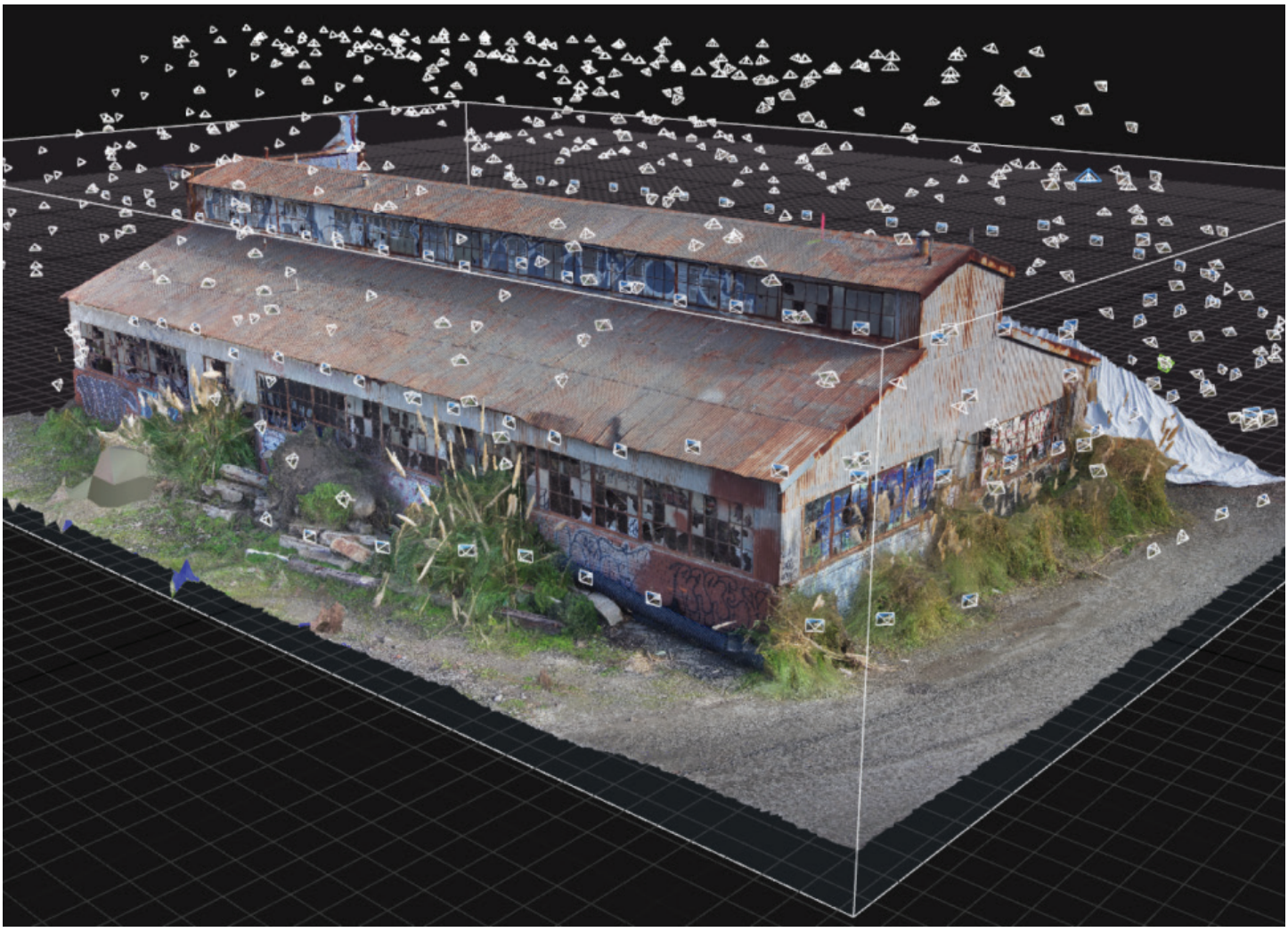
Skydio

SKYDIO 3D Scan™

Operator Manual for Skydio 2 Enterprise



⚠ ***WARNING:*** *READ AND FOLLOW ALL INSTRUCTIONS. FAILURE TO FOLLOW WARNINGS AND INSTRUCTIONS MAY RESULT IN SERIOUS INJURY, PROPERTY DAMAGE, OR PRODUCT FAILURE.*

Updated: **June 9, 2021**
Version: **14.3**

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Skydio 3D Scan™

Skydio 3D Scan™ is first-of-its-kind adaptive scanning software seamlessly incorporated into Skydio Autonomy™. 3D Scan automates data capture of any scene with comprehensive coverage and ultra-high resolution so that crews can perform higher quality inspections in less time and with minimal pilot training.

With an AI-driven workflow, Skydio 2 builds a live 3D model of the scene as it flies and plans a path to image all surfaces with overlap so you get the right data for inspections and photogrammetry. It operates with no reliance on prior maps, magnetometer readings or internet connectivity.

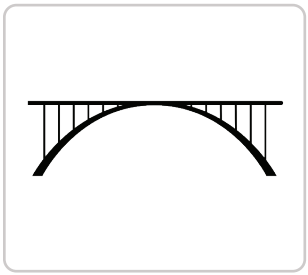
Choose your 3D Scan mode, specify the area to inspect, and Skydio 3D Scan does the rest! It adaptively maps the structure as it flies to guarantee uniform, high-resolution coverage.

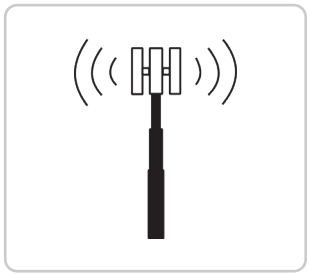
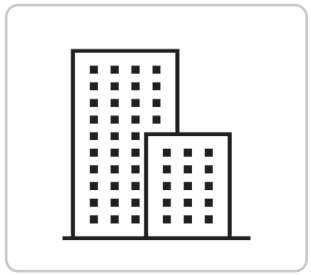
Skydio 3D Scan combines advanced autonomy and photogrammetry software to capture high-resolution models of structures, bridges, and energy infrastructure. There are two different scan modes available with 3D Scan.

3D Capture

Efficiently scan complex structures with 3D Capture. Skydio assesses the scan volume and generates autonomous and adaptive flight patterns to ensure every angle of the structure is captured. Capture data can be used for inspection or to generate high-fidelity 3D models.

3D Capture is best for scanning structures such as bridges, transmission towers, architecture, machinery, telecommunications towers, and vehicles.

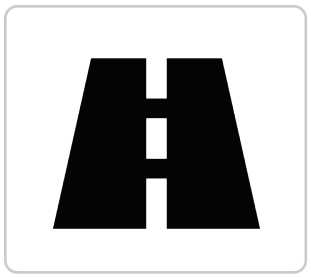


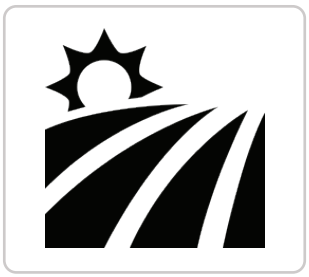



2D Capture

Rapidly cover large areas with 2D Capture scans. 2D Capture is a planar scanning capability that captures imagery for orthomosaic models. This mode supports traditional capture patterns, but with superior obstacle avoidance and the 3D Surface Engine for accurate localization even in GPS-denied environments.

2D Capture is best for wide, flat area mapping. Use 2D Capture when you need a 2D orthomosaic map of areas such as accident sites or farmland. Recommended for area scans up to 400 ft /120 m in altitude.





Getting Started

Before you fly, read the Skydio 2 Enterprise App User Guide to learn how to fly Skydio 2 and understand the full Skydio 2 Enterprise feature set. Ensure both Skydio 2 and the Skydio Controller are fully charged, and your controller is paired to your drone. For more information about those features and Skydio 2, visit skydio.com.

Follow the Skydio Safety and Operating Guide when flying 3D Scan—avoid thin branches, thin wires, and large glass/reflective panes.

Equipment and Software

To fly 3D Scan you will need:

Hardware

- Skydio 2
- Skydio 2 Batteries
- Skydio 2 Controller (optional but strongly recommended, included in Pro Kit)
- 2x UHS Class 3 microSD cards (minimum 128 GB)
- iOS mobile device with 1 GB available storage

NOTE: *We strongly recommend flying 3D Scan with the Skydio 2 Controller to provide more precise control and extend the connection range. Find more information in the Skydio Controller User Guide.*

Software

- Skydio Enterprise app (iOS)
- Skydio Autonomy Enterprise Foundation™ (AEF) software add-on
- Skydio 3D Scan™ software add-on

SD Cards

Skydio 2 requires UHS Class 3 (U3) or faster microSD cards to complete 3D Scans. Skydio 2 cannot scan without properly formatted microSD cards.

1. Media Card
2. Logs Card

NOTE: *We recommend using SanDisk Extreme PLUS (128gb and 256gb).*

Installing SD Cards

If you purchased an Enterprise Pro Kit directly through a Skydio Sales Representative, both the Media Card and Logs Card come pre-installed.

If you obtained your drone online and later purchased 3D Scan™, you will need to purchase a second SD Card and install both cards yourself.

1. Remove the battery from the bottom of Skydio 2.
2. Flip the drone over and locate the Media Card slot. To the right of this, you'll notice a black cover blocking access to the Logs Card. You will need to remove this. Carefully and slowly pull the bottom of the cover toward the camera. This will expose a plastic placeholder for the Logs Card. Gently push inward to dislodge the plastic insert.
3. Insert your SD cards

How to Format Your Logs Card

You must format the Logs Card within the Skydio Enterprise app to fly 3D Scan.

1. Enter 3D Scan Mode. See instructions for changing Vehicle Modes under **How to Enable 3D Scan Mode** on page 10.
2. Open the Skydio Enterprise app and connect to your Skydio 2 via WiFi.
3. Navigate to the **INFO** tab.
4. Select your Skydio 2 from the Devices list, then select **Manage Data**.
5. Tap **Format Logs Card**.

NOTE: *Formatting your Logs Card permanently deletes all flight data from your drone.*

How to Format Your Media Card

To format the Media Card within the Skydio Enterprise app, follow the steps below

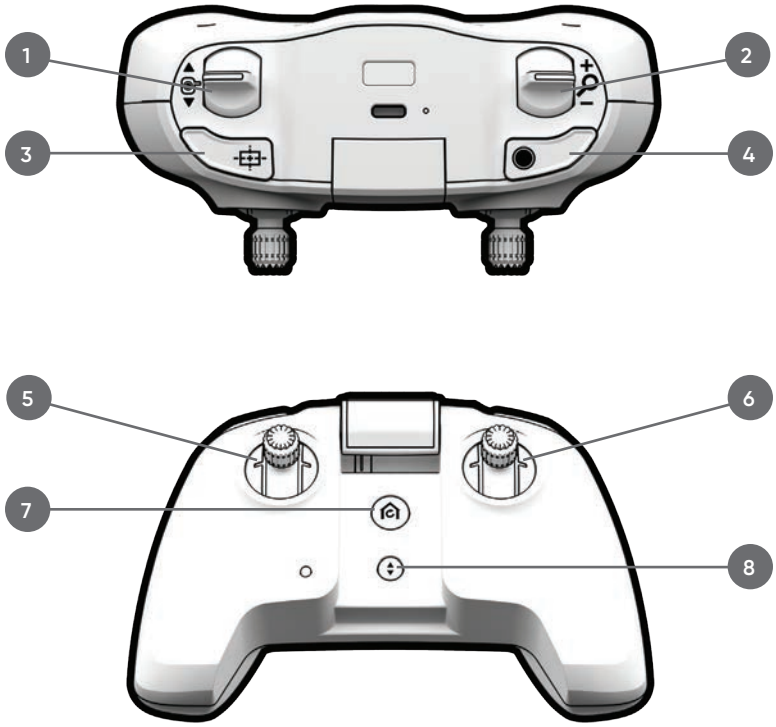
1. Open the Skydio Enterprise app and connect to your Skydio 2 via WiFi.
2. Navigate to the **INFO** tab.
3. Select your Skydio 2 from the Devices list, then select **Manage Data**.
4. Tap **Format Media Card**.

