone controller devices, if used). Hardware and software requirements for the SwarmShield Command Center Android device:

- Android O/S 10 or higher
- Quad-core or better CPU with Arm64 architecture
- Wi-Fi a/b/g/n/x

Recommended Hardware Configuration

SwarmShield supports drone swarms of any size. It is recommended to operate SwarmShield drone swarms consisting of 5 drones and 1 command center for each swarm. We recommend purchasing 2-3 spare drones for each swarm.

Below is the recommended complete hardware configuration for the SwarmShield solution.

Drone equipment (per drone):

- DJI Mini 3 Pro
- DJI RC N1

Optional drone equipment:

- Additional DJI Mini 3 Intelligent Flight Batteries and Charging Hub (Fly More Kit)
- Replacement parts and accessories (carrying cases, drone landing pads, RC tablet holder)

Android device equipment:

- Lenovo Tab M8 (3rd Gen) as drone controller devices, one per drone
- Lenovo Tab M10 Plus (3rd Gen) as the SwarmShield Command Center device

Network equipment:

- ASUS/NETGEAR/TP-Link dual band Wi-Fi router for the local network on which SwarmShield operates

A complete parts list for a typical size SwarmShield system based on the recommended hardware configuration is shown below:

Part	Quantity
DJI Mini 3 Pro	5
DJI RC N1	5
DJI Fly More Kit Plus	2
Lenovo Tab M8 (3rd Gen)	5
Lenovo Tab M10 Plus (3rd Gen)	1
Wi-Fi Router	1
SwarmShield Drone Controller App	5
SwarmShield Command Center App	1

Initial Setup

This section assumes you have acquired the minimum required hardware and software equipment for the SwarmShield solution. If you purchased the SwarmShield solution with hardware and software setup services, your system is already configured and you do not need to perform the initial setup.

The following system parts are referred to in the setup:

- DJI drone
- DJI RC
- Drone controller Android device
- Command center Android device
- Wi-Fi router
- SwarmShield Drone Controller Android app
- SwarmShield Command Center Android app

Hardware Setup

The network setup needs to be performed once. Same network may be used for multiple SwarmShield systems operating in parallel.

- Plug in and power on the Wi-Fi router
- Configure Wi-Fi network security as per manufacturer's instructions and set a strong network key

Note: Only drone controller Android devices and the command center Android device need to communicate over the Wi-Fi network. The drones themselves do not connect to the Wi-Fi network and communicate to the drone controller devices via separate, dedicated, radio communication channels. It is recommended that the Wi-Fi router is placed close to drone controller Android devices and DJI RCs as well as the command center Android device to ensure reliable Wi-Fi communication. Do not use IT equipment intended for indoor use outdoors or in unsuitable weather conditions.

Drone hardware setup needs to be performed once for each drone in the SwarmShield swarm.

- Unpack the DJI drone and insert the battery if required, according to manufacturer's instructions
- Unpack the DJI RC and install corresponding accessories
- Charge both the drone and the RC, according to manufacturer's instructions
- Pair the DJI RC to the DJI drone (if it is not already paired), according to manufacturer's instructions
- If external Android drone controller device is used (recommended option)
  - Charge the drone controller Android device
  - Connect the drone controller Android device to the DJI RC via the provided USB cable, according to manufacturer's instructions
- Connect the drone controller device (external device or DJI RC built-in device) to the designated Wi-Fi network
- Install the DJI Fly Android app on the drone controller Android device and perform the manual drone flight test to ensure drone is fully operational

The command center hardware setup is performed once per swarm.

- Unpack and charge the command center Android device
- Connect the command center Android device to the designated Wi-Fi network

Note: It is recommended to set a lock code and configure biometric security on each Android device for security reasons. SwarmShield Command Center and SwarmShield Drone Controller applications will display a warning on startup if no biometric security has been configured on the device.

Software Setup

The SwarmShield system setup is completed by setting up the required software onto the drone controller and command center devices.

- Install the SwarmShield Drone Controller Android app onto each drone controller Android device using a provided installation package or from the Google Play store
- Install the SwarmShield Command Center Android app onto the command center Android device using a provided installation package or from the Google Play store
- Launch the SwarmShield Drone Controller app on each drone controller Android device and activate it
- Launch the SwarmShield Command Center app on the command center Android device and activate it

When the application starts, it will check if it has the appropriate permissions on the Android device. SwarmShield Command Center application requires location permissions to locate the device the on the map. Upon starting the application, if you are presented with the below screen, it means you need to grant the location permissions to the application.
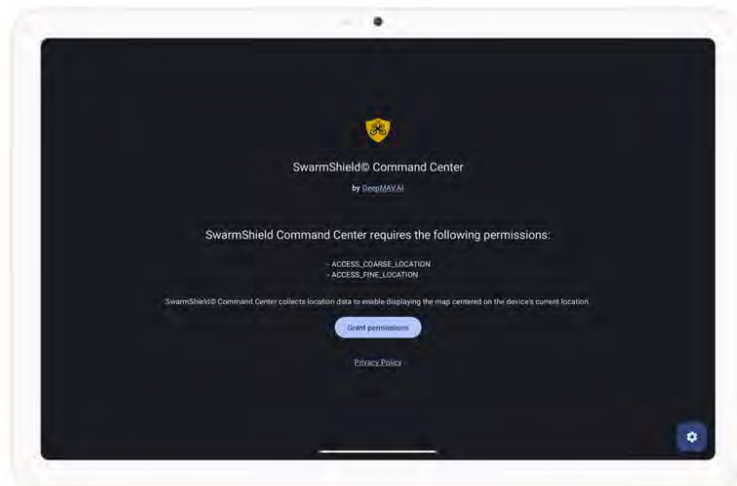

Press the Grant permissions button. On the next screen you will be prompted to confirm if you wish to grant the location permissions while the application is in use or one time only.

Press While using the app to allow the SwarmShield Command Center application to use the device location.

Once you have granted the location permissions, you will be prompted to enter the product license key to activate the application. You only need to enter the license key once to activate it.

**Note:** Activating the license requires an internet connection.
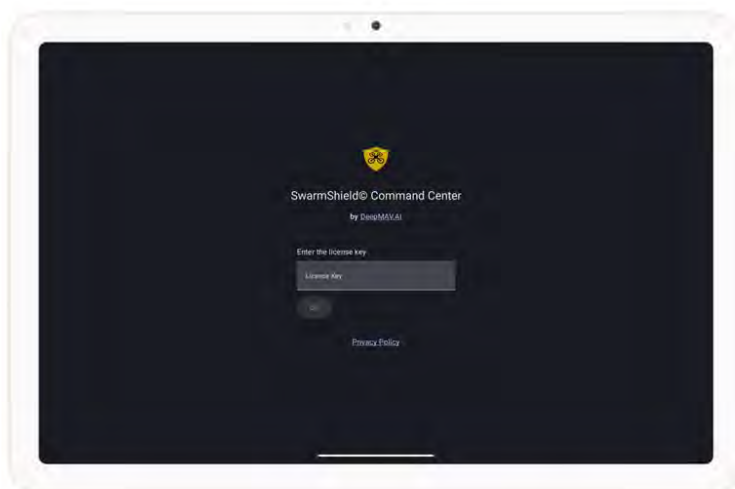
Perform the same license activation step in the SwarmShield Drone Controller application, on each drone controller device. Make sure to use the right license key for each application.

Your system is now ready for use.

System Overview

System Components

Following figure shows the diagram of the complete SwarmShield solution.
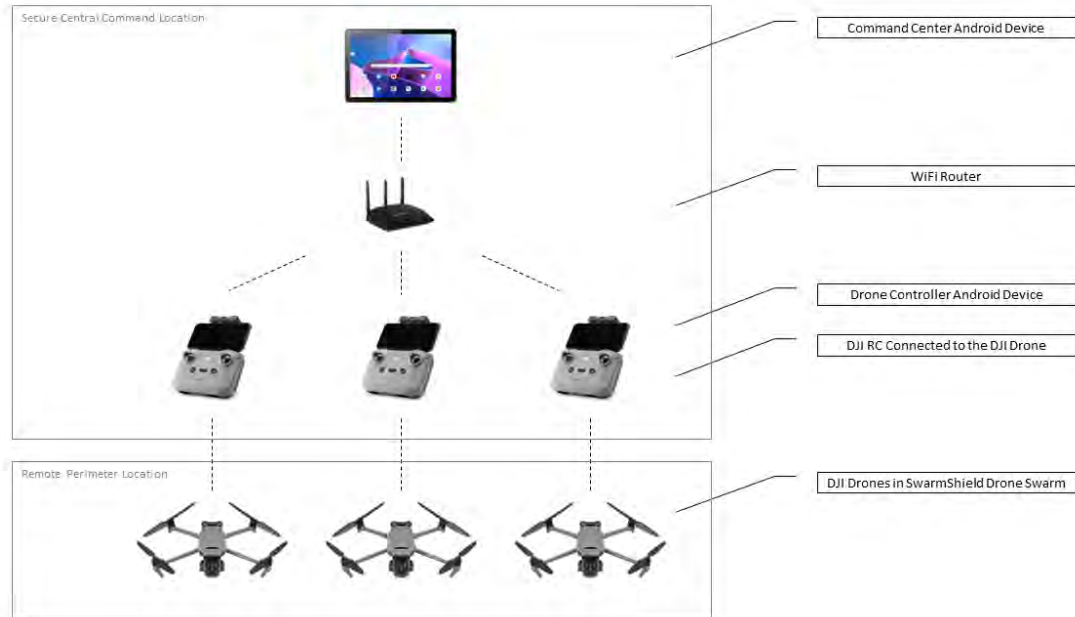
The SwarmShield system is comprised of the following components:

