TELEDYNE FLIR

SKYRANGER® R70

PILOT OPERATING MANUAL

FOR MCS VERSION 13.2

Pilot Operating Manual

For Mission Control Station (MCS) software Version 13.2

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For the latest documentation, visit the Customer Self-Service Portal at https://selfservice.teledyneflir.com.

This aircraft supports ASTM F3411-220a-RID-B and is ID- and tracking-capable.

Software numbering convention

MCS uses the following convention for its software numbering:

- The first two numbers denote the release.
- The last number denotes any service pack released for the software.

Manufacturer's disclaimers

- The content in this manual, and all other collateral documents, is subject to change at the manufacturer's sole discretion.
- The software and hardware are subject to change due to the manufacturer's continuous development process.

- The manufacturer shall not be liable for any damages, losses, costs, or expenses, direct, indirect or incidental, consequential or special, arising out of, or related to the use of this content or the products described herein including failure to heed warnings or cautions.
- You are solely and personally responsible for your conduct and control while operating this aircraft and any consequences as a result.

Symbols and conventions

This manual uses the following symbols and conventions:

This symbol indicates a note with recommendations from the manufacturer.

This symbol indicates a helpful tip or recommendation that can enhance the performance of the aircraft or software.

This symbol indicates a caution or warning. For safety purposes, always follow the instructions described.

This symbol indicates tasks that you must perform before completing the procedure described.

This type of box contains the steps required to complete a task.

Glossary

°C
Degrees Celsius; used as a measurement of temperature

°F
Degrees Fahrenheit; used as a measurement of temperature

ft
Feet; used as a measurement of distance

ft/s
Feet per second; used as a measurement of speed

g
Grams; used as a measurement of weight

GHz
Gigahertz; used as a measurement of frequency, where one GHz represents 1 billion cycles per second

GPS
Global Positioning System; used to determine the aircraft's geolocation and time information, including latitude and longitude coordinates

kg
Kilograms; used as a measurement of weight

km/h
Kilometers per hour; used as a measurement of speed
lb
Pounds; used as a measurement of weight
m
Meters; used as a measurement of distance
m/s
Meters per second; used as a measurement of speed
mph
Miles per hour; used as a measurement of speed
MHz
Megahertz; used as a measurement of frequency, where one MHz represents 1 million cycles per second
MSH
Minimum safe height
MSL
Mean sea level; used as a measurement of altitude
oz
Ounces; used as a measurement of weight
pitch
Used to describe the aircraft's movements around its lateral axis (nose up / nose down, where "nose" refers to the front EO/IR camera)
roll
Used to describe the angle of rotation around the longitudinal (tail / nose) axis of the aircraft
yaw
Used to describe the aircraft's movements around its vertical axis

CONTENTS

SAFETY INFORMATION

General cautions

- This product has been designed with the highest concern for safety and for its intended purpose in accordance with the instructions contained within this manual. The use of the aircraft in any manner that is not specified in this manual, or using the aircraft improperly, will void the warranty and could cause injury to the operators or damage to the system itself, or other property.
- Observe all warnings, precautions, and instructions. Read this instruction manual carefully before using the system to ensure that you obtain the best possible results.
- Keep the aircraft and all its components away from children.
- Perform regular inspections of your system.
- The system should only be used by suitably qualified and trained personnel. All operators must complete a Teledyne FLIR-certified training program.
- Check for MCS updates frequently. These updates provide safety and performance enhancements. See "Upgrading the system software" on page 337.
- All operators are responsible for obtaining as much information as possible about all meteorological conditions (including icing conditions) before takeoff. Adjust all flight plans according to the weather conditions. Failure to do so could result in personal injury, damage to property, or damage to the aircraft and its components. Failing to adjust any flight plans can also lead to a decrease in the performance of the aircraft or, potentially, a crash.
- Wind fronts play an important part in the formation of icing conditions and flight. Operators should be aware of a front's location, type, speed, and direction of movement. Operators should try to keep track of where the front is moving and look for indications of frontal activity or frontal passage, such as a wind shift or temperature change.
- Operators are responsible for checking their surroundings for potential hazards or obstacles, as well as air temperature and pressure for safety and optimal performance of the aircraft.