NOTE: *Formatting your Media Card permanently deletes all flight videos, stills, and media files from your drone..*

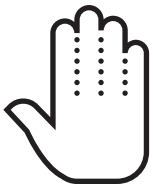
Controls

Move through the scan workflow using the Skydio 2 Controller. The workflow pane will collapse when you are prompted to manually fly and the app will display available Controller shortcuts. Find more information in the Skydio Controller User Guide.

1. **Left Paddle:** Adjusts camera gimbal tilt
2. **Right Paddle:** Minimizes/maximizes the workflow pane
3. **Left Shoulder Button (L):** "DONE" and other controls
4. **Right Shoulder Button (R):** "BEGIN" and other controls
5. **Left Joystick:** Controls vertical movement (throttle) and drone rotation (yaw)
6. **Right Joystick:** Controls horizontal movement
7. **Return to Home Button:** Skydio 2 will fly in a straight path to return to the Launch Point
8. **Launch/Land Button:** Skydio 2 will takeoff and land in its current position

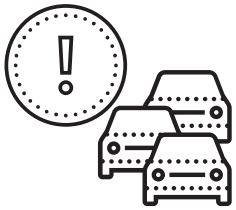


Safety Guidelines



Keep your fingers away from moving propellers at all times.

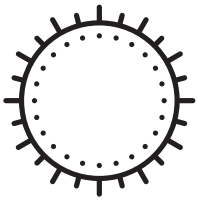
Use caution around thin branches, utility lines, ropes, wires, netting, chain link fencing, etc.



Skydio 2 does not avoid moving objects or cars.

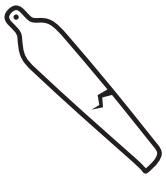
Skydio 2 is not weatherproof – don't fly in rain, snow, fog, high winds, etc.

Fly cautiously over bodies of water more than 30 ft (9.1 m) across.



Don't fly in low-light conditions or in poor visibility

Clean all of the cameras so Skydio 2 can see clearly.



Check your propellers for damage before flying.

Follow all civil aviation authority regulations (U.S. FAA and CASA in Australia,...), as well as any applicable local and federal laws.

- Skydio 2 relies on cameras for navigation—it's essential to keep the camera lenses clean. Use a clean microfiber cloth to ensure that all of the camera lenses are dust and smudge-free before every flight.
- Skydio 2 uses magnets to seat the battery that may attract metallic debris. Visually inspect the magnets and connections prior to flight.
- Inspect batteries for damage. Do not attempt to use batteries that are damaged, dented, or ruptured after a crash or drop. Visually inspect propeller blades for nicks, cracks, or other visible damage. **Never fly with damaged propellers**.

⚠ ***WARNING:*** *Keep your fingers away from the propellers. Attempting to touch the propellers or the drone during flight, launch, or landing has a high risk of severe injury. Exercise caution when holding Skydio 2 in windy environments, as gusts may cause the propellers to spin.*

- When landing, Skydio 2 descends straight down and **does not avoid obstacles**. Ensure your landing area is flat and clear of obstacles. **Stay clear of the landing area to avoid injury.**
- Do not intentionally try to crash Skydio 2.
- Fly indoors with caution in well-lit, large, open areas such as warehouses or gymnasiums. Avoid flying near glass, mirrors, texture-less walls, dark areas, or polished, reflective flooring.
- **Do not fly in temperatures below 23° F (-5°C) or above 104°F (40°C).** Endurance may be degraded when operating near temperature limits.
- When flying in temperatures below 32°F (0°C), ensure your batteries are room temperature (50°F / 10°C) prior to takeoff.
- Do not fly Skydio 2 in high winds or gusts above 25 mph (40 km/h). Skydio 2 will automatically Return to Home (RTH) if it is too hot.
- **Skydio 2 is not weatherproof** and requires good visibility. Do not fly in any precipitation, including rain, fog, or snow.
- Do not fly over bodies of water more than 30 ft (3 m) across.
- **Do not fly around thin branches, telephone or power lines, ropes, netting, wires, chain link fencing or other objects less than .5 in (1.27 cm) in diameter.**
- Skydio 2 only avoids obstacles that are **not** in motion. Cars, boats, balls, animals, other drones, other people, or similar moving objects may not be avoided. **You should exercise extreme caution and good judgment when flying near people.**
- Do not fly around transparent or reflective surfaces such as windows or mirrors greater than 23 in (58 cm) wide.
- If your Skydio 2 strikes an obstacle it will attempt to stabilize and continue the flight.
- When the sun is low on the horizon, it can temporarily blind the cameras depending on the drone's angle. Your drone may be cautious or jerky when flying directly toward the sun.
- Skydio 2 flight speed is ~36 mph/58 km/h (ground speed) or 25 mph/40 km/h (air speed) under most conditions.
- **Standard obstacle avoidance is enabled when Skydio 2 is autonomously executing a 3D Scan.** Close, Minimal, or Disabled obstacle avoidance is only accessible when manually capturing photos.
- Skydio 2 will alert you if it encounters an error or determines the environment is not safe for flying. When instructed to do so, immediately fly Skydio 2 to the safest area and land.
- Flying at high altitudes may significantly increase the time required to return and safely land. The pilot in command is responsible for managing altitude, range, and battery level at all times. Monitor in-app messages and alerts.
- **Skydio 2 is NOT A TOY** and should not be used or handled by a person under the age of 18.

Go to https://skydio.com/safety and https://skydio.com/support for more information and helpful tips, videos, and articles.

Where to fly

- You are responsible for your Skydio 2 at all times. **Follow all local civil aviation authority regulations (ex: the FAA in the US and CASA in Australia), as well as any applicable local and federal laws.**
- **Before every flight, you must ensure that you are authorized to fly in the airspace** using airspace awareness services, such as the B4UFLY app, knowbeforeyoufly.org, and b4ufly.kittyhawk.io/. If you are located in Australia, check a CASA-verified drone safety app or website before flying.
- **DO NOT enter restricted airspace**, which may include sporting events and other public gatherings, without express authorization from the relevant civil aviation authority. If you have any doubt whether you are able to fly, **do not fly**.
- Flight in U.S. controlled airspace requires FAA authorization. Visit **FAA LAANC** for more information.
- **DO NOT** fly directly over people or crowds.
- **Keep Skydio 2 within visual line of sight at all times,** unless you have received express permission to fly beyond visual line of sight from a civil aviation authority such as the FAA.

How to Enable 3D Scan Mode

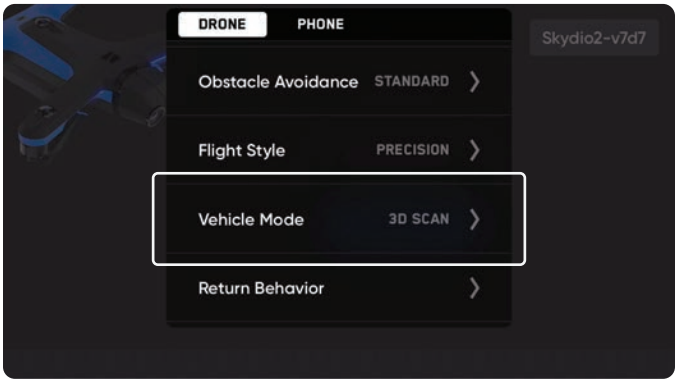
Change Vehicle Mode

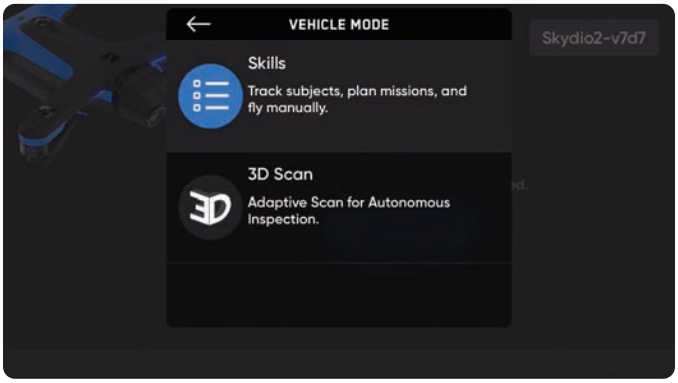
Before starting a 3D Capture or 2D Capture, the drone must first reboot to enter the 3D Scan Mode. Skydio 2 will remember your operating mode through power cycles, so you will only have to do this when switching between 3D Scan and other Flight Skills.

STEP 1: Enter 3D Scan mode

To change operating modes, you must enter 3D Scan while on the ground and connected to the drone.

Navigate to **Device Settings** > **Drone** > **Vehicle Mode** > **3D Scan**.

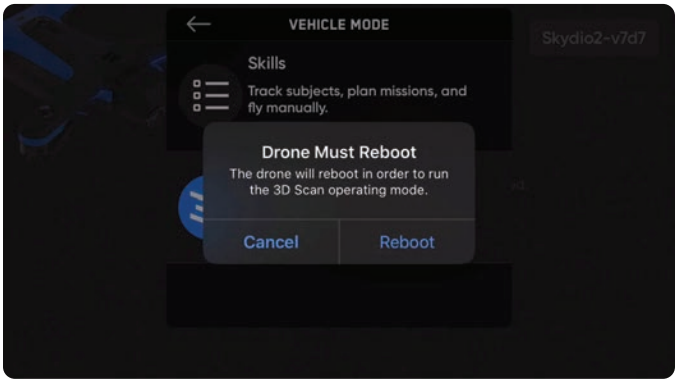




STEP 2: Drone automatically reboots

Select **Reboot**—Skydio 2 will automatically restart. This should take about one minute.

After rebooting, Skydio 2 will reconnect to your controller and mobile device.



STEP 3: Begin flight

After Skydio 2 has finished entering 3D Scan, you are ready to fly! Ensure your Logs Card has been formatted before starting a scan. If you have not yet done so, a notification will display in the app. See the above **SD Card** section in **Getting Started** on page 5 for instructions on how to format.

Press **Start Scan** and select **Agree** to the disclaimer, acknowledging that you will comply with all relevant laws and FAA regulations.

NOTE: *You must exit 3D Scan to regain access to Flight Skills. To exit, first land the drone. Navigate back to the Device Settings Menu and change the Vehicle Mode to Skills.*

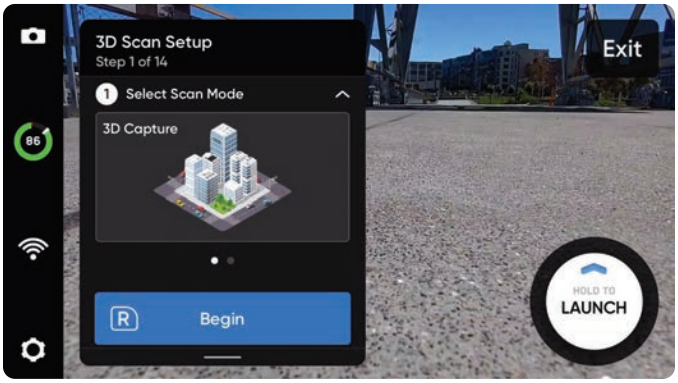
3D Capture Workflow

Before you fly

- GPS will be required for scans higher than 65 ft (20 m).
- If needed, you can move backwards and re-do any steps in the workflow. Doing so will reset the steps you have already completed and discard any media that has been captured. You will not be charged for discarded media.