- a swarm of DJI drones autonomously traversing a configured perimeter based on defined mission parameters
- a set of DJI RCs connected to DJI drones, one RC per drone
- drone controller Android devices plugged into DJI RCs, one per RC
- command center Android device from which the system is operated
- Wi-Fi router to establish a closed local network for the communication of command center and drone controller devices

SwarmShield Command Center is an application running on the command center device. It is used for mission planning and operation, control over the swarm, and intelligence operations. SwarmShield Command Center is the main interface through which the SwarmShield commander operates the system.

SwarmShield Drone Controller application runs on each drone controller Android device. It is used for connecting DJI drones and making them part of the SwarmShield system.

SwarmShield Command Center and SwarmShield Drone Controller applications are required parts of the SwarmShield solution and must be active in order for the system to operate.

SwarmShield Command Center device, local network, and SwarmShield Drone Controller devices and RCs are typically placed in a secure central command location where they are operated by the SwarmShield commander.

DJI drones operate in the remote outdoor perimeter by autonomously navigating, gathering intel, and relaying it to the SwarmShield command center in real-time. Note that in order for the system to function, reliable radio communication is required between DJI drones operating in the remote perimeter and the DJI RCs placed in the central command location. For maximum operable distance and possible sources of radio interference, consult the manufacturer's manual and website.

Secure Communication

SwarmShield system ensures confidentiality and integrity of information transferred within the system using industry-standard encryption methods.

Communication between each DJI drone and corresponding DJI RC uses DJI proprietary communication protocol over radio waves operating at 2.4GHz and 5.7GHz frequencies. Communication is encrypted with industry-standard encryption methods. For DJI-specific radio communication security measures, see the manufacturer's manual.

Communication between SwarmShield Drone Controller applications running on each drone controller Android device and the SwarmShield Command Center application is based on the proprietary SwarmShield protocol. All data transferred between components of the SwarmShield system, except for the live video stream, is encrypted with rotating session keys for maximum security. Live video stream data used for integration into NVR systems is secured with generated credentials.

Note: To ensure secure, closed-circuit, operation of the SwarmShield system, configure the Wi-Fi router with strong security settings and disconnect the Wi-Fi network from the public internet. To better protect from cyberattacks against the SwarmShield system, do not share the Wi-Fi network key with third parties. For Wi-Fi router security settings, consult the manufacturer's manual.

Software Updates

SwarmShield Command Center and SwarmShield Drone Controller applications are Android applications compatible with the Android operating system version 10 and above.

When installed through the Google Play app store, both applications receive published software updates automatically. All minor software updates are backwards compatible and ensure uninterrupted operation of the system. Major software updates may require re-importing application data and additional configuration for continued use.

When installed outside of the Google Play app store, SwarmShield Command Center and Swarm Shield Drone Controller software updates are made available via secure downloads provided via a separate website link sent to customers.

Hardware Upgrades

Replacing or Upgrading Drone Equipment

SwarmShield allows an individual DJI drone to be replaced or upgraded to a different drone model without any change in the configuration or operation of the system.

Simply replace the DJI drone and its corresponding DJI RC with another DJI drone and RC from the list of compatible models and perform the initial setup of the drone as described in this manual. A replacement

DJI drone does not require a new drone controller Android device. The drone controller Android device from the drone being replaced may be reused.

Replacing or Upgrading Android Device Equipment

SwarmShield allows replacing or upgrading any of the Android devices used in the system, whether a drone controller or the command center Android device.

Configure the replacement Android device following the instructions in the initial setup procedure. Install the SwarmShield application on the new device according to instructions. Erase the Android device being replaced for maximum security. Connect the new device according to instructions and continue with normal use.

If the SwarmShield applications were not installed from Google Play app store and you require a copy of the installation media to set up the replacement device, contact us and we will provide the software installation.

Perimeter Management

SwarmShield Perimeter Management allows you to define perimeter areas and save them in the SwarmShield Command Center.

A perimeter area is a geometric simple two-dimensional polygon area defined on a map using map locations (i.e. latitude and longitude). Besides its boundary points that define the area, each perimeter has an assigned name and default altitude for drone flight. This altitude may be overridden when using the perimeter for a SwarmShield mission.

Note: All altitudes in SwarmShield are expressed in meters above takeoff position. SwarmShield does not rely on barometric MSL altitude. Changing the initial takeoff location of the drones impacts the true MSL altitude at which drones perform its mission.

Perimeter areas are used as flight boundaries for SwarmShield drone missions. During the autonomous mission navigation, all drones connected to SwarmShield will traverse the selected perimeter area for the current session performing surveillance and gathering intel. There is no restriction on the shape of the perimeter as long as it is a simple polygon (i.e. no self-intersections).

To access Perimeter Management in SwarmShield Command Center, select the Perimeters menu option from the side menu, as shown in the picture below. If the side menu is not visible, press the menu button in the top right corner.

Note: Side menu in SwarmShield Command Center can always be shown by pressing the menu button in the top right and hidden by pressing the menu button at the top of the side menu.

The main Perimeters screen displays the new perimeter creation area at the top and the list of saved perimeters below.

Creating and Editing a Perimeter

The first step in parameter management is to create a new perimeter.

Creating a new perimeter is performed on the main Perimeters screen in the SwarmShield Command Center application.

Enter a name and default altitude for the perimeter and press the Save button as shown in the picture below.

When you press the New Perimeter button, the perimeter is created and the perimeter editing screen is opened showing the perimeter properties and a map allowing you to edit the perimeter points.

Note: In order for the map to display on the screen, the SwarmShield Command Center device must be connected to the internet.

The perimeter editing screen has Save and Delete buttons on the right side. To change the perimeter name or default altitude, type the new values into the appropriate field on the screen and press the Save button.

To delete the perimeter, press the Delete button on the right side. The application will ask you to confirm perimeter deletion.

Defining and changing perimeter points is done in the map area at the lower part of the perimeter editing screen as shown in the picture below. The lower part of the perimeter editing screen contains action buttons, Edit, Clear and Close.

To begin editing perimeter points, press the Edit button. Once the perimeter is in edit mode, tap on the map to define perimeter points. To finish editing the perimeter points, press the Close button at the top of the map and the perimeter polygon will connect the first and the last point entered, creating a closed

polygon area. Pressing the Clear button will clear perimeter points, after asking you to confirm, allowing you to start entering points from the beginning.

Mission Management

The next step in preparing for SwarmShield mission operations is to define a mission in SwarmShield Command Center.

A mission contains the configuration of a SwarmShield drone operation, including the chosen perimeter and other mission parameters that affect the objectives of the mission.

To access mission management, in SwarmShield Command Center application, press the Missions button in the side menu.

The main Missions screen shows the mission creation area at the top of the screen and the list of saved missions below, as shown in the picture. To see all existing missions, scroll the mission list by dragging the list up or down.

Creating and Editing a Mission

To create a new mission, first select the perimeter from the dropdown in the top left of the main Missions screen. Then, press the New Mission button on the right side.

When you press the New Mission button, a new mission is created and is configured with the chosen perimeter as its flight boundary.

Each mission created in SwarmShield is assigned a unique ID consisting of alphanumeric characters.

When you create a mission by pressing the New Mission button, the mission editing screen is opened showing the properties of the newly created mission.

If you want to edit an existing mission, press on the mission in the list of missions in the main Mission screen.

The mission editing screen that opens when you create a new mission or when you edit an existing mission consists of multiple sections:

- Mission Status
- Flight Boundary
- Navigation Options
- Camera Options
- Intelligence Options
- Mission Log

All sections except Mission Status are expandable and can be expanded and collapsed by pressing the button on the top right side of each section.

Mission Status

The Mission Status section shows the unique ID of the mission in its heading and the status of the mission in the content area, as shown in the picture.

Mission status can have one of the following values:

- New – mission has been created but it has not yet been finalized
- Finalized – mission properties have been finalized
- Active – mission is currently active

When a mission is first created, it has the status of New. A mission that is in New status can be edited and its properties can be changed. Once you done with editing the properties of a mission, press the Finalize button in the mission status area to finalize the mission.