- Ensure that your flight plan does not direct the aircraft toward (but not limited to): people, airplanes, animals, power lines, objects, trees, buildings, or transparent objects, such as glass or water.
- If there is a crash, do not fly the aircraft. Contact Support.
- Check all local laws and regulations regarding operation of the aircraft, including authorized frequencies.

The aircraft includes a laser altimeter as a redundant height sensor. Although the altimeter contains an eye-safe class 1 laser, you should not look at it with magnifying instruments. Eye injury can occur.

OPERATING CONDITIONS

Flying in rainy conditions

The aircraft (when fully assembled) is IP54 ingress protected and supports operation in rain up to four inches per hour as defined by MIL-STD-810G. To prevent critical electrical interfaces from getting wet, always perform the following actions under cover:

- Assembling and disassembling the aircraft
- Inserting and removing batteries
- Attaching and removing payloads

If flying in rainy conditions, use caution and adjust your operation accordingly using the following recommendations:

- Never turn the aircraft upside down in the rain.
- It is very important to remove all moisture from the aircraft with a towel before removing or replacing any components, especially the batteries. After removing all components, wipe all moisture from the aircraft again. Wipe all arms, legs, batteries, and payloads before storing them in the mission case.
- If there is any water in the battery compartments, do not use the aircraft until you can bring the aircraft indoors, turn it upside down, and dry it out for 24 hours, with a fan blowing on the battery compartments. Failure to do so can damage the aircraft and cause failures during a flight.
- Even though the aircraft is designed to tolerate rain, it is not recommended to leave the aircraft wet for long periods of time because water can enter the aircraft. Always keep the mission case dry and never store a wet aircraft or wet components.
- Always inspect the aircraft and its components after every flight to ensure that water cannot enter the aircraft. It is especially important to inspect the battery gaskets around the battery compartments. For more information, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for "Maintenance Manual."
- Rain, fog, water mist, and other environmental conditions can make the aircraft sense the ground, even though it is flying. If you notice rain, fog, or water mist, turn off the ground sensors and turn them on again before landing. For more information, see "Fly without ground sensors" on page 295.

Flying in windy conditions

The aircraft operates in sustained winds up to 65 km/h / 40 mph and gusts up to 90 km/h / 56 mph. In windy conditions, regardless of the aircraft's ability, use caution and adjust your operation using the following recommendations:

- Do not attempt to take off until the winds at ground level decrease below 45 km/h / 28 mph.
- When operating near wind limits, descend to a lower altitude.
- Wherever and whenever possible, use a large, clear area for takeoff and landing.
- Account for wind direction when returning home into a headwind since flying into the wind requires extra battery power and quickly drains the battery.
- Adjust your aircraft flight settings to increase the battery margin. Increasing the battery margin allows more time and power to return home and land in windy conditions.
- Adjust your flight plan to account for less vertical stability. The aircraft's vertical positioning might diminish to maintain accurate horizontal positioning.

When warning messages appear on the screen, obey them and adjust your flight operations and flight path as necessary. See "Understanding errors and warning messages" on page 247.

If the aircraft travels faster than its specified capabilities, and the wind pushes the aircraft past its Maximum Range, a fatal error causes the aircraft to initiate an emergency landing at its current location. This emergency landing could result in injury, damage to property, or damage to the aircraft and its components.

If you fly in windy conditions often, after each flight, perform a thorough visual inspection and complete the required maintenance on the aircraft and its propulsion arms. See "Performing maintenance on the system" on page 330.

Flying in icing conditions

Icing conditions can impact and diminish the stability of the aircraft and the overall performance of the flight. Ice impacts the smooth flow of air over the propellers, which increases drag and decreases the ability to create lift.

Flying in icing conditions is not recommended. If you choose to fly in such conditions, frequently monitor battery temperature levels and obey all warnings that appear on the screen. Failure to do so could result in loss of control, damages to property, or damages to the aircraft.

Flying in areas of heavy tree cover

In areas of heavy tree cover, taking off and landing the aircraft can pose numerous challenges. You might need to ascend or descend in a narrow opening in the tree cover.

⚠

In heavily treed areas, there is an increased potential for interruption or loss of GPS signal. You must monitor your GPS connection more closely. See "Check the aircraft's GPS connection strength" on page 61.