STEP 1: Select Scan Mode

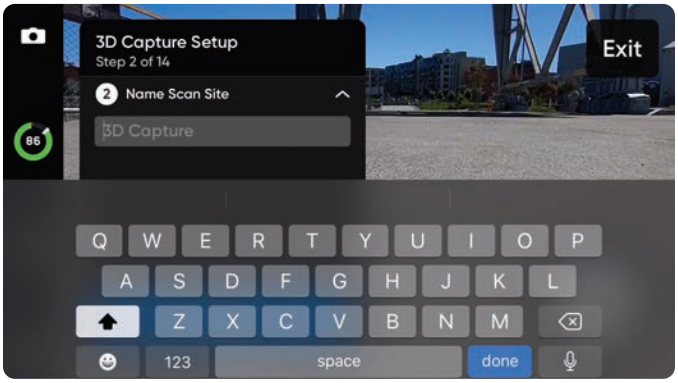
Select 3D Capture as the Scan Mode. Tap Begin on the screen or use the right shoulder button on the Controller.



STEP 2: Name Scan Site

After selecting Begin, you may optionally rename your scan. The default scan name is composed of the scan mode you select followed by a UTC timestamp. Renaming the scan will replace the scan mode.

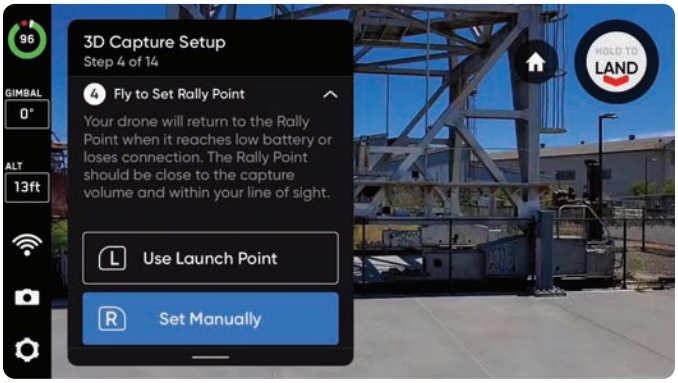
Ex: 3D_Capture__2021-05-20T19-50-55.135854+00-00



STEP 3: Launch

Select and hold the **LAUNCH** button to begin your flight. The drone will automatically climb to 16 ft (5 m) and hover.

STEP 4: Set Rally Point



Upon completing its mission, Skydio 2 will return to the Rally Point. Additionally, when the battery level is low or the drone loses connection, Skydio 2 will return to the Rally Point.

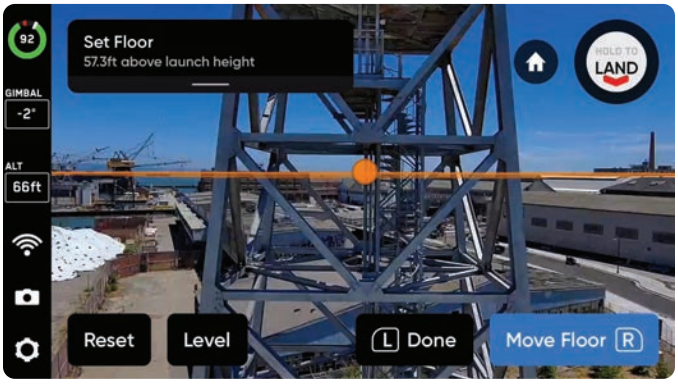
To set your Rally Point, select one of the following options:

- **Use Launch Point** – drone will return to the take-off location instead of a manually set Rally Point.
- **Set Manually** – allows you to use Skydio Controller to manually pilot the drone to a new location.

Tips for setting a Rally Point:

- The Rally Point should be in your line of sight with a clear path to the Launch Point.
- Set your Rally Point close to the scan region so that the drone can safely and easily return to that point autonomously. Even if you change position during the scan, the drone will always have a point to return to safely without obstruction.

STEP 5: Set Scan Floor



The Floor defines the bottom of the 3D volume you wish to scan. It will also define the bottom of your scan in the **Visual Geofence** (see page 20) and the **Edge Model Viewer** (see page 36).

If launching from the ground, the Floor is automatically set to include the ground. The workflow pane will collapse to show a full-screen view of the Floor AR. You may either drag the orange dot or fly to set the Floor.

NOTE: *By default the Floor is set to 6.5 ft (2 m) below the Launch Point. If taking off from the ground, this means that the ground will be included in your scan—this does not mean that the drone will try to fly underground to complete your scan.*

- **Move Floor** – Moves the location of the Floor to the current altitude of the drone
- **Done** – Sets the Floor in your desired location and proceeds to the next step
- **Level** – Moves the camera gimbal pitch to 0°
- **Reset** – Sets the Floor back to default

STEP 6: Set Scan Ceiling

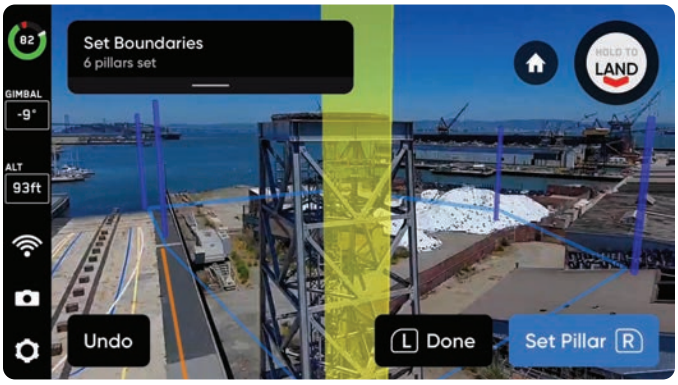
The Ceiling defines the top of the 3D volume you wish to scan. It will also define the top of your scan in the **Visual Geofence** (see page 20) and the **Edge Model Viewer** (see page 36). The Ceiling needs to be set above the structure you plan to scan.

By default, the Ceiling is set to 9.8 ft (3 m) above the Launch Point, or 16 ft (5 m) above the Floor. The workflow pane will collapse to show a full screen view of the Ceiling AR. You may either drag the green dot or fly to set the Ceiling.

NOTE: *To adjust the Ceiling, select Move Ceiling prior to selecting Done.*

- **Move Ceiling** – Moves the location of the Ceiling to the current altitude of the drone
- **Done** – Proceeds to the next step
- **Level** – Moves the camera gimbal pitch to 0°
- **Reset** – Sets the Ceiling to 16 ft (5 m) above the user-defined Floor

STEP 7: Set Lateral Pillar Boundaries



Set AR pillars to encompass the structure to be scanned. These pillars define the lateral bounds for the **Visual Geofence** (see page 20). It will also define the lateral area of your model in the **Edge Model Viewer** (see page 36).

To set pillars, fly to the desired location and use the right shoulder button to select Set Pillar. Continue placing pillars until the desired structure is encompassed. A minimum of 3 pillars must be set to create a 3D volume.

Edges of the polygon defined by the pillars must not cross each other in order to proceed.

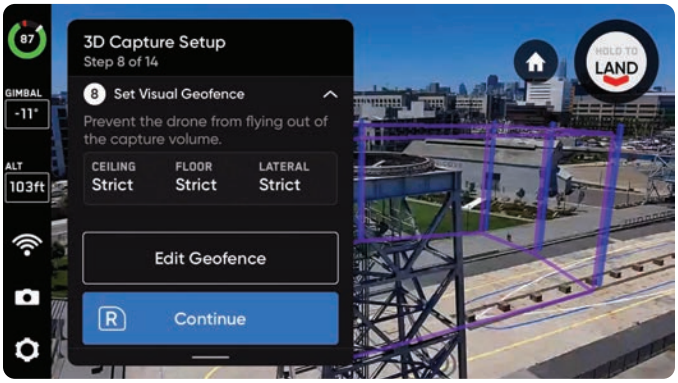
- **Set Pillar** – Adds a new bounding pillar
- **Undo** – Removes the previous bounding pillar
- **Done** – Completes this step and sets the pillars where you've added them

TIP: *Try adjusting the angle of the camera gimbal for a better view of where you are placing pillars.*

STEP 8: Set Visual Geofence

Enables a strict geofence around the scan volume. The Visual Geofence uses the drone's visual navigation system to always enter and exit the 3D volume from the same location.

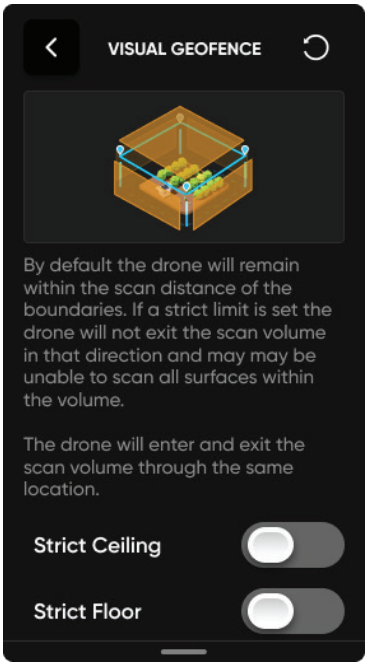
Skydio 2 will honor the Visual Geofence during the Explore phase and the scanning process, as well as when transitioning between the two. For more details, read the **Visual Geofence** section on page 20.



To set the Visual Geofence, independently toggle strict or default geofence settings: **Ceiling, Floor,** and **Lateral**. By default, Skydio 2 will remain within the scan distance of the boundaries.

Enabling a strict geofence means each geofence blocks flight outside of the scan volume along that bound. The drone will continue to enter and exit the scan volume through the same location.

NOTE: *Skydio 2 will skip image capture locations that are located outside any of the toggled geofence boundaries. This may result in gaps in coverage.*

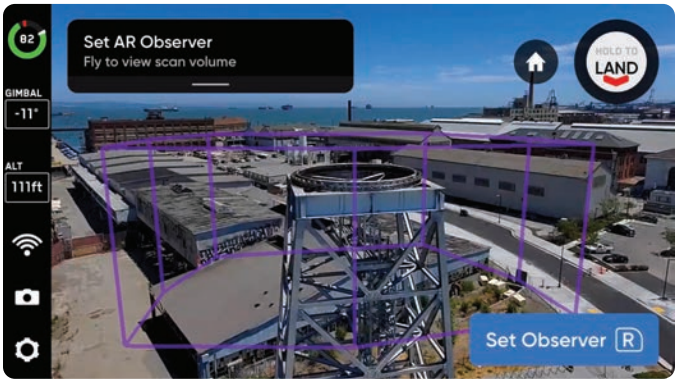


STEP 9: Set AR Observer

Set the perspective from which you'll observe the progress of your scan in augmented reality (AR). You may set the AR Observer two ways:

- **Review Suggestion** means Skydio 2 will fly to the ceiling of the pillar closest to the takeoff position. The drone will then face the structure (the centroid of the AR polygon-prism). **We recommend selecting this option.**
- **Set Manually** allows you to manually pilot the drone to your preferred vantage point, using the Skydio Controller. If you choose to manually set the location of the AR Observer, ensure you are choosing a spot that provides you with the best situational awareness for monitoring the scan's progress. **For best performance, fly no more than 10m from the scan volume and tightly frame the structure.** Fill the frame vertically or horizontally.

  NOTE: *The AR Observer point is used to reorient the drone after completing a battery swap and resuming the scan. Ensure the drone has a clear path between the Launch Point, Rally Point (if set manually) and AR Observer point.*



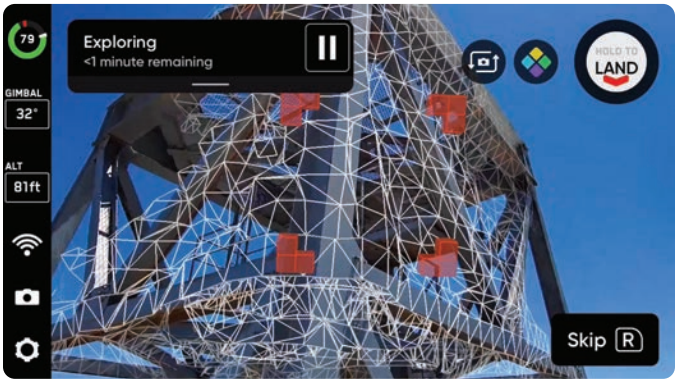
The white lines denote the planned path of the drone

Toggle to switch between the static AR Observer image and the drone's camera feed at any time during the scan.