A mission that has the status of Finalized can no longer be edited and is ready for operation.

When the mission is started, its status changes to Active. When the active mission is stopped, its status changes back to Finalized.

Depending on mission status, the action button on the right side of the Mission Status content area will display different buttons.

Start for a finalized mission, Stop for an active mission.
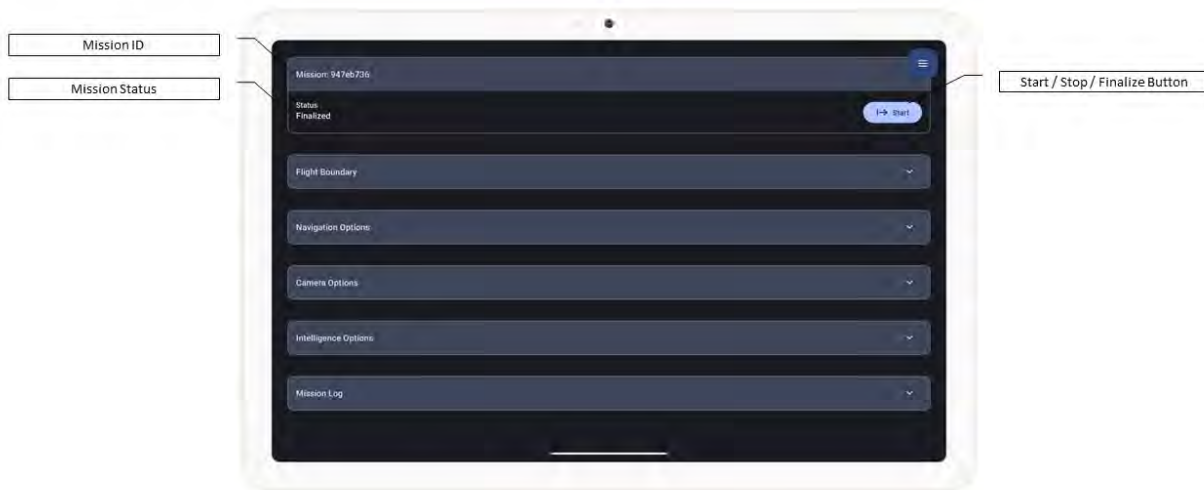
When the mission is in New status, the action buttons include the Finalize button which finalized the mission and the Delete button which deletes the mission.
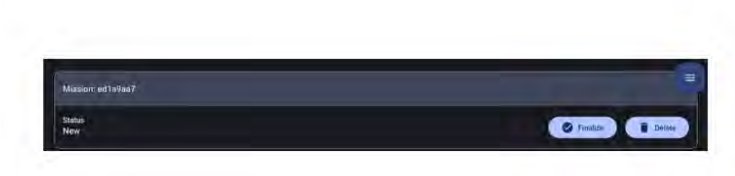
Pressing Delete will prompt you to confirm if you want to delete the mission. Only missions that are in New status can be deleted. Finalized or Active missions cannot be deleted.

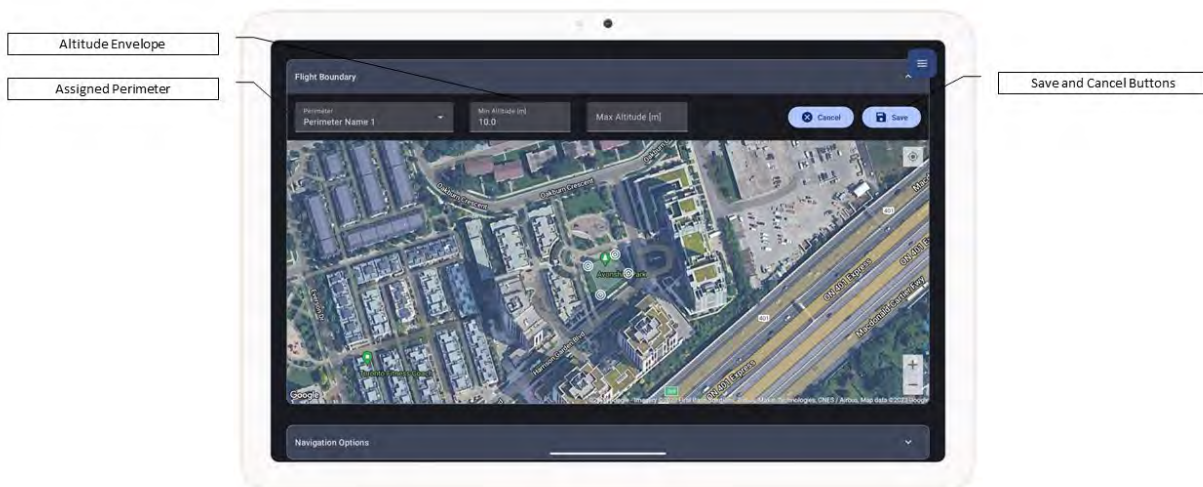## Flight Boundary

Expanding the flight boundary section opens the panel that displays the perimeter that is selected for the current mission.

The top part of the panel shows the information about the assigned perimeter, as well as the minimum and maximum altitude for the mission drone flight. The bottom part of the panel shows the map of the perimeter assigned as the flight boundary to the mission.

In the top right, the Edit button allows you to change the flight boundary properties. The Edit button is only enabled for missions that are in status New. Missions that have been finalized cannot be changed.

Assigned Perimeter Information

Edit Button

Pressing the Edit button show the fields where you can enter new flight boundary properties. To save the edits, press the Save button on the right.

Altitude Envelope

Assigned Perimeter

Save and Cancel Buttons

Selecting the perimeter from the dropdown will assign the chosen perimeter to the mission, to be used as the flight boundary for autonomous drone flight.

Minimum and maximum altitude determine the flight envelope for the autonomous drone flight when performing the current mission. Minimum altitude is assigned, by default, to the default perimeter altitude and maximum altitude is unbounded. Minimum and maximum altitudes may be set to constrain the range of altitudes at which drones in the swarm fly when performing the mission. Drones will automatically select an altitude in the assigned range when performing autonomous navigation.

To revert the changes to mission flight boundary properties, press the Cancel button on the right.

Navigation Options

Mission navigation options allow you to control which navigation strategy is used for autonomous drone swarm navigation as part of the current mission.

As of the current version, SwarmShield supports perimeter coverage navigation strategy only. Future versions will provide additional options to customize how the drones autonomously traverse the perimeter.

Perimeter coverage is a proprietary, fully autonomous, drone navigation strategy in which drones move within the assigned flight boundary at their selected altitude with the objective of traversing the entirety of the interior of the perimeter and scanning the exterior of the perimeter continuously and evenly.

Camera Options

Mission camera options allow you to configure the primary drone camera motion during autonomous drone flight. Camera options can be changed for missions in New status only.

During flight, SwarmShield drones will automatically tilt the camera back and forth within a range of vertical (pitch) angles and pan back and forth within a range of horizontal (yaw) angles relative to the drone's orientation. In the default configuration, all SwarmShield drones will point their camera down 30 degrees and straight in the direction of their flight, making it stationary.

Changing the minimum and maximum camera pitch and yaw angles allows you to configure automatic camera pan and tilt. When the minimum and maximum angles are set at different values, the automatic tilt and pan will be enabled within the defined range. The recommended range of camera pitch angles is between -90 degrees to 0 degrees. The recommended range of camera yaw angles is -15 to +15 degrees.

As the SwarmShield drones are in continuous motion while in autonomous mission navigation mode, the primary drone cameras will inherently scan the surrounding perimeter area even when the camera position is stationary relative to drone's orientation. Enabling automatic camera pan and tilt further improves perimeter scanning by changing the orientation of the camera while the drone's orientation is fixed during straight-line flight.

Intelligence Options

Mission intelligence options allow you to configure how SwarmShield gathers intelligence events during mission operation and to review gathered intel for past mission operations.

SwarmShield system comes with built-in Artificial Intelligence capabilities that allow it to automatically detect and identify potential threats and other events of interest.

Mission intelligence options allow you to configure the parameters of the built-in AI used for threat detection. Mission intelligence options can be edited for mission in New status only. Finalized mission intelligence properties cannot be changed.

Minimum score field set to 0.5 by default represents the threshold above which an auto-detected event is reported. Due to the nature of the Artificial Intelligence capabilities, some false positive detections are possible. Higher levels of minimum score threshold will reduce the occurrence of false positives but could also miss important events. The recommended setting is the default value of 0.5 and should be appropriate for most missions.

The list of autodetection categories contains the types of objects that SwarmShield can automatically detect using its built-in AI capabilities that analyzes the video from onboard drone cameras in real-time. As of the current version, SwarmShield can auto-detect the following type of objects: persons, ground, aerial and naval vehicles, weapons such as handguns, rifles, knives and grenades, and multi-copter drones. During mission operation, SwarmShield will capture and report intel events for enabled auto-detection categories.