Use the camera to control the descent carefully. See "Land the aircraft with video assistance" on page 77.

Flying in high-altitude locations

If your flight is 1828 m / 6000 ft above MSL, the aircraft automatically adjusts the control parameters to optimize the flight for lower pressure environments.

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The aircraft is designed to fly 4572 m / 15000 ft MSL.

Additional information

For more information on flying in challenging environments, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for "environmental conditions."

BATTERY CARE AND STORAGE 

The system is powered by high-performance, lithium-ion batteries that require basic care to ensure their long-term health and performance.

- Use only the lithium-ion batteries provided by the manufacturer, specifically designed for the aircraft.
- Failure to use the correct batteries can cause personal injury or death or irreparable damage to the aircraft and components and will render warranty null and void.
- DO NOT PUNCTURE OR CRUSH THE BATTERIES. If the batteries are breached in any way, do not use them. Take all safety measures to dispose of the batteries according to local regulations.
- The lithium-ion cells store a great deal of energy and might combust, catch fire, or ignite if they are crushed, punctured, or if they sustain other severe damage.
- Check the cycle count and health of the batteries before each flight. You should only fly with batteries that have a cycle count of less than 400 or health greater than 80%. For more information, see "Check the status of the aircraft" on page 59.

Care for, maintain, and store your batteries

Follow these guidelines to take care of your batteries properly.

✓ If the battery power level is very low, the battery can enter a mode where it attempts to preserve battery power. In this mode, no lights turn on when you press the battery power button. To exit this mode, charge the battery.

Care for the aircraft batteries

- If you are using standard batteries, it takes approximately 2.5 hours to charge an aircraft battery fully from empty using the battery charger provided with your system. If you purchase the 8-Bay Battery Charger, it takes approximately 1.5 hours to charge a standard battery fully from empty. For more information on the 8-Bay Battery Charger, see the "*8-Bay Battery Charger Quick Start Guide*" in the Customer Self-Service Portal at https://selfservice.teledyneflir.com.
- If you are using XL batteries, it takes approximately 6 hours to charge the battery fully from empty using the battery charger provided with your system. If you are using the 8-Bay Battery Charger, it takes approximately 3 hours to charge a battery fully.

- After a flight, charge your batteries to 100% if you are going to use them again within a week. See "Charge the aircraft batteries" on page 23.
- If you are not going to use the batteries within a week, ensure that they are charged to approximately 50% (at least three of the LED lights are illuminated when you press the battery power button. For more information, see "Check the status of an aircraft battery" on page 359.
- If you drained the batteries completely after your flight, always charge them to the appropriate charge level described above within one week.
- If the battery power level is very low, the battery can enter a mode where it attempts to preserve battery power. In this mode, no lights turn on when you press the battery power button. To exit this mode, charge the battery for approximately 5 minutes. Ensure that you charge the batteries fully before flying with them.
- Check the status of the batteries every three months to ensure that they maintain at least a 40% charge. See "Check the power level of an aircraft battery" on page 22.
- Before transporting batteries on an airline, use the battery diverter to drain the batteries automatically to 30% (only two of the LED lights are illuminated when you press the battery power button). Alternatively, you can fly the aircraft to drain the batteries. When the LED on the diverter turns off, remove the battery from the diverter. For more information on using the diverter, see "Drain an aircraft battery using the battery diverter" on page 360.
- Do not expose the batteries to extreme heat (60°C / 140°F or higher).
- All lithium-ion batteries gradually lose their charge over time, even if they are not used. If a battery has a very low charge, it can enter a low-voltage mode, which prevents it from charging. If the battery enters this state, you cannot use it. To purchase new batteries, contact Support.

Store the aircraft batteries

Follow these guidelines to store your aircraft batteries properly:

Before storing batteries, always ensure that they are charged to approximately 40% (at least three of the LED lights are illuminated when you press the battery power button). Failing to do so can permanently degrade the battery capacity and reduce flight times.

- Store the batteries in a dry location in the mission case, a battery case, or a fireproof container, at a temperature between 0°C and 30°C / 32°F and 86°F and a humidity level of less than 50%.
- Do not store the batteries near any heat sources or in direct sunlight.