STEP 10: Explore

In this step the drone will briskly (5.5 mph; 9 km/h) and autonomously fly around the scan volume to build an internal model of the structure being scanned. Skydio 2 uses this internal model to intelligently predict overall scan time and number of capture points needed to complete the scan.

The explore phase should be a small fraction of the total scan time, and a rough time estimate is given.



STEP 11: Review or Edit Settings

View a summary of your scan settings, plus estimates for the total scan time, number of batteries needed and total number of photos. Review your current settings and make any edits before the scan begins. Editing scan settings will impact the total flight time, number of photos and the required number of batteries. See **3D Capture Settings** on page 21 for more guidance.

Scan settings persist across scans. Select the Reset button in the top right corner to restore settings to defaults.

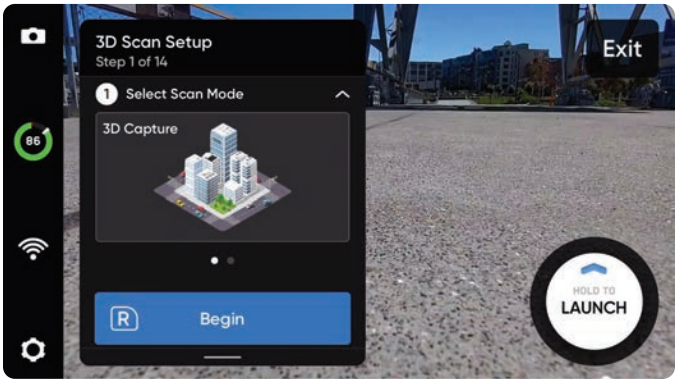
Once your settings are finalized, you may select **Begin Scan** and Skydio 2 will begin autonomously scanning the structure.

STEP 12: Scan

Optionally toggle on the AR Coverage Mesh during your scan to monitor the photo coverage progress of the scan. Learn more about this feature in the **AR Coverage Mesh** section on page 19.

Your scan may require using several batteries to complete. For more information, see **Scanning with Multiple Batteries** on page 33.

You may pause at any point during your scan. Use the left shoulder button or tap the ⏸ icon in the workflow pane to pause scanning. Skydio 2 will display how many photos have been captured. While paused, you have the option to manually capture photos using the right shoulder button. To resume autonomous scanning, use the left shoulder button or press the ▶ icon. Use the right shoulder button during a scan to Skip the next capture point.

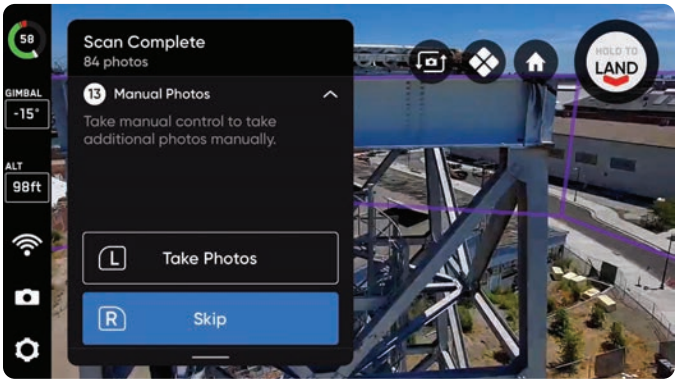


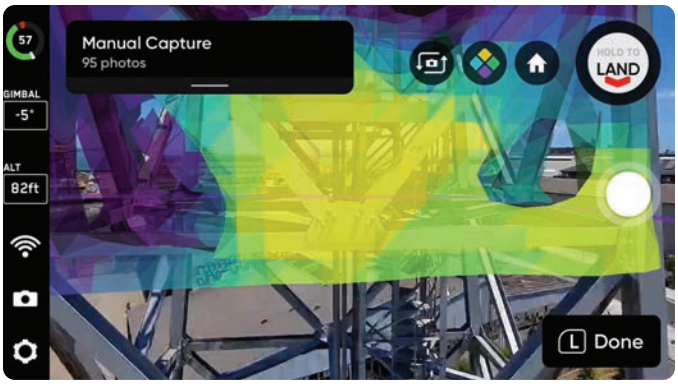
STEP 13: Manually Capture Photos (optional)

Once your scan completes, you will be given the option to manually capture more photos of the scene or details of specific areas of interest. Use the right shoulder button to take a photo. Manual photos will show up in the scan folder and in the Edge Model Viewer alongside the autonomously captured photos.

NOTE: *Manual photos may be captured at any time by pressing pause. You may also optionally enable interval mode to have the drone take photos at different time intervals (ex: capture a photo every 5 seconds).*

Obstacle Avoidance set to Standard—and cannot be changed—when Skydio 2 flies autonomously. If you are manually piloting the drone, you have the option to adjust your obstacle avoidance setting within the Device Settings menu.





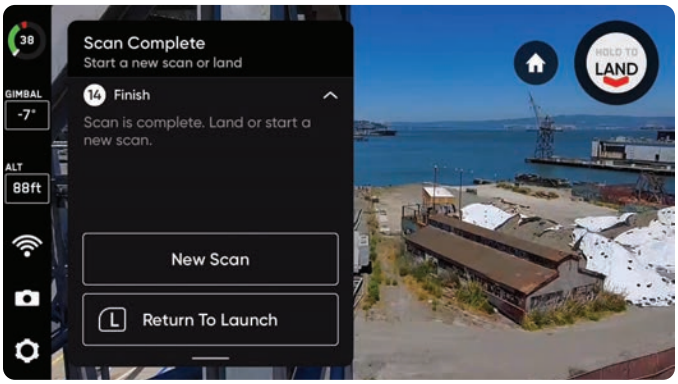
STEP 14: Scan Complete

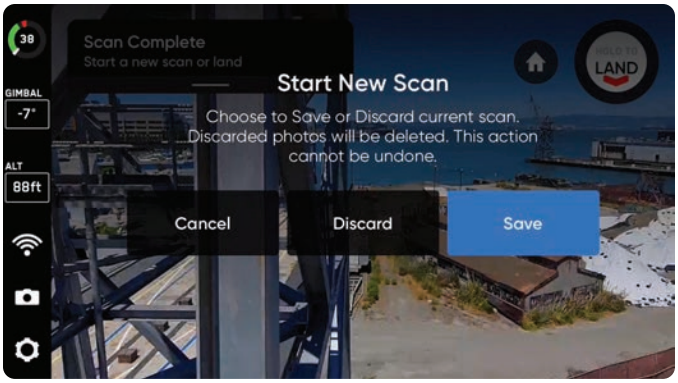
Once Skydio 2 finishes its scan, the drone will return to the Scan Start Point. From here, you will have the option to start a new scan or return to the Launch Point/Rally Point.

NOTE: *Starting a new scan will prompt you with an option to save or discard the scan you just completed.*

After landing, you will see a summary of your scan and the option to save the scan you completed. Select **Save** and wait for the drone to complete post-flight tasks. This is an important step to ensure your media is grouped by scan and can be viewed in the Skydio Edge Model Viewer. **Do not remove the battery or power off during post-flight tasks.** Doing so will result in loss of data.

You will see **Processing Scan**, followed by **Task Queue** and finally **Calibrating**. **Do not power off or disconnect from the drone until you return to the Ready to Fly screen**.





AR Coverage Mesh

The AR Coverage Mesh allows you to monitor the photo coverage progress of your scan. Tap the icon to display real-time AR photo coverage of your scan.

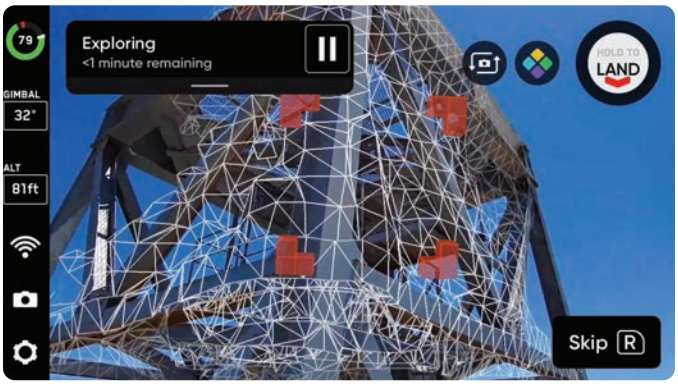
Ensure coverage of key areas and enable the AR Coverage Mesh:

- During the Explore phase
- Live while scanning
- When viewing the scan in the AR Observer
- During manual capture

Yellow indicates minimal coverage and purple indicates full coverage based on your chosen overlap settings.

NOTE: *Images are not captured during the explore phase, but the coverage mesh will show the low-poly map building process.*

AR Coverage Mesh toggled on during scan



AR Coverage Mesh wireframe toggled on during the Explore step

Visual Geofence

The Visual Geofence gives you the ability to further constrain the drone to a safe flight area while scanning autonomously. By default, the drone will remain within an area defined by the scan volume and the scan distance.

The Visual Geofence uses the drone's visual navigation system to always enter and exit the 3D volume from the same location without the use of GPS. Skydio 2 will honor the Visual Geofence during the Explore phase and the scanning process, as well as when transitioning between the two.

This setting gives you the ability to toggle on or off three independent visual geofences: Ceiling, Floor, and Lateral. When enabled, each geofence blocks flight outside of the scan volume along that plane. If an image capture point is located outside of a toggled fence boundary, Skydio 2 will not fly there and instead skip those capture points.

- **Ceiling** uses the maximum height geofence
- **Floor** uses the minimum height geofence
- **Lateral** uses the lateral (pillars) geofence

NOTE: *For example, when scanning a bridge, toggle the Ceiling geofence to avoid flying over the bridge deck; if you are scanning close to private property, toggle the Lateral geofence to avoid flying over the property.*

3D Capture Settings

Settings will persist between scans and between flights. If you would like to restore settings back to default, select the reset button in the top right on the workflow pane during the Review or Edit Settings steps of a scan.

Distance to Surface

Determines how close the drone will fly to the structure or area being scanned. Smaller distance to surface (closer) means more photos taken and higher resolution, but an increased total scan time. The Distance to Surface corresponds directly to Ground Sample Distance (GSD) which defines the distance between two consecutive pixel centers on the ground. For example, a one-millimeter GSD would suggest that the distance of the two consecutive pixel centers in the photo reflects one millimeter on the ground.

NOTE: *The minimum surface distance is 1.5 m for 3D Scan.*

GSD at various fixed Distance to Surface

DISTANCE TO SURFACE (FT)	DISTANCE TO SURFACE (M)	SKYDIO 2 GSD (MM)
5	1.5	0.632
8	2.4	1.011
12	3.7	1.558
15	4.6	1.938
20	6.1	2.568
25	7.6	3.851

Overlap Percentage

Overlap between photos along a path. The default overlap is 80% for complex scenes. For example use cases, review the **Suggested 3D Capture Settings** on page 23.

Sidelap Percentage

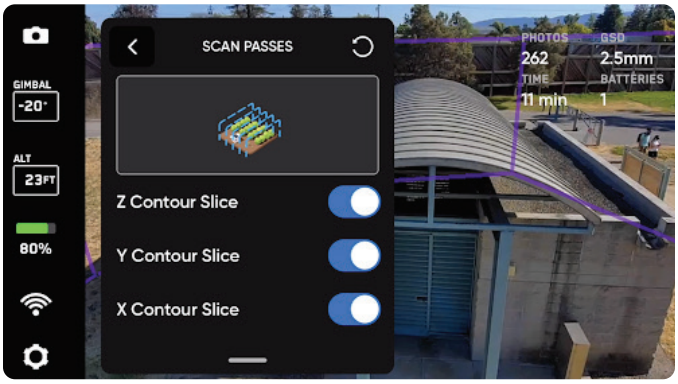
Sidelap between two adjacent flight paths. The default sidelap is 70% for complex scenes. For example use cases, review the **Suggested 3D Capture Settings** on page 23.

Scan Passes

Organizes the capture path into three continuous slices, Z, Y, and X. The Z slices are completed first and resemble orbits at fixed heights going around the structure. The X and Y slices follow and resemble a cross hatch pattern.