To save mission intelligence options, press the Save button on the top right. To reset mission intelligence options to the current values, press the Reset button in the top right.

To review gathered intelligence events from past mission operations of the current mission, press the Intelligence Events button at the bottom of the mission intelligence options panel. For further details on intelligence events, see the Intelligence section.

Mission Log

Mission log section allows you to review and export the mission log entries for the selected mission.

Every SwarmShield mission operation generates log entries along with a precise timestamp and log of important events in the mission operation.

Mission log entries are stored in the SwarmShield Command Center application and may be exported to a CSV file for offline storage.

Mission log entries are displayed in a list starting from the most recent. Pressing the Export button will automatically generate a CSV file with the content of the mission log and prompt you to choose a location where to send the exported mission log file.

Starting a Mission

Operating the SwarmShield system requires an active mission. Only one mission may be active on one SwarmShield system at a time.

Starting a SwarmShield mission activates it and creates a session for that mission that is shared across all devices connected to the SwarmShield system.

Starting a mission requires entering a Pin Code. A session Pin Code is a temporary secret key entered by the SwarmShield commander in the SwarmShield Command Center application that ensures authorized connection by each drone that is part of the SwarmShield system. Session Pin must be a minimum of eight characters long and must contain at least one lowercase alphabet character, one uppercase alphabet character, one numeric character, and one special character.

SwarmShield system stores the Pin code in encrypted storage and it is never shared or transmitted in unencrypted form between parts of the SwarmShield system.

A new Pin code must be entered each time a session is started. SwarmShield commander should note the Pin code as it will be needed to connect each drone to the SwarmShield session.

Note: For maximum security, do not share the Pin with third parties and do not reuse Pin codes across sessions. Sessions should be started at the beginning of a mission operation and stopped at the completion of a mission operation.

## Starting a Mission from Mission Management

A typical way to start a mission is from the Mission screen in SwarmShield Command Center application.

Navigate to the Mission Management screen using the sidebar menu. Check if there is already an active mission running and stop it if needed. Select the Mission you wish to start from the list to open the mission screen.

Review mission properties, including the flight boundary, navigation options, camera options, and intelligence options. Finalize the mission by pressing the Finalize button if the mission is not already in the Finalized state. Confirm the mission is finalized by checking the displayed state in the mission status section.

Then, to start a new mission session, press the Start button on the right side of the mission status section. The application will prompt you to enter the Pin code for the session. Once you enter the Pin code and press OK, the mission session is started.

Pin Code Dialog
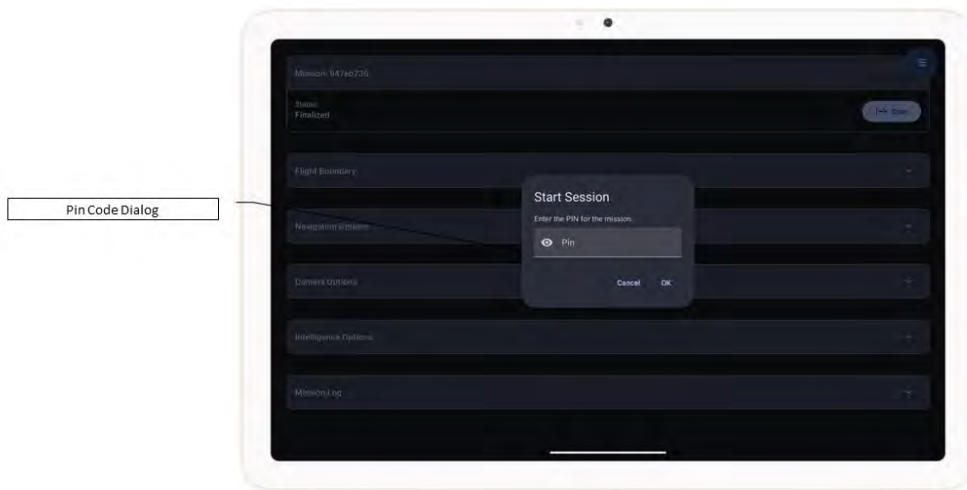
Confirm that the mission is active by reviewing the displayed status in the mission status section of the mission screen.

Active Mission Status

Confirm that the mission is active by reviewing the mission list in the mission management screen. Navigate to mission management by selecting the Missions sidebar menu option. Note the active mission with a green light indicator on the right side.

Quick Starting a Mission

A second way to start a mission is from the Quick Start screen. Note that quick-starting a mission both creates a new mission with default mission parameters and starts the newly created mission at the same time. Quick-starting a mission is an easy way to get started with a mission operation if the default flight boundary, camera, and intelligence options would suffice.

Navigate to the Home screen by selecting the Home sidebar menu option. If there is no currently active mission, the screen will display the quick start dialog.

Select the perimeter for the mission from the dropdown. Enter a Pin code for the session. When you press the Start Session button, SwarmShield creates a new mission in the system with the selected perimeter for its flight boundary and default mission properties, finalizes it, and starts a new session for that mission.

Mission Status Monitoring

The Status screen in the Home area in SwarmShield Command Center application is used for monitoring the overall status of the active SwarmShield mission, and the status of the drones participating in the mission operation.

Navigate to the Home area in SwarmShield Command Center application by selecting the Home sidebar menu option. Select the Status bottom navbar menu option to show the status screen.

The left side of the Status screen displays the Active Session section containing the session information and the mission log for the currently active mission.

Each session is assigned a unique ID in the SwarmShield system, distinct from the mission ID as one mission may have many sessions over multiple mission operations. The session information also includes the time when the session was started, its duration, and the perimeter used for the mission.

The mission log at the bottom of the Active Session section displays all logged messages by the SwarmShield system for the currently active mission, sorted from the most recent.

On the right side of the Active Session section heading, the Stop Session button allows you end the mission operation by stopping the current session. Stop Session button in the Status screen has the same effect as the Stop button in the Mission screen for the active mission. Stopping a session orders all drones participating in the mission operation to return to their home positions and land, and completes the mission operation.

The right side of the Status screen shows the Drone Swarm section. Drone Swarm contains the list of drones connected to the current session, along with status indicators and video streaming controls.

Each drone is identified with a unique auto-generated identifier.

Note: The drone identifier stays the same across sessions and missions and is tied to the drone controller device. Replacing the DJI drone while reusing the same drone controller Android device does not change the drone identifier. Reinstalling the SwarmShield Drone Controller application on the drone controller device or replacing the drone controller device will result in a new drone identifier being generated.

Next to the identifier, the drone list displays the current flight status for each drone. A drone's flight status may have one of the following values:

- Landed
- In Flight
- Landing
- Returning Home
- Disconnected

On the right side, the drone list displays status indicators for each drone.

SwarmShield keeps track of the status and location of each drone participating in the mission operation and reports it in the SwarmShield Command Center in real-time. If a SwarmShield drone fails to report its state or location its status indicators will reflect that.

Note: If a SwarmShield drone displays a disconnected status, it means the SwarmShield Command Center is no longer able to communicate with the drone to control it. In that situation, you should manually take control of the drone via the SwarmShield drone controller device and attempt to re-establish connection.

The last icon on the right of each drone list item is the drone video control button. Pressing the video control button opens the Drone Video Link dialog. See Drone Video Streaming section for more information on how to monitor live video feeds from each drone and integrate into an NVR video surveillance system.

Connecting Drones to a SwarmShield Session

Once the mission is started in the SwarmShield Command Center, each drone that is going to be used in the mission operation needs to be connected to the session. Connecting the drone to SwarmShield is performed in the SwarmShield Drone Controller application on the drone controller Android device.

First, position the DJI drone at its outdoor takeoff location near the mission perimeter. Power on the drone and ensure its onboard light indicators indicate nominal status. Then, power on the DJI RC and ensure its light indicators display nominal status and successful connection to the DJI drone. Ensure both the drone, RC, and drone controller device are fully charged before performing a mission operation. For details of the drone and RC power-on procedure, consult the manufacturer's manual.

Then, power on the drone controller Android device and launch the SwarmShield Drone Controller application on the drone controller device. Upon launch, you are prompted to connect to the SwarmShield session.

Ensure that both the drone controller and the command center devices are connected to the Wi-Fi network.

Enter the same Pin code specified when the session was created and press the Connect button. Upon successful connection to the SwarmShield session, the drone controller device will display the Connected status and open the drone video feed.

In case the specified Pin code is incorrect, the SwarmShield Drone Controller application will display the disconnected status.

The connection procedure should be repeated for each drone used in the mission operation.

Once the mission operation is complete and drones returned to their takeoff location and powered off, the SwarmShield Drone Controller application will automatically disconnect from the SwarmShield session and should be turned off.

Drone Video Streaming

Each drone connected to SwarmShield is capable of streaming live video from its primary camera.