We recommend leaving all three slices enabled. You have the option to independently toggle each of the scan slices as needed. If all three slices are disabled, the drone will enter Manual Capture mode.

NOTE: *Toggle on only the Z scan pass for faster scans around structures that do not need to be viewed from above.*

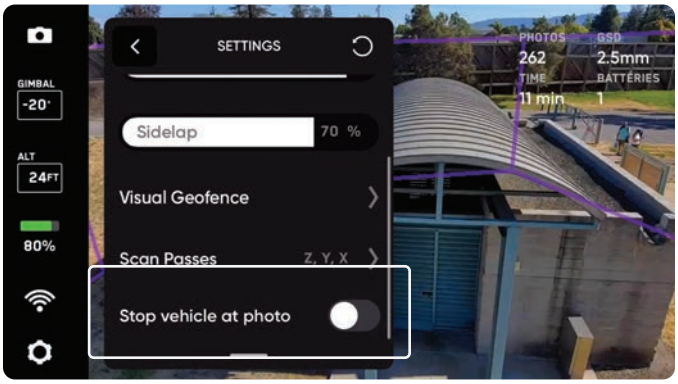


Stop Vehicle at Photo

By default, the drone will fly through image capture points without stopping for smooth and efficient flight. Skydio 2 will automatically set the best speed to capture photos based on your scan distance and lighting conditions, while ensuring your images remain crisp and clear.

- 2 m distance = 0.28 m/s photo speed
- 4 m distance = 0.56 m/s photo speed
- 8 m distance = 1.12 m/s photo speed

Toggle on **Stop vehicle at photo** if you would like Skydio 2 to stop before capturing a photo at each capture point. The drone will still accelerate between capture points. Enabling this setting significantly increases the amount of time and batteries required to complete your scan.



Suggested 3D Capture Settings

Default settings are optimized for 3D reconstruction.

If your objective is only to capture highly detailed imagery (without later processing), you can decrease the overlap and sidelap percentages (e.g. 30/30) to significantly speed up scan time.

Example GSD Settings

INDUSTRY	USE CASE	ASSET TO SCAN	ARTIFACTS TO DETECT	PRECISION REQUIREMENT (GSD)
Construction	Progress assessments, inventory management (volumetrics), site survey	Equipment inspections	Asset damage, misalignment vs. tolerance across subcontractors	Up to 1 centimeter
Transportation	Bridge inspection	Bridges, roads, railroad tracks	Cracks and delamination in concrete, bolts, nuts, connection points in weight bearing areas	Sub-millimeter to 5 mm
Utilities	Actionable transmission and distribution data	Power plants, transmission lines, oil pipelines	Rust and loose/missing retaining hardware	Up to 0.5 centimeter

Use Case Example: Key Requirements for Bridge Inspection

DISTANCE TO SURFACE	Set to achieve 1-2 centimeter precision (GSD)
OVERLAP/SIDELAP	80% / 80% overlap/sidelap of all angles, particularly the underside of the bridge

Use Case Example: Key Requirements for Transmission & Distribution Inspection

DISTANCE TO SURFACE	Set to achieve up to 0.5 centimeter precision (GSD)
OVERLAP/SIDELAP	30%/30% overlap/sidelap from multiple angles of the tower infrastructure

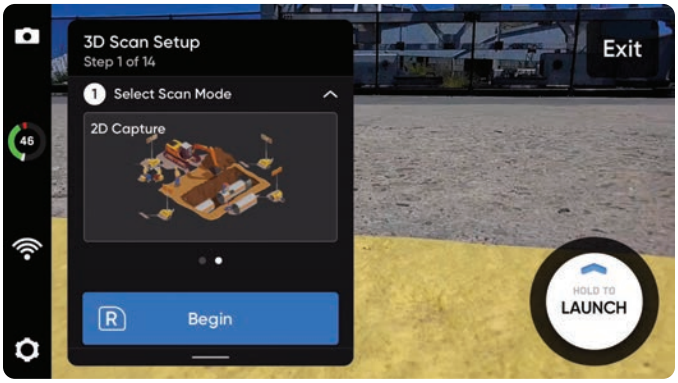
2D Capture Workflow

Before you fly

- GPS will be required for scans higher than 65 ft (20 m).
- If needed, you can move backwards and re-do any steps in the workflow. Doing so will reset the steps you have already completed and discard any media that has been captured. You will not be charged for discarded media.

STEP 1: Select Scan Mode

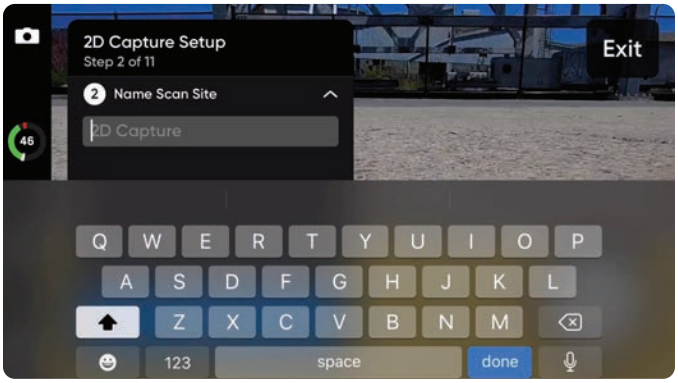
Select 2D Capture as the Scan Mode. Tap Begin on the screen or use the right shoulder button on the Controller.



STEP 2: Name Scan Site

After selecting Begin, you may optionally rename your scan. The default scan name is composed of the scan mode you select followed by a UTC timestamp. Renaming the scan will replace the scan mode.

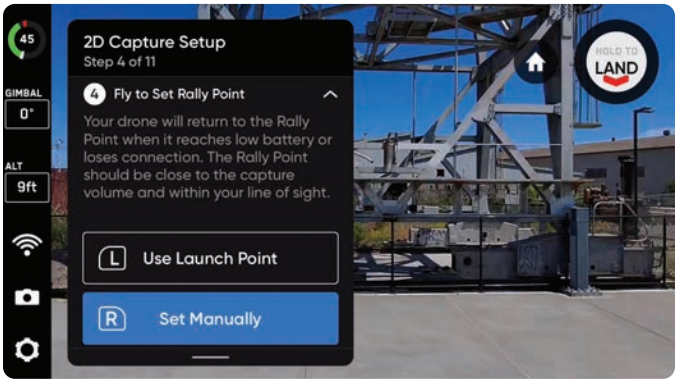
Ex: 2D_Capture__2021-05-20T19-50-55.135854+00-00



STEP 3: Launch

Select and hold the **LAUNCH** button to begin your flight. The drone will automatically climb to 16 ft (5 m) and hover.

STEP 4: Set Rally Point



Upon completing its mission, Skydio 2 will return to the Rally Point. Additionally, when the battery level is low or the drone loses connection, Skydio 2 will return to the Rally Point.

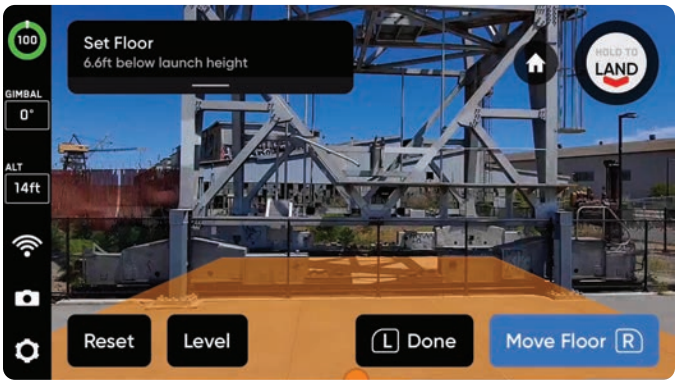
To set your Rally Point, select one of the following options:

- **Use Launch Point** – drone will return to the take-off location instead of a manually set Rally Point.
- **Set Manually** – allows you to use Skydio Controller to manually pilot the drone to a new location.

Tips for setting a Rally Point:

- The Rally Point should be in your line of sight with a clear path to the Launch Point.
- Set your Rally Point close to the scan region so that the drone can safely and easily return to that point autonomously. Even if you change position during the scan, the drone will always have a point to return to safely without obstruction.

STEP 5: Set Scan Floor



The Floor defines the bottom of the area you wish to scan. It will also define the bottom of your reconstructed model in the **Edge Model Viewer** (see page 36).

If launching from the ground, the Floor is automatically set to include the ground. The workflow pane will collapse to show a full-screen view of the Floor AR. You may either drag the orange dot or fly to set the Floor.

NOTE: *By default the Floor is set to 6.5 ft (2 m) below the Launch Point. If taking off from the ground, this means that the ground will be included in your scan—this does not mean that the drone will try to fly underground to complete your scan.*

- **Move Floor** – Moves the location of the Floor to the current altitude of the drone
- **Done** – Sets the Floor in your desired location and proceeds to the next step
- **Level** – Moves the camera gimbal pitch to 0°
- **Reset** – Sets the Floor back to default

STEP 6: Set Scan Ceiling

The Ceiling defines the top of the area you wish to scan.

By default, the Ceiling is set to 9.8 ft (3 m) above the Launch Point, or 16 ft (5 m) above the Floor. The workflow pane will collapse to show a full screen view of the Ceiling AR. You may either drag the green dot or fly to set the Ceiling.

NOTE: *To adjust the Ceiling, select Move Ceiling prior to selecting Done.*

- **Move Ceiling** – Moves the location of the Ceiling to the current altitude of the drone
- **Done** – Proceeds to the next step
- **Level** – Moves the camera gimbal pitch to 0°
- **Reset** – Sets the Ceiling to 16 ft (5 m) above the user-defined Floor

STEP 7: Set Lateral Pillar Boundaries

Set AR pillars to encompass the area to be scanned. The pillars bound the area laterally. It will also define the lateral area of your reconstructed model in the **Edge Model Viewer** (see page 36).

To set pillars, fly to the desired location and use the right bumper to select **Set Pillar**. Continue placing pillars until the entire area is encompassed. A **minimum of 3 pillars must be set** to create an area boundary.

Edges of the polygon defined by the pillars must not cross each other in order to proceed.

- **Set Pillar** – Adds a new bounding pillar
- **Undo** – Removes the previous bounding pillar
- **Done** – Completes this step and sets the pillars where you've added them

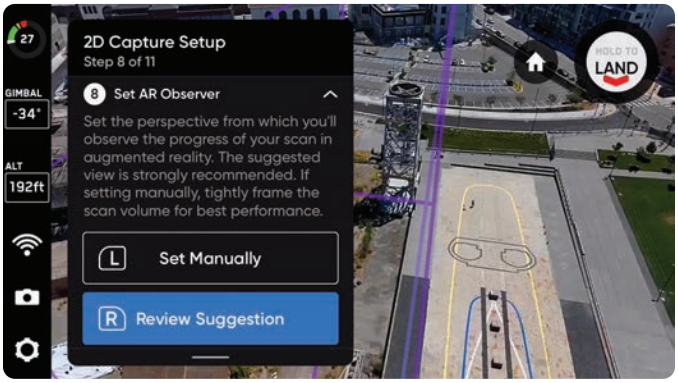
TIP: *Try adjusting the angle of the camera gimbal for a better view of where you are placing pillars.*

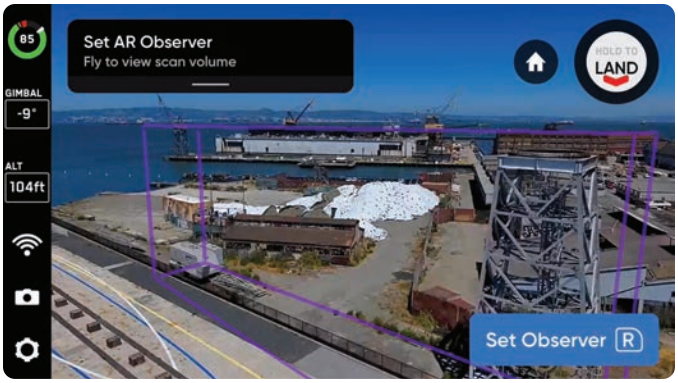
STEP 8: Set AR Observer

Set the perspective from which you'll observe the progress of your scan in augmented reality (AR). You may set the AR Observer two ways:

- **Review Suggestion** means Skydio 2 will fly to the ceiling of the pillar closest to the takeoff position. The drone will then face the structure (the centroid of the AR polygon-prism). **We recommend selecting this option.**
- **Set Manually** allows you to manually pilot the drone to your preferred vantage point, using the Skydio Controller. If you choose to manually set the location of the AR Observer, ensure you are choosing a spot that provides you with the best situational awareness for monitoring the scan's progress. **For best performance, fly no more than 10m from the scan volume and tightly frame the structure.** Fill the frame vertically or horizontally.

  NOTE: *The AR Observer point is used to reorient the drone after completing a battery swap and resuming the scan. Ensure the drone has a clear path between the Launch Point, Rally Point (if set manually) and AR Observer point.*





Toggle to switch between the static AR Observer image and the drone's camera feed at any time during the scan.

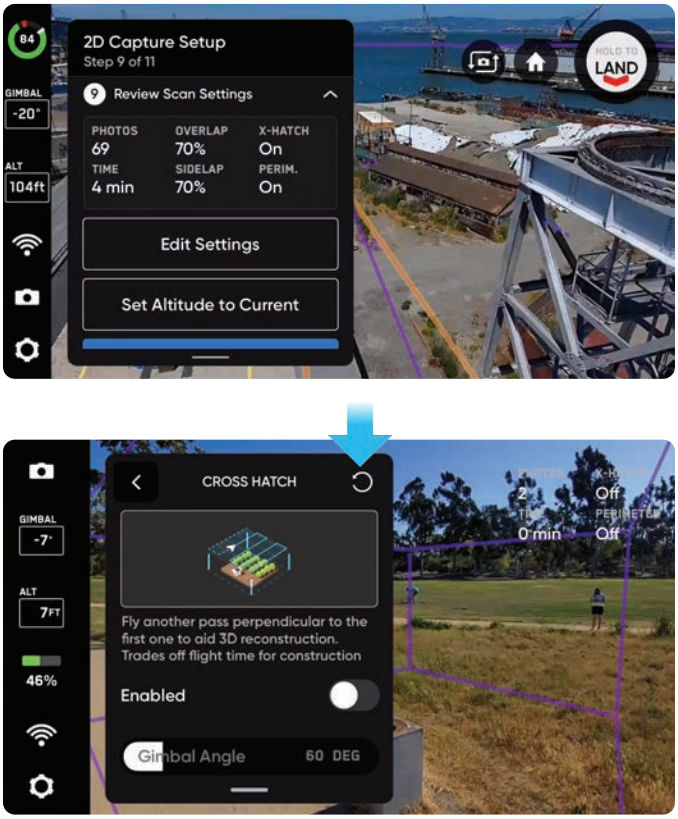
STEP 9: Review or Edit Settings

View a summary of your scan settings, plus estimates for the total scan time, number of batteries needed and total number of photos. Review your current settings and make any edits before the scan begins. Editing scan settings will impact the total flight time, number of photos and the required number of batteries. See **2D Capture Settings** on page 30 for more guidance.

Scan settings persist across scans. Select the Reset button in the top right corner to restore settings to defaults.

Set Altitude to Current will set the scan altitude to the drone's current height.

Once your settings are finalized, you may select **Begin Scan** and Skydio 2 will begin autonomously scanning the area.



STEP 10: Scan

Your scan may require using several batteries to complete. For more information, see **Scanning with Multiple Batteries** on page 33.

You may pause at any point during your scan. Use the left shoulder button or tap the ⏸ icon in the workflow pane to pause scanning. Skydio 2 will display how many photos have been captured. While paused, you have the option to manually capture photos using the right shoulder button. To resume autonomous scanning, use the left shoulder button or press the ▶ icon. Use the right shoulder button during a scan to **Skip** the next capture point.

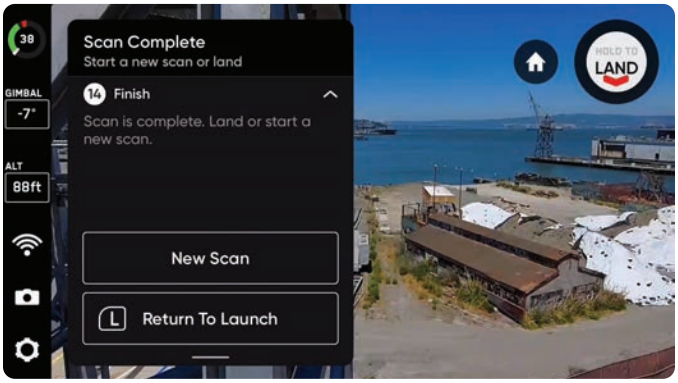
STEP 11: Scan Complete

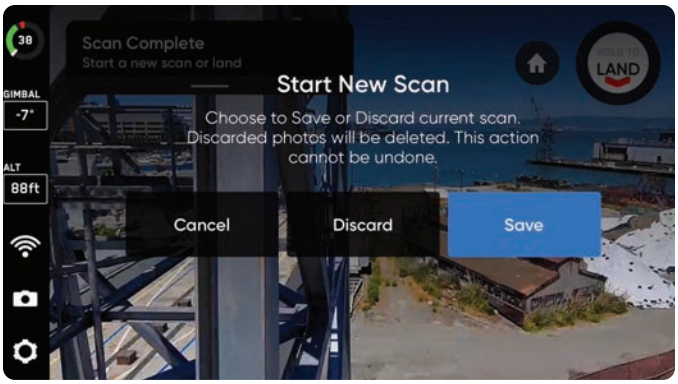
Once Skydio 2 finishes its scan, the drone will return to the Scan Start Point. From here, you will have the option to start a new scan or return to the Launch Point/Rally Point.

NOTE: *Starting a new scan will prompt you with an option to save or discard the scan you just completed.*

After landing, you will see a summary of your scan and the option to save the scan you completed. Select **Save** and wait for the drone to complete post-flight tasks. This is an important step to ensure your media is grouped by scan and can be viewed in the Skydio Edge Model Viewer. **Do not remove the battery or power off during post-flight tasks.** Doing so will result in loss of data.

You will see **Processing Scan**, followed by **Task Queue** and finally **Calibrating**. **Do not power off or disconnect from the drone until you return to the Ready to Fly screen**.





2D Capture Settings

Settings will persist between scans and between flights. If you would like to restore settings back to default, select the reset button in the top right on the workflow pane during the Review or Edit Settings steps of a scan.

Height

The most important setting for 2D Captures. Lower altitude means more photos taken and higher resolution, but an increased total scan time. GPS will be required for scans higher than 65 ft (20 m). The Height corresponds directly to Ground Sample Distance (GSD).

NOTE: *GPS will be required for scans higher than 65 ft (20 m).*

GSD at various fixed Heights

HEIGHT (FT)	HEIGHT (M)	SKYDIO 2 GSD (MM)
5	1.5	0.632
8	2.4	1.011
12	3.7	1.558
15	4.6	1.938
20	6.1	2.568
30	9.1	3.851
40	12.2	5.135
50	15.2	6.419
75	22.86	9.629
100	30.5	12.838

Cross Hatch

Capture oblique images by enabling the Cross Hatch setting. When enabled, Skydio 2 will capture in a rotating lawn mower pattern. This increases the number of photos but provides better oblique imagery for reconstruction. Instead of capturing top-down (nadir), the camera gimbal angle is adjustable to capture images at an angle for more detailed reconstruction.

When disabled, the drone will capture photos in a nadir lawn mower pattern.

Overlap Percentage

Overlap between photos along a path. Recommended default is 70% for complex scenes. For an example use case, review the **Suggested 2D Capture Settings** on page 32.

Sidelap Percentage

Sidelap between paths. Recommended default is 70% for complex scenes. For an example use case, review the **Suggested 2D Capture Settings** on page 32.

Perimeter

Scan 3D volumes by traversing the 2D perimeter at multiple heights and taking pictures inward. This will take place at the end of the scan, and the additional inward photos will improve reconstruction. This is a good setting to enable when scanning vertical structures like tall buildings or towers.

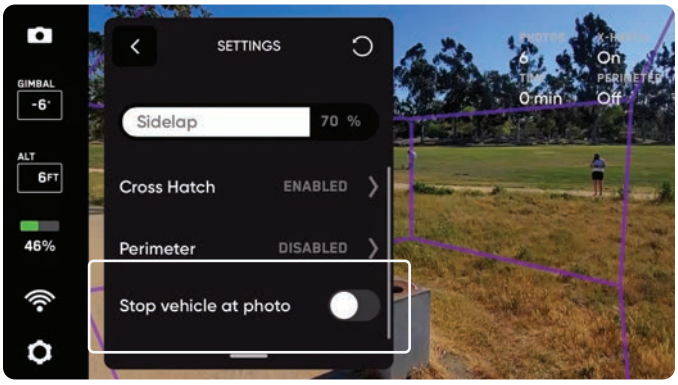
Adjust the Gimbal Angle slider to your desired camera angle.

Stop Vehicle at Photo

By default, the drone will fly through image capture points without stopping for smooth and efficient flight. Skydio 2 will automatically set the best speed to capture photos based on your scan distance and lighting conditions, while ensuring your images remain crisp and clear.

- 2 m distance = 0.28 m/s photo speed
- 4 m distance = 0.56 m/s photo speed
- 8 m distance = 1.12 m/s photo speed

Toggle on **Stop vehicle at photo** if you would like Skydio 2 to stop before capturing a photo at each capture point. The drone will still accelerate between capture points. Enabling this setting significantly increases the amount of time and batteries required to complete your scan.



Suggested 2D Capture Settings

Default settings are optimized for 2D orthomosaic generation in 2D Capture. Your GSD will adjust based on your altitude settings. Higher overlap and sidelap percentages result in longer scans and a greater number of photos. You have the ability to adjust these settings before the scan begins.

NOTE: *If your goal is to create a high fidelity reconstruction, increase your overlap and sidelap percentages. If you do not plan to create a model of your scan, lower overlap and sidelap percentages will suffice.*

Example GSD Settings

INDUSTRY	USE CASE	ASSET TO SCAN	ARTIFACTS TO DETECT	PRECISION REQUIREMENT (GSD)
Construction	Progress assessments, site survey	Construction sites, equipment inspections	Asset damage, misalignment vs. tolerance across subcontractors	Up to 1 centimeter
First responder	Collision scene reconstruction	Crime or accident scenes	Crumple damage, skid marks, weapons, broken glass	~1 millimeter
Transportation	Road grading and survey	Bridges, roads, railroad tracks	Cracks and delamination in concrete, bolts, nuts, connection points in weight bearing areas	Sub-millimeter to 5mm
Utilities	Long linear inspection for wildfire risk / wildfire monitoring	Forest inspections	Ignition sequence, origin cause	Up to 0.5 centimeter (Primarily photos, not models)

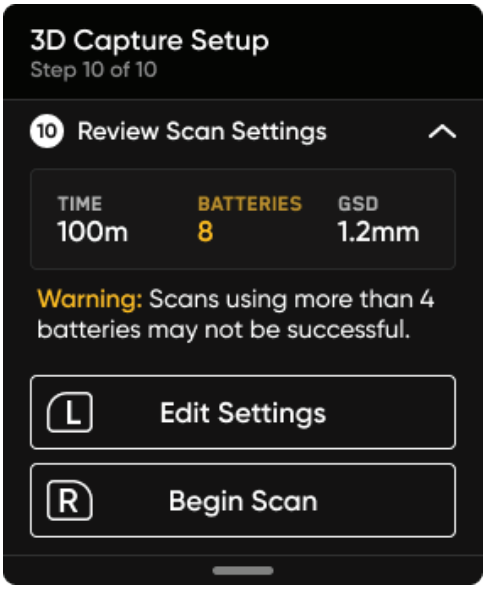
Use Case Example: Key Requirements for Crime and Accident Scene Reconstruction

HEIGHT	Set to achieve ~1 mm precision (GSD)
OVERLAP/SIDELAP	80%/80% Overlap/Sidelap with full and comprehensive photo coverage

Scanning with Multiple Batteries

Using computer vision, Skydio 2 can resume scans across multiple battery changes without reliance on GPS.