Video streaming is not enabled by default when a session is started.

To enable video streaming from a drone, press the Video Control button on the right side of the drone list in the Status screen in the SwarmShield Command Center application.
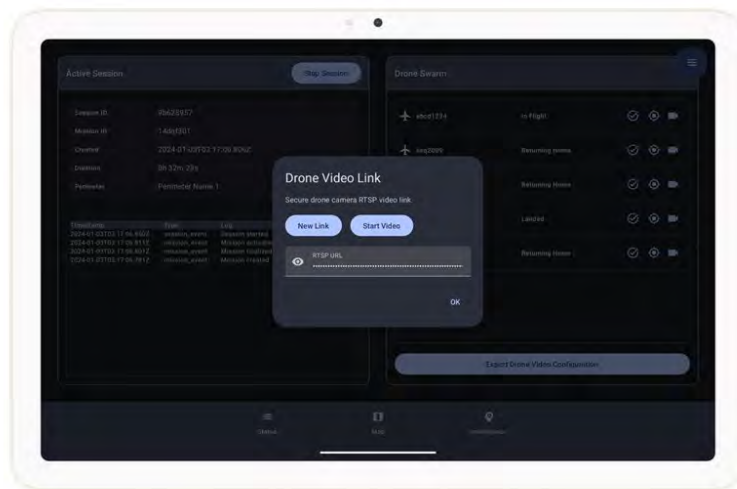
SwarmShield drones stream real-time video feeds over the RTSP protocol – an industry standard streaming protocol used for security cameras that is compatible with all security surveillance systems.

RTSP video streaming from SwarmShield drones is secured with auto-generated credentials. Pressing the New Link button in the Drone Video Link dialog will generate a new RTSP URL with credentials.

Pressing the Start Video button will cause the SwarmShield drone to start streaming a live video feed from its primary camera and make it available on the displayed RTSP URL.

To integrate live video feeds from SwarmShield into an NVR video surveillance system, see the NVR Integration section.

In addition to streaming video feeds over RTSP, SwarmShield drones will stream video feeds to the SwarmShield Drone Controller applications on their corresponding drone controller devices in real-time, regardless of whether the RTSP stream is enabled or not. This allows the SwarmShield commander to observe the video feed from the SwarmShield drones involved in the mission operation outside of the NVR system.

Exporting Video Configuration

The Export Drone Video Configuration button on the bottom right of the drone list section in the Status screen in the SwarmShield Command Center application allows you to generate an export file with a list of all RTSP URLs for each drone in the SwarmShield session.

Only the drones that have RTSP video streaming enabled are included in the export file.

An export file may be saved to the device to shared across the network to other devices for storing. Once exported, the video RTSP URLs can be manually configured in an external NVR system of your choice.

In addition to manual configuration of an external NVR system, SwarmShield supports automated NVR integration. For details of NVR integration, see the NVR Integration section.

Controlling Drones

SwarmShield Command Center application allows the commander to have a real-time view of the SwarmShield drone swarm connected to the system and to take control over the drones from one central location.

Navigate to the Home area in the SwarmShield Command Center application by selecting the Home sidebar menu option. Then, select the Map bottom navbar menu option to open the Map screen.

The Map screen displays a map view of the mission perimeter overlaid with real-time information for each drone. SwarmShield system keep track of each drone connected to the session, including its position, orientation, altitude, flight state, and other telemetry. The drones' real-time pose is displayed on the map with oriented arrow icons as shown in the picture above. The map is always oriented North-Up, while the orientation of the drone icons displayed represents each drone's true current orientation.

Note: For the map to display, the command center device must either be connected to the Internet or the map area cashed in the application by loading it while connected to the Internet prior to the mission operation.

The left side of the screen contains the flight control panel. The flight control panel consists of buttons that allow the command to issue commands to the drones. The right side of the screen contains map position and zoom controls.

In the top left of the screen, the drone selection dropdown allows you select an individual drone on the map. When selected, the drone icon is displayed in a distinct color. Drone may also be selected by pressing on the drone icon on the map itself. Pressing on the drone icon again when selected de-selects the drone. Similar effect is achieved if the Swarm item is selected from the drone selection dropdown.

When a drone is selected, the flight control panel displays two additional command buttons. Additionally, the map displays the drone state for the selected drone in the top left, as shown in the picture.

The flight control panel contains commands that allow the commander to control the drone swarm as a whole or each individual drone in the swarm. When a drone is selected, the flight control panel buttons have the same distinct color as the selected drone icon. Flight commands always apply to the drone selected and if none is selected then to the whole drone swarm. Issuing a flight command to the whole drone swarm sends the command to each drone currently connected to the SwarmShield session.

SwarmShield system keeps track of each drone's current state, including its currently active navigation mode and flight state. Depending on the current state of the drone, certain flight commands in the flight control panel may be disabled.

The Take Off flight command is enabled when the drone is on the ground ready for flight. Issuing the Take Off command to a drone will cause it to perform the automatic take-off operation which consists of taking off straight up from its current position to a predefined default altitude and hovering in place. For more details on configuring DJI-specific auto-takeoff settings, see manufacturer's manual.

The Start Autonomous Flight command will switch the drone to autonomous flight mode. In autonomous flight, the drone flies autonomously obeying the selected navigation mode. The default navigation mode is autonomous perimeter coverage. When the autonomous flight is started, the drone will fly into the perimeter and start autonomous flight operation.

Pause Autonomous Flight command will turn off autonomous flight for a drone, causing it to hover in place.

The Land flight command will cause the drone to land straight down at its current location. When a drone receives the Land command, it performs the automatic safe landing operation. For more details on configuring auto-landing, see manufacturer's manual.

The Return Home flight command causes the drone to perform the automatic return operation. Typically, automatic return operations consist of the drone changing its altitude to the preconfigured RTH altitude, then flying in a straight line back to the takeoff position, followed by landing straight down. For more details on configuring the parameters of the automatic return home sequence, see manufacturer's manual.

When a drone is selected, the flight control panel displays two additional commands used for switching a drone between a manual navigation mode and autonomous mission navigation. The default navigation mode when the drone connects to a SwarmShield session is autonomous mission navigation.

In manual navigation mode, the commander can directly control the flight of the drone on the map.

In autonomous mission navigation mode, the drone flies autonomously and continuously following the perimeter coverage navigation strategy.

Both navigation modes require that the autonomous flight is turn on for the drone.

Note: As a safety feature, all DJI drones perform an automatic return when the drone battery depletes below the preconfigured threshold. For more information on how to configure failsafe modes, see manufacturer's manual.

Manual Drone Navigation

Switching a drone into manual navigation mode allows you to directly control the flight of the selected drone by sending the drone to a target location on the map.

Drones in manual navigation mode perform autonomous flight to the defined target location by flying in a straight line to the target.

To perform manual drone navigation, first select the drone by either pressing on the drone icon on the map or selecting the drone from the dropdown in the top left of the screen. Then, press the Manual Navigation Mode button in the flight control panel. When the drone is switched to manual navigation mode it will hover waiting for the manual navigation target location to be set.

To define the target location for manual navigation, press on the map on the location where you would like the drone to navigate to. Once pressed, the map displays the target icon over that location. Note that target locations for manual navigation are saved for each drone, until a new target location is defined for it.

As soon as the target location is defined, the drone will being autonomous flight towards the target location. Once the drone reaches the target location, it will stop and hover at the target location.

Repeat the steps to define new target locations for the drone in order to manual traverse multiple locations, one at a time. A new target location may be defined for a drone in manual navigation mode while it is in flight towards the currently defined target location. Simply pressing on the map will change the defined target location causing the drone to turn and fly towards the newly defined target.

When you no longer wish to manually control drone navigation, you may switch the drone back to autonomous mission navigation by pressing the Mission Navigation button in the flight control panel. When pressed, the manual navigation target location is removed from the map and the drone resumes its autonomous perimeter coverage flight.

Note: Automatic camera pan and tilt is disabled in manual navigation mode and automatically re-enabled in mission navigation mode.

Recommended Drone Control Strategy

Prior to starting a mission operation, ensure you have carefully reviewed the defined mission flight boundary properties, including the chosen perimeter boundary and flight altitude envelope.

Once started, ensure all drones intended to be used in a mission operation have successfully connected to the SwarmShield session and their status and location is displayed in the SwarmShield Command Center.

It is recommended to start the mission operation by performing an auto-takeoff via the Take Off command in the flight control panel. You may perform takeoff on the whole swarm at the same time. For safety, it is often more practical to perform takeoff of individual drones in the swarm. Upon takeoff, confirm that the SwarmShield Command Center still shows the nominal drone status and location in the Status and Map screens.

Next, you can turn on autonomous flight for each drone. Again, you may start autonomous flight on the whole swarm, or you may do it on individual drones in sequence. For safety, it is often more practical to start autonomous flight on individual drones as the drones will commence autonomous navigation immediately, flying to the perimeter.

During the mission operation, make sure to monitor the status and location of the drones in the swarm. In case of any issues with one of the drones in the swarm, take control of the drone in question and return it safely to its takeoff location for troubleshooting.

SwarmShield commander should monitor intelligence events during a mission operation for any threats detected in or around the perimeter. When an event of interest is reported, the commander may wish to manually investigate the area of interest in more detail. In such a situation, you can switch a drone to manual navigation mode and direct it to the desired target area while carefully observing the video feed from the drone.

For optimal perimeter security coverage, it is recommended that the drone swarm be kept in mission navigation mode to autonomously traverse the perimeter scanning for threats and detecting and reporting them automatically to the SwarmShield Command Center.

Due to practical limitations of drone power usage, each drone can stay airborne for a limited amount of time, depending on the drone model, battery used, and battery charging state. For around the clock, continuous perimeter security coverage, ensure to have spare drones charged and ready to join a SwarmShield session when the drones currently engaged in a mission operation need to be returned home.

Intelligence

SwarmShield system automatically gathers intelligence during a mission operation and reports it in real-time in the SwarmShield Command Center application.

SwarmShield system comes with a built-in Artificial Intelligence capability that performs automatic threat detection in and around the perimeter. SwarmShield is capable of automatically detecting a range of object categories using an ensemble of built-in AI neural net models running on drone controller devices and processing the drone camera video feed in real-time.

Mission intelligence properties in the Mission screen allow you to configure the parameters of the Artificial Intelligence capability, including enabling or disabling object categories for automatic detection and setting the minimum detection threshold. The default mission configuration is to detect all supported object categories.

SwarmShield supports the following object categories:

- Persons
- Weapons (handguns, rifles, knives, and grenades)
- Ground vehicles (cars, trucks, busses)
- Marine vessels
- Aircrafts (airplanes and other fixed wing aircrafts, multi-copter drones)
- Animals (dogs and horses)

When objects of interest are detected by a drone, an intelligence event is immediately reported to the SwarmShield Command Center along with additional metadata and a capture of the video feed that contains the detected objects.

Intelligence event metadata includes the following properties:

- The location, altitude, and orientation of the drone that made the detection
- The camera orientation at the time of the detection
- The list of object categories detected
- The number of objects of each category detected

Intelligence Monitoring

SwarmShield Command Center allows you to monitor intelligence events in real-time in the Intelligence screen.

Navigate to the Home area in SwarmShield Command Center by selecting the Home sidebar menu option. Then, select the Intelligence bottom navbar menu option to open the Intelligence screen.

If there is a currently active session, the Intelligence screen displays the real-time intelligence information.
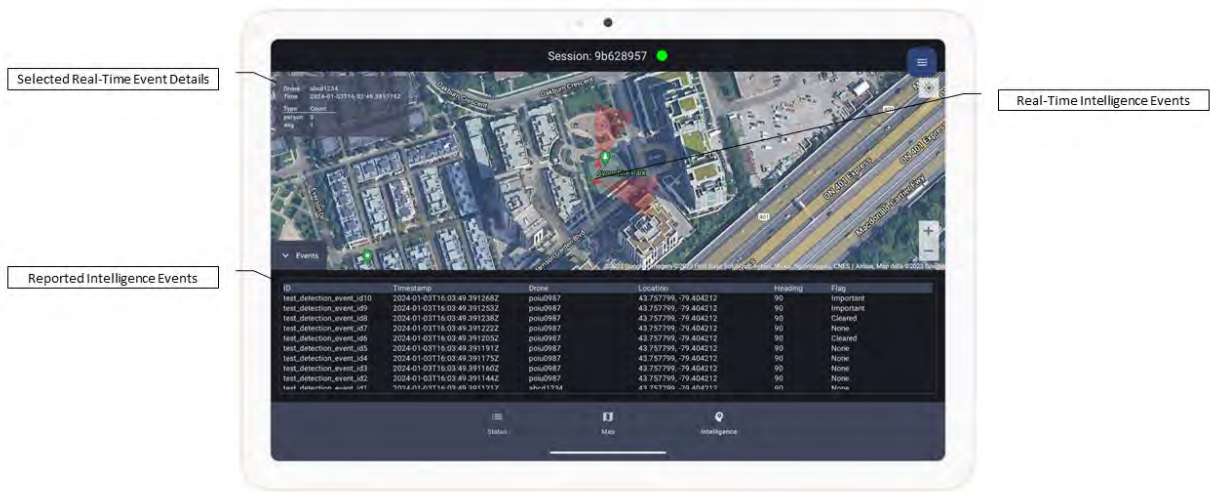
The top part of the Intelligence screen contains a map that displays real-time intelligence events as they are reported from the drones to the SwarmShield Command Center. Only the last intelligence event reported by each drone is displayed on the map. The intelligence event is represented by a red drone icon located and oriented based on the drone's pose at the time of the detection as well as a red camera field-of-view cone positioned and oriented based on the reported camera orientation from intelligence event metadata.

Pressing on the intelligence event on the map opens the event details panel in the top left corner of the map that displays more information about the intelligence event selected.

The bottom part of the Intelligence screen displays the list of all intelligence events reported in the current session, starting from the most recent on top. Scroll the list to view all past intelligence events in the current session. Each event in the list shows the unique identifier of the event, the time of the reported event (in UTC time), the identifier of the drone that reported the event, its location coordinates in latitude and longitude, its heading, and the status of the event.

Pressing on the intelligence event in the list navigates to a new screen that shows the details of that intelligence event.

Reviewing Intelligence Events

Each reported intelligence event in SwarmShield is associated with metadata describing the location of the event and the list of objects of interest detected.

Each event also contains the video frame capture that was processed and caused an intelligence event to be reported.

SwarmShield intelligence events should be reviewed by the SwarmShield commander as they are reported throughout the mission, and after mission completion as part of mission retrospective.

Selecting the intelligence event in the list in the Intelligence screen opens the intelligence event details screen, shown in the picture.
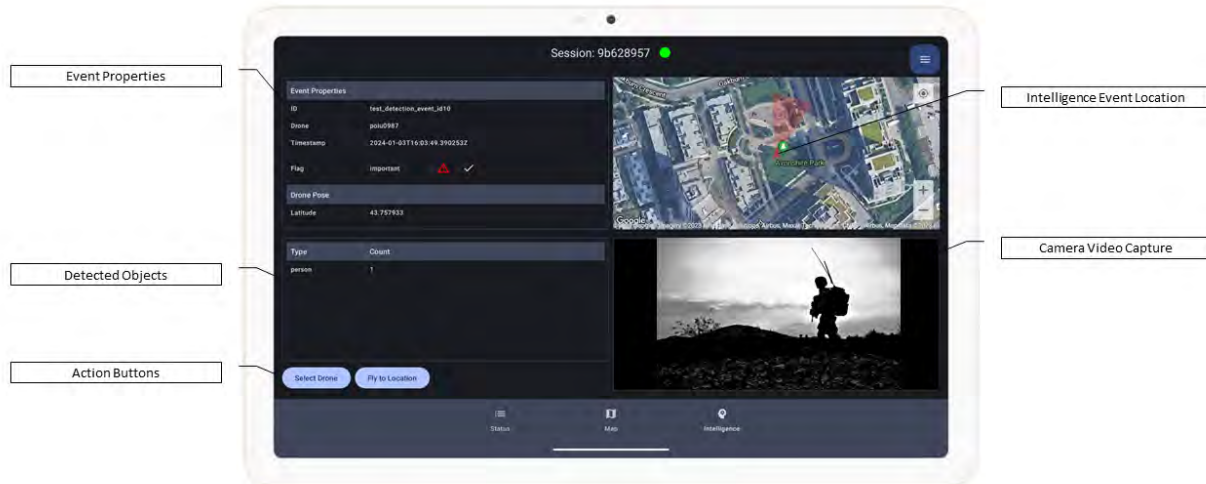
The intelligence event details screen is divided into four quadrants. The top left part displays the intelligence event metadata, including event and drone identifiers, time of the event, drone location, altitude, and orientation, and camera orientation. It also contains the review flag icons.

The bottom left part shows the list of objects of interest that were detected as well as the number of objects of each category that were detected.

The top right shows the location of the drone and camera field of view on the map.

The bottom right of the screen shows the drone camera video frame capture that resulted in the reported intelligence event.

Upon review, an intelligence event can be marked with a review flag. Two types of review flags may be assigned to an intelligence event:

- Important – for events that should be marked as significant and requiring further investigation
- Cleared – for events that do not represent a threat and do not require further investigation.

Pressing the red exclamation mark icon will set the Important flag on the intelligence event.

Pressing the green checkmark icon will set the Cleared review flag on the intelligence event.

Intelligence event review flags can subsequently be used in mission reviews and analysis to assess the progress and outcome of the mission operation.