We recommend flying scans that require no more than 4 batteries. During the Review Scan Settings step, you will see a scan summary which includes the total scan time and estimated number of batteries. If your total number of batteries is greater than 4, consider adjusting your settings or split the volume into separate scans.



Do not remove or swap out the Logs Card or Media Card between flights of the same scan.

How to Change Batteries Mid-Scan

When the battery has about 18-25% charge (or 3 minutes of flight time) remaining, your drone will follow **Low Battery procedures** (page 44) and return to the Rally Point. You will have the option to Land Now or Take Control to reposition Skydio 2 for landing.

After landing, do not remove the battery or power off while the drone completes post-flight tasks. Powering off prematurely will result in errors. After completing post-flight tasks, the app will indicate that a scan is in progress and can be resumed once the battery swap is complete.

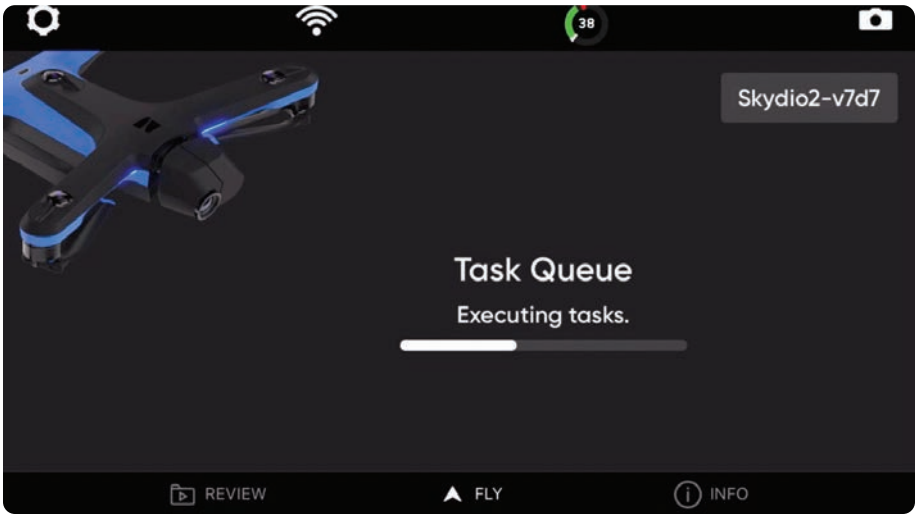
To successfully resume a scan after replacing the battery, **the drone must take off from the exact same position and orientation between each flight.** Taking off in a different location or orientation will result in errors when attempting to resume your scan. We strongly recommend taking off from the Skydio case.

After replacing the battery, take off to begin your flight. You should see an option to either continue the scan or begin a new scan. Select Continue when prompted to resume a scan. Ensure Skydio 2 has a clear path between the Launch Point, Rally Point (if set manually) and AR Observer point. After it reaches the AR Observer point, the drone will automatically resume where it left off.

***GOOD** – Place at the center of the case logo facing forward in the same spot every flight.*

***BAD** – Do not place the drone askew or in a different location from where you took off in the previous flight.*

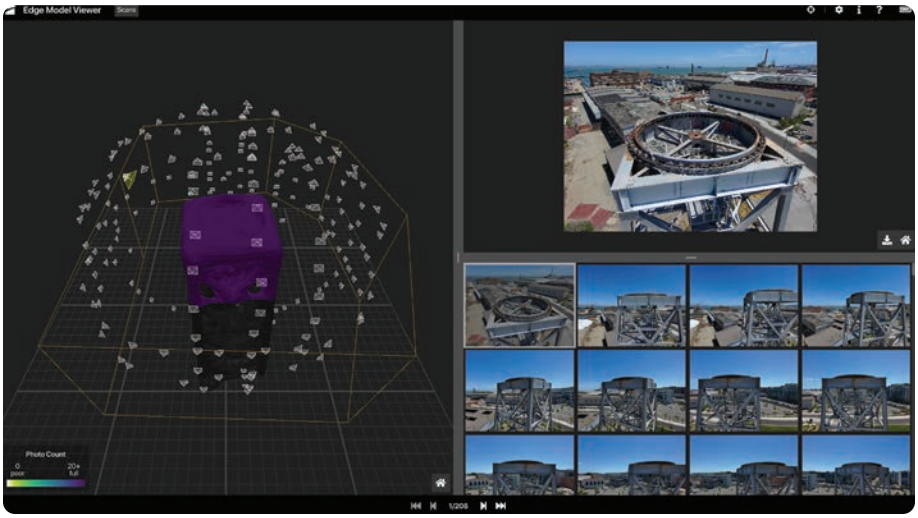
Executing Post-Flight Tasks



After landing, wait for the drone to complete post-flight tasks. This is an important step to ensure your media is grouped by scan and can be viewed in the Skydio Edge Model Viewer. Completing post-flight tasks should take about 30-90 seconds. **Do not remove the battery or power off during post-flight tasks.** Doing so will result in loss of data.

After landing and saving a scan, you will see **Processing Scan**, followed by **Task Queue** and finally **Calibrating**. Do not power off or disconnect from the drone until you return to the **Ready to Fly** screen.

Edge Model Viewer

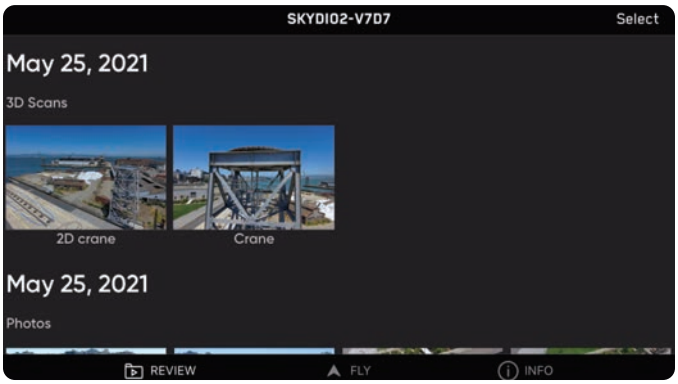


The Edge Model Viewer promptly generates photosets and enables intelligent photo browsing in the field for real-time inspection and decision-making. Use this tool to preview scans directly in-app or on a laptop after a flight.

Accessing the Edge Model Viewer

To open the Edge Model Viewer **within the Skydio Enterprise app**, follow these steps:

1. Navigate to the **REVIEW** tab in the bottom left. Wait a moment while the scan thumbnails sync in the Skydio Enterprise app.
2. Tap on the scan you would like to view. The Edge Model Viewer will automatically open with this scan loaded.



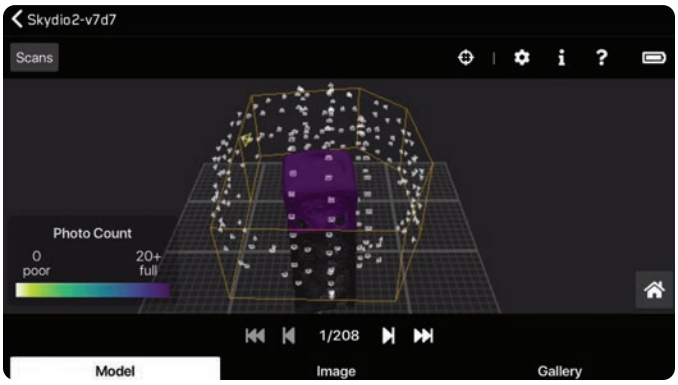
To access the Edge Model Viewer **on a laptop or other mobile device** follow the steps below:

1. Make sure you are connected to the drone's WiFi. In your web browser, navigate to http://192.168.10.1/viewer
2. Select a scan from the dropdown menu. Click **X** in the top right to close the scan selection window.

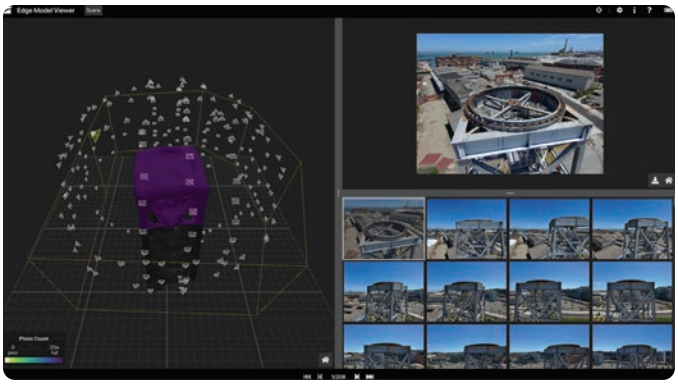
Navigating the Edge Model Viewer

Once the scan loads, you will see three separate tabs at the bottom of your screen. On larger screens, these tabs appear as resizable windows:

- **Model** previews a 3D reconstruction of your structure or area. The Edge Model Viewer will begin in this tab by default.
- **Image** shows the individual image associated with the selected capture point.
- **Gallery** shows all photos taken during the scan. When using the Inspect Tool, the Gallery will show all images containing that specific point.

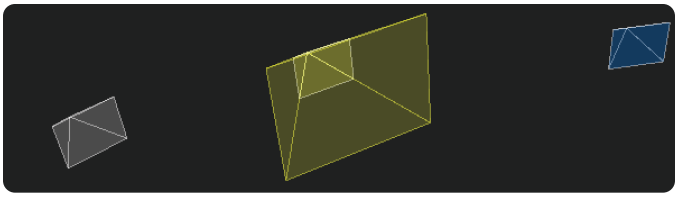


Zoom in and out by pinching with two fingers. Drag to navigate around the model. Use the arrows at the bottom of the screen to navigate through individual images and capture points on the model. Any time the active thumbnail changes, the image gallery will update to that view.



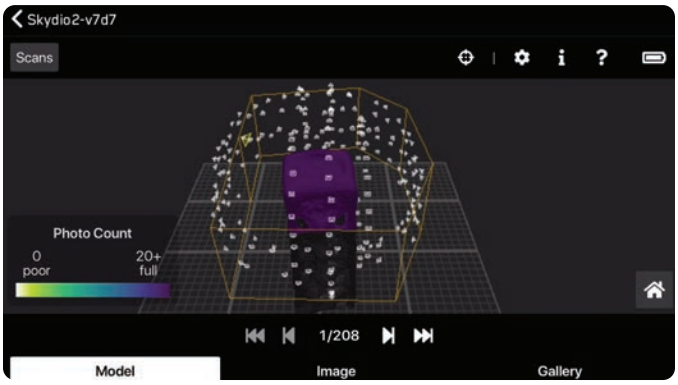
Capture Points

Select individual capture points to view photos. Once selected, the frustum will turn blue to denote you have already viewed that point.



Coverage Heatmap

You'll notice a coverage heatmap over the structure. This indicates how many photos were taken at each location. The photo count defines the coverage mesh colors in relation to the number of photos taken. Minimum and maximum photo numbers scale with your scan's overlap settings. Yellow indicates minimal coverage and purple indicates full coverage.