Actioning on Intelligence Events

If a reported intelligence event in the SwarmShield Command Center is suspected to represent an active threat to a perimeter being secured, you should perform an action to investigate the threat further.

SwarmShield supports two types of actions that can be performed directly from the intelligence review screen.

By pressing the Select Drone button in the bottom left of the screen, SwarmShield Command Center will switch to the Map screen with the drone that reported the intelligence event selected. You may then switch the selected drone to manual navigation mode if you wish and take control of its navigation to explore the area in question further by hand.

Alternatively, pressing the Fly to Location button in the intelligence review screen opens the drone selection dialog that allows you to send one or more drones from the swarm to the location of the intelligence event. The drone selection dialog displays the list of drones currently connected to the swarm that are not in manual navigation mode already, sorted from the drone closest to the intelligence event location. This way, you may select the closest one or two drones and send them to investigate the event.
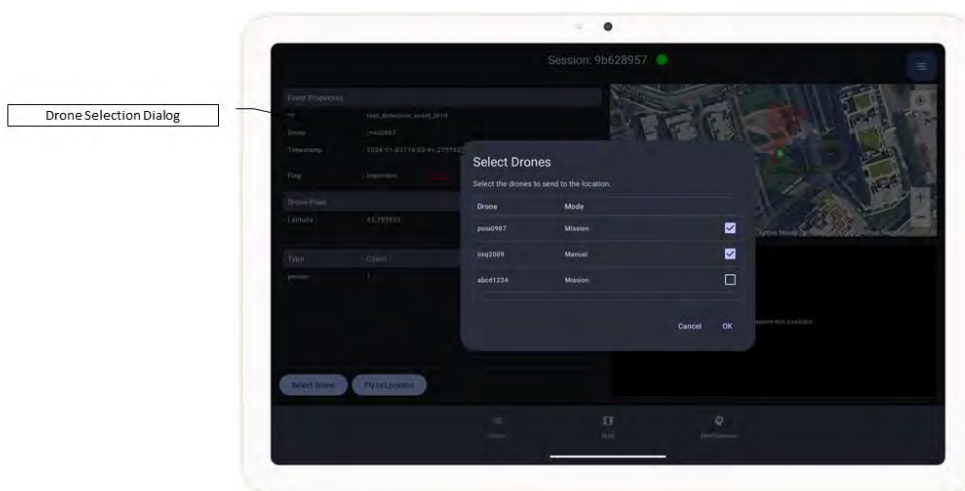

When you select the drones you wish to send to investigate the event and press OK, SwarmShield will automatically dispatch the commands to the selected drones to switch them to manual navigation mode and assign the targets for manual navigation aligned with the intelligence event. Note that the drones sent to investigate an event will be positioned such that they together get an optimal view of the area reported in the intelligence event.

Once you have completed the event investigation, you may switch the drones back to autonomous mission navigation to resume perimeter security surveillance.

Mission Intelligence Retrospective

Upon the completion of a mission operation, you should review the intelligence events reported during the mission.

Navigate to the Mission Management area by selecting the Missions sidebar menu option. Then, select the mission you wish to review from the list. In the Mission screen that opens, scroll to the Intelligence Options section, expand it, and press the Intelligence Events button to open the mission intelligence events screen.
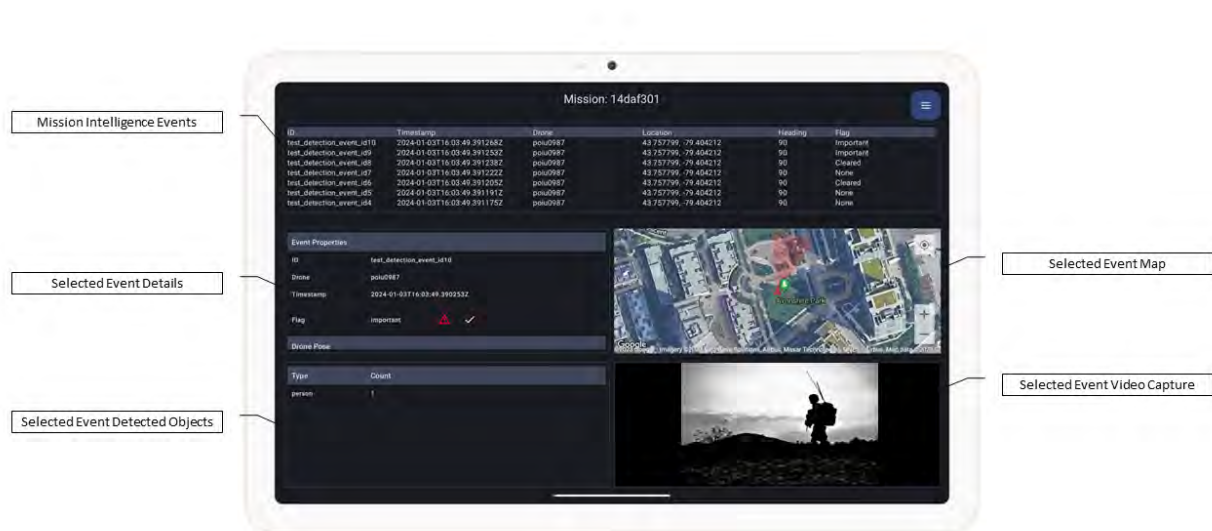
The mission intelligence events screen shows a list of all intelligence events reported in past operations of that mission, from the most recent on top. Scroll the list to see all the intelligence events reported for this mission.

Selecting an intelligence event in the list displays the details of the intelligence event in the bottom part of the screen.

Like intelligence event monitoring and reviews during a mission operation, an intelligence event may be marked with a review flag in this screen.

Settings

SwarmShield Command Center application allows you to configure the behavior of the SwarmShield system through the Settings screen. Navigate to the Settings screen by selecting the Settings sidebar menu option.

The Settings screen contains a series of sections containing different system settings as shown in the picture.

The Session settings section allows you to change the period with which the SwarmShield session is automatically renewed. To increase security, SwarmShield automatically renews internal sessions rotating encryption keys used for internal communication. The default setting is recommended.

The Drone settings section allows you to change the timeout periods for drone state reporting. For most missions, the default setting is appropriate. You may decide to increase the timeout in semi-reliable radio environments.

The Shinobi Integration section is used for configuring direct integration into the Shinobi NVR video surveillance system. For more information on NVR integration, see the NVR Integration section.

The Backup and Restore section allows you to export and import SwarmShield data for backup and restore purposes.

The Data section allows you to purge application data older than 30 days to free up space on the device.

Importing and Exporting SwarmShield Data

SwarmShield Command Center application allows you to export application data and save the export file on the device or upload to Cloud storage of your choice as a backup.

Supported data sets include perimeters and missions.

Session data such as past mission operations, mission logs, and intelligence events are not exported.

Navigate to the Settings screen by selecting the Settings sidebar menu option. Scroll down to the Backup and restore section of the Settings screen.

Pressing the Export App Data button generates the export file and launches the screen to choose the destination where to save the export file, as shown in the picture.
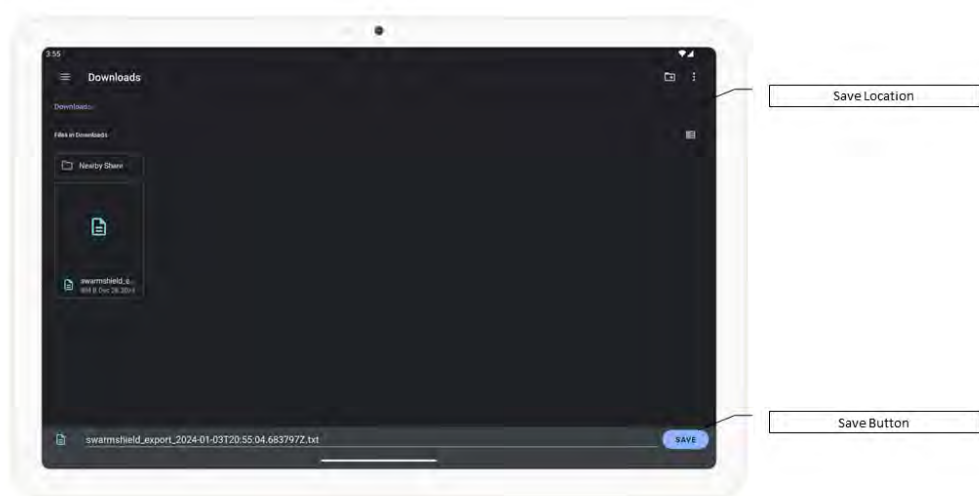
After you choose the location, press the Save button to save the export file. The export file is named swarmshield_export_<timestamp>.txt by default. You may change this file name.

Once you have exported SwarmShield perimeter and mission data to a file, you may import it into the SwarmShield Command Center application at a later time. It is recommended to export mission and perimeter data periodically and store in backup storage in the Cloud. You may import the exported SwarmShield data into the same or new SwarmShield Command Center installation on any device.