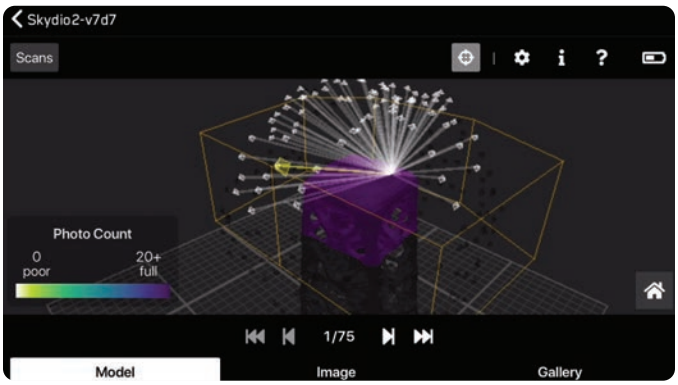


Toolbar

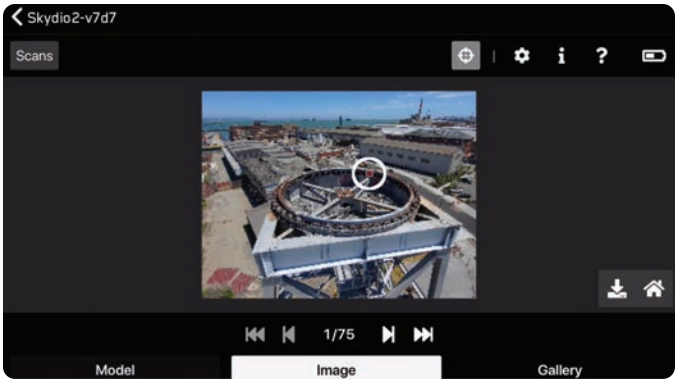
In the top right of the screen, there is a toolbar with the following icons:

Inspect Tool

Allows you to pick any point on the model and filter for all images containing that specific point.



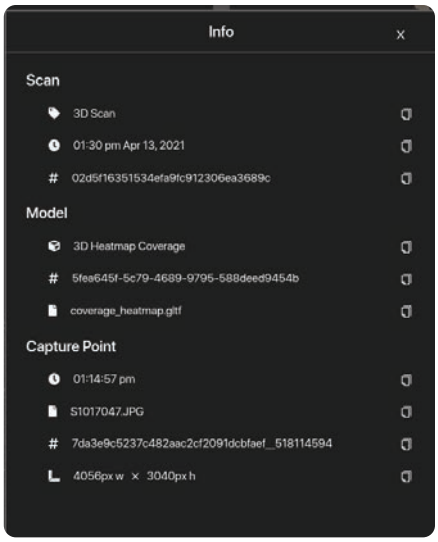
A red sphere will appear on both the model and photo to show your current placement. Use this tool in the field to review the settings and angles you chose and see where images are spatially located in relation to the model.



Info

Summarizes information about the scan, the model and the image that is currently selected. This includes data such as the date and time of the scan, image size, and scan name.

To copy any of this information to your clipboard, press the icon to the right.



Help

Outlines directions about controls and how to navigate the Edge Model Viewer.

Expand

Enters fullscreen.

Battery

Indicates the battery level of your Skydio 2.

Downloading Images

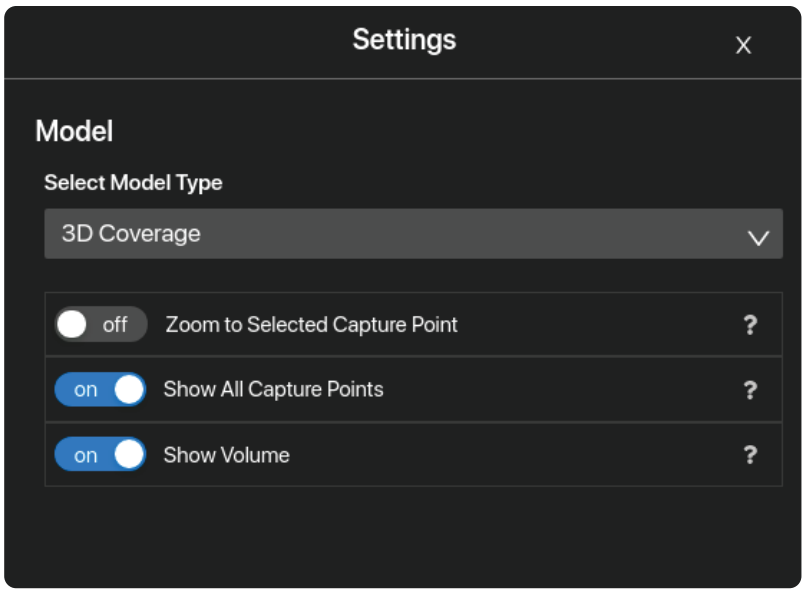
In the Gallery panel, find the image you wish to download. Once selected, navigate to the Image panel and select the icon. Photos download as **.JPG** files and include scan information such as the time, scan name, and dimensions. You will have the option to rename your photo.

Home

Resets to default view.

Edge Model Viewer Settings

Locate the following settings by clicking the ⚙ icon in the top right of your screen.



Select Model Type

- **3D Coverage** – Shows a photo coverage map that matches the in-flight AR Coverage Mesh. This is the only option for 3D Capture.
- **2D Coverage** – Highlights the idealized plane at the bottom of the scan volume. This is the only option for 2D Capture.

Zoom to Selected Capture Point

Automatically aligns the 3D view with the active capture point.

Show All Capture Points

Shows all capture points. When toggled off, this hides other points and shows only the active camera selected.

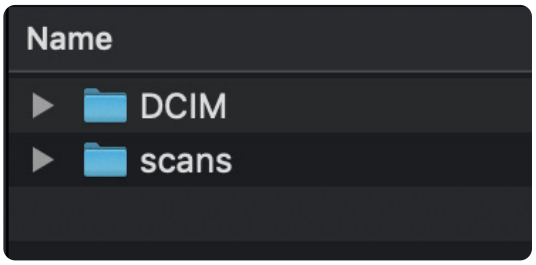
Show Volume

Adds a yellow prism around the structure to denote the user-defined scan volume.

Accessing Scan Data

Retrieve valuable contextual data about scans after your flight. To access the photos off of your device, you must remove the microSD card from your Skydio 2. Use any microSD or SD card reader to view and copy your full-resolution photos to your personal computer.

There are two different folders on your Media Card:

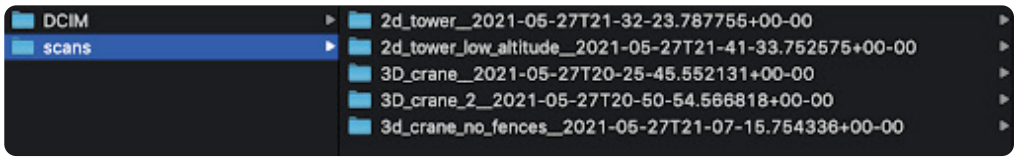


Digital Camera Images (DCIM) Folder

The DCIM folder holds a subfolder titled **100SKYDO** which houses low-resolution video files (.LRV) of your scan. You will not need these files to create 3D reconstructions.

Scans

Locate your individual scans within this folder. Folders are titled by scan name followed by a UTC timestamp. For example, 3D_Capture__2021-05-20T19-50-55.135854+00-00.



After selecting the scans folder, you will see a few different types of files inside:

Hypertext Markup Language (.HTML)

Includes a report with the summary of your scan details. Click this to view a webpage that outlines the following information:

- Scan ID
- Time and date
- GPS location
- Scan setting details (scan mode, overlap, sidelap, scan passes etc.)
- Scan area
- Number of pillars set
- Number of batteries used
- Total flights and flight time
- Total number of images (captured manually and autonomously)

Graphics Language Transmission Format (.glTF)

A standard file format for 3D models. This is the model shown in the Edge Model Viewer.

Joint Photographic Experts Group (.JPG)

A digital image format containing compressed image data. **These are the images you captured during your scan.** You will need these files for creating reconstructions in photogrammetry software programs.

Protocol Buffer (.PBUF)

This file contains serialized metadata about your scans. You will not need this to create 3D reconstructions.

3D Reconstructions

You must use a third party provider such as DroneDeploy or Bentley to create 3D models of your scans.

To create a 3D model, save the JPG files from the scan onto your personal computer. Next, upload these files to your preferred photogrammetry software program to create your model.

To locate the JPG images of your scan, follow these steps:

1. Place your Media Card in any microSD or SD card reader and insert into your personal computer.
2. Locate the card reader in your files.
3. You'll see two folders, DCIM and scans. Open scans.
4. Each folder is a different scan. Locate the scan you wish to reconstruct.

   NOTE: *Folder titles include the scan name followed by a UTC timestamp. For example: scans/Scan_Name__2021-06-02T19-50-55..135854+00-00*

Lost Connection, Low Battery & Environmental Factors

Lost Connection

If Skydio 2 loses connection to the Skydio Controller or mobile device during a scan, it will continue scanning for about one minute.

If it is unable to reconnect, the drone will move through a series of steps:

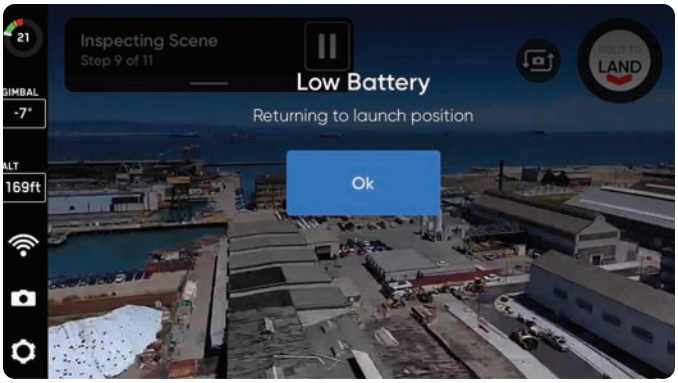
1. After waiting 60 seconds, the drone will first return to the **scan starting point.**
2. If it still doesn't reconnect in the next 30 seconds, the drone will return to the **Rally Point.**
3. If it still doesn't reconnect after another 30 seconds, the drone will return to the **Launch Point.**

The drone will then hover at the Launch Point until it reconnects. If it does not reconnect, **the drone will eventually run out of battery and auto-land.**

Low Battery

When the drone reaches a low battery level (about 3 minutes of flight time remaining), it will automatically return to the scan start point, wait, then proceed to the Launch Point.

You will then be prompted to return to home and land. If the battery reaches a critical level the drone will auto-land.

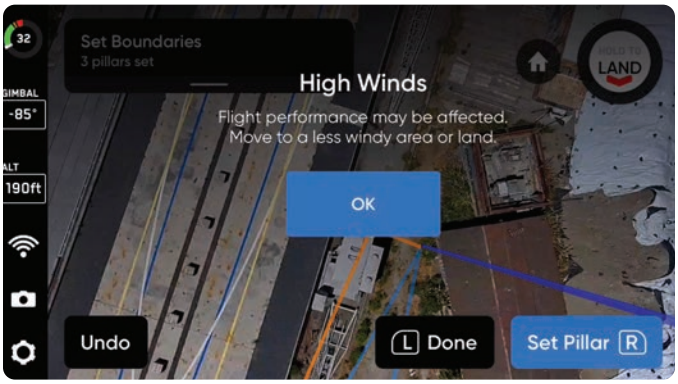


Environmental Factors

Skydio 2 should not be flown in temperatures below 23°F (-5°C) or above 104°F (40°C). Do not let Skydio 2 sit in direct sunlight when on the ground or when processing post-flight tasks.

If it is too hot or too windy, the drone will return to the scan start point. You then have the option to take over and pilot the drone home.

Based on the available lighting conditions, Skydio 2 will automatically adjust photo settings to ensure it captures the best quality images. You will see in-app notifications alerting you if there are problems with the lighting conditions. The drone will continue flying for 20 seconds, and if conditions do not clear then it will return to the Rally Point.



Tips & Best Practices

- Do not remove or swap out the Logs Card between flights of the same scan.
- Keep your drone and app up-to-date. Visit Updating your Skydio 2 for update instructions.
- Do not let your Skydio 2 sit in direct sunlight for extended periods of time and use caution when flying in hot or cold temperatures.
- **If you are flying using DroneDeploy then you must exit 3D Scan to regain access to Flight Skills.** To exit, first land the drone. Navigate back to the Device Settings Menu and change the Vehicle Mode to Skills.
- GPS will be required for scans higher than 65 ft (20 m).