To import mission and perimeter data into SwarmShield, open the Settings screen in SwarmShield Command Center by selecting the Settings sidebar menu option. Then, scroll to the Backup and Restore section and press the Import App Data button. A screen will open allowing you to choose the file to import into SwarmShield, as shown in the picture.

Choose a location and select a previously exported SwarmShield file. As soon as you select a file, SwarmShield Command Center application will import the data. When the import is complete a message will be displayed.

Confirm that the perimeters and missions have been imported into SwarmShield by navigating to the Perimeter Management and Mission Management screens and reviewing the list of perimeters and missions in the application.

Note: Importing does not overwrite existing data in the SwarmShield Command Center application but rather adds new entries. If you imported previously exported data into the same SwarmShield Command Center application, you may end up with duplicate entries. Manually inspect and delete duplicate entries.

NVR Video Surveillance Integration

SwarmShield enables implementing a fully autonomous, mobile, drone-based, Artificial Intelligence-supported video surveillance system.

SwarmShield can be seamlessly integrated into existing video surveillance systems using industry-standard protocols.

There are two ways to integrate SwarmShield into an NVR video surveillance system. Manual integration can be done with any industry-leading video security system. Automated integration is supported only for the Shinobi software-based NVR system.

Shinobi is an industry-leading software-based NVR system. It is the recommended NVR for use with SwarmShield. For more information on how to set up Shinobi, see the manufacturer's manual.

Manual Integration

Manual NVR integration involves exporting RTSP video URLs from SwarmShield and configuring them in the NVR system.

When video streaming is enabled for a SwarmShield connected drone, the drone streams the video from its primary camera over the industry standard RTSP protocol. The RTSP URL is protected with auto-generated credentials.

Navigate to the Status screen in SwarmShield Command Center application, press the video link button on the right of a drone entry in the drone list, and press the Start Video button in the dialog to enable the video on a SwarmShield drone. Then, copy or export the generated RTSP URL form the SwarmShield Command Center and configure it in your NVR system as a monitor.

Note: Secret RTSP URLs for each drone remain unchanged across sessions and missions, until manually regenerated from the SwarmShield Command Center.
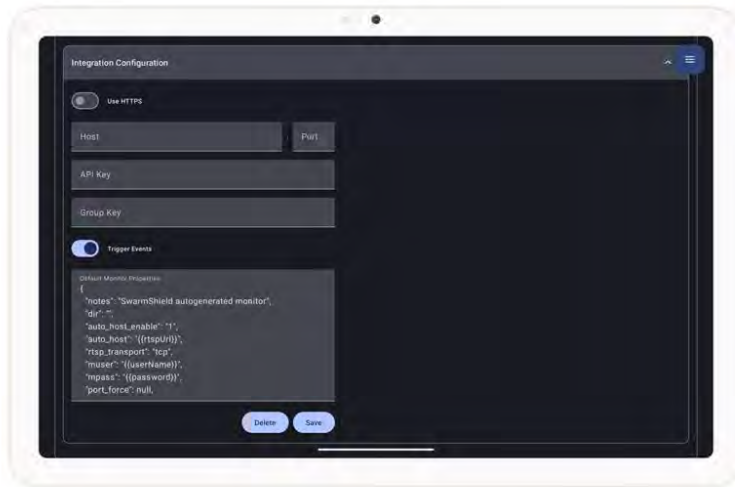
Shinobi Integration

SwarmShield supports direct integration with the Shinobi NVR system via secure REST API.

Automatic API integration with Shinobi allows SwarmShield to automatically configure monitors in the Shinobi NVR system for each SwarmShield drone and to trigger monitor events in Shinobi from SwarmShield intelligence events.

It is recommended to set up and configure Shinobi NVR on a local IP network accessible to the SwarmShield system. Once set up, provision an API key in Shinobi for SwarmShield integration with monitor management permissions.

Then, in the SwarmShield Command Center, navigate to the Settings screen by selecting the Settings sidebar menu option and scroll down to the Shinobi Integration section. Expand the section show the Shinobi integration settings, as shown in the picture.

Configure the hostname or IP address and port where the Shinobi NVR system is set up, the API key that was provisioned in Shinobi for SwarmShield integration and the group key for the Shinobi installation. For details on REST API integration in Shinobi, see manufacturer's manual.

Leave the Trigger Events switch to on if you wish SwarmShield to trigger monitor events in Shinobi from SwarmShield intelligence events.

The Default Monitor Properties field is an advanced configuration option that allows you to change the parameters of Shinobi monitors created from SwarmShield.

Press the Save button and the integration configuration is complete.

Test the integration by running a SwarmShield mission and turning on video for one or more SwarmShield drones. Confirm that the monitors have been automatically created and are displaying live video from SwarmShield drones in Shinobi.

Testing SwarmShield in Simulation Mode

SwarmShield Drone Controller application allows you to test the SwarmShield system operation in simulation mode, i.e. without physically flying the drone.

In order to test SwarmShield in simulation mode, the system must be configured according to instructions in the Initial Setup section. When the system is running in simulation mode, it is fully functional and operating all of its functions with the exception of physical drone flight.

Simulation mode is configured on drone-by-drone basis. To put one of the SwarmShield drones into simulation mode, launch the SwarmShield Drone Controller application on the drone controller device. Make sure the drone and the RC are powered on and connected as described in the Starting a Mission section.

Once the SwarmShield Drone Controller launches, connect to the SwarmShield session by providing the Pin. Once connected, the SwarmShield Drone Controller displays the main application screen with the video feed from the drone's primary camera. Press the menu icon in the bottom right and select the Enable Simulator option from the popup menu.

While in simulation mode, the SwarmShield Drone Controller application will display Simulation On status on the main screen. You may now proceed to perform the SwarmShield mission operation as if the drone was in normal use mode. All flight commands will perform as in non-simulated flight mode, including takeoff, landing, autonomous flight, and manual flight mode.

Note: Due to power usage and battery heating characteristic, simulation mode should only be run for 5 minutes at a time. Power off the drone and RC after completing the test.

Troubleshooting

Check the below table for possible failure modes and suggested resolution steps.

Failure Symptoms	Steps to Troubleshoot and Resolve
DJI drone does not power on	- Check that the drone battery is fully charged - Plug in the DJI drone to charge until the light indicators indicate fully charged - Consult the manufacturer's manual on troubleshooting drone startup issues
DJI RC does not power on	- Check that the RC is fully charged - Plug in the DJI RC to charge until the light indicators indicate fully charged - Consult the manufacturer's manual on troubleshooting RC startup issues
SwarmShield Command Center application does not start	- Check that the command center device is fully charged - Check if the command center device satisfies hardware requirements - If the command center device powers on but the SwarmShield Command Center application does not start, restart the device - Delete and reinstall the SwarmShield Command Center application
SwarmShield Drone Controller application does not start	- Check that the drone controller device is fully charged - Check if the drone controller device satisfies hardware requirements - If the drone controller device powers on but the SwarmShield Drone Controller application does not start, restart the device - Delete and reinstall the SwarmShield Drone Controller application
SwarmShield Drone Controller cannot connect to the SwarmShield session	- Check that the Pin entered is correct, including case and special characters - Check that the drone controller device has good network connectivity and is on the same network as the command center device - Check that the command center device has good network connectivity - Stop and restart the SwarmShield session in SwarmShield Command Center

SwarmShield drone video does not display in the SwarmShield Drone Controller application	▪ Check that the DJI drone and RC are powered on and connected ▪ Check that the SwarmShield Drone Controller application permissions are granted on the drone controller device ▪ Restart the SwarmShield Drone Controller application
Drone appears disconnected in the SwarmShield Command Center	▪ Check that the DJI drone has not crashed ▪ Check that the drone is connected to the DJI RC ▪ Check that the SwarmShield Drone Controller application is running and is connected to the SwarmShield session ▪ Restart the DJI drone ▪ Restart the SwarmShield Drone Controller application
Drone does not respond to flight commands issued from the SwarmShield Command Center	▪ Check that the drone is connected in SwarmShield Command Center ▪ Check that the drone is connected in SwarmShield Drone Controller ▪ Check that SwarmShield Drone Controller application permissions have been granted on the drone controller device ▪ Take over the manual drone control by stopping the SwarmShield Drone Controller application and launching the DJI Fly application on the drone controller device ▪ Return the drone to its takeoff location and troubleshoot
SwarmShield does not report any intelligence events	▪ Check the intelligence options on the Mission screen for the currently active mission and confirm at least one of the object categories is enabled ▪ Check that the drones are connected in SwarmShield Command Center ▪ Land the drones and restart the SwarmShield Drone Controller applications ▪ Reconnect to the SwarmShield session

SwarmShield is developed and sold by 14101316 Canada Inc. (DeepMAV.ai).

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