- DO NOT STORE BATTERIES IN THE AIRCRAFT FOR EXTENDED PERIODS OF TIME. The recommended maximum time to store batteries in the aircraft is two weeks.
- If you do store the batteries in the aircraft, do not lock them into place until you are going to fly. If the batteries are locked into place, they draw power, which can drain them faster.
- During cold months, if you store the batteries overnight in an aircraft, the batteries can get very cold. If the battery temperature is below -10°C / 14°F, the aircraft will not take off until the batteries warm up.
- The aircraft draws battery power during flight, which increases the battery temperature. If you store the batteries in an aircraft overnight during warm months, the starting battery temperature is higher than normal. When the aircraft estimates the remaining power available, it accounts for the higher battery temperature and reduces the amount of remaining flight time. Both battery and environmental temperature can increase or decrease flight time.
- Check the status of the batteries every three months to ensure that they maintain at least a 40% charge. See "Check the power level of an aircraft battery" on page 22.

Care for the base station battery

- It takes approximately 4 hours to charge the base station battery fully from empty.
- After a flight, charge the base station to 100% if you are going to use it again within a week. See "Charge the base station" on page 240.
- If you are not going to use the base station within a week, ensure it is charged to approximately 50%. To view the base station battery level, turn on the base station. The battery level appears on the LCD screen.
- Check the status of the base station at least monthly to ensure that it has at least a 50% charge. Charge the battery if it is below 50%.
- Before transporting the base station on an airline, drain the battery (by leaving it on to drain by itself or by flying) until it’s charged to approximately 30%.
- Do not expose the base station to extreme heat (60°C / 140°F or higher).
- If you drained the battery completely after your flight, always charge it to the appropriate charge level described above within one week.
- If the battery power level is very low, the battery can enter a mode where it attempts to preserve battery power. In this mode, the LCD screen does not turn on when you press the power button. To exit this mode, charge the battery for approximately 30 minutes. Ensure

that you charge the base station battery fully before flying.

- All lithium-ion batteries gradually lose their charge over time, even if they are not used. If a battery has a very low charge, it can enter a low-voltage mode, which prevents it from charging. If the battery enters this state, contact Support.

Store the base station battery

Follow these guidelines to store your base station properly:

Before storing the base station, always ensure that it is charged to approximately 50%. Failing to do so can permanently degrade the battery capacity.

- Store the base station in a dry location in the mission case, at a temperature between 0°C and 30°C / 32°F and 86°F and a humidity level of less than 50%.
- Do not store the base station near any heat sources or in direct sunlight.
- Check the status of the base station at least monthly to ensure that it has at least a 50% charge. Charge the battery if it is below 50%.

Care for the tablet battery

- It takes approximately 2.5 hours to charge the tablet battery fully from empty (when the tablet is turned off.)
- After a flight, charge your tablet to 100% if you are going to use it again within a week. See "Charge the tablet" on page 241.
- If you are not going to use the tablet within a week, charge the battery to between 30% and 70%, then remove the battery. For more information, see "Remove the tablet battery" on page 242.
- Before shipping the tablet with the system, ensure that the battery is charged to 30%.
- Do not expose the tablet battery to extreme heat (60°C / 140°F or higher).

Store the tablet

Follow these guidelines to store your tablet properly:

Before storing the tablet, charge the battery to between 30% and 70%.

- Remove the battery. For more information, see "Remove the tablet battery" on page 242.
- Store the tablet battery in a dry location in the mission case, at a temperature between 0°C and 30°C / 32°F and 86°F and a humidity level of less than 50%.
- Do not store the tablet battery near any heat sources or in direct sunlight.

Battery diverter

- Use only the diverter available from the manufacturer. The diverter can get hot, so handle it with care.
- Depending on the battery level, it can take a long time to discharge the battery to 30%. Remove the battery from the diverter when the battery level is at 30%.
- Use the battery diverter in a dry, indoor location only.

Battery charger

- Use only the manufacturer's battery charger. Failure to use the manufacturer's charger will void the warranty, could result in injury or risk of fire, or could permanently damage the batteries or diminish performance of the aircraft.
- This equipment is not suitable for use in locations where children are likely to be present.
- Charging should only occur if the batteries and battery charger are between 4°C and 40°C / 39°F and 104°F.
- Use the battery charger in a dry location only.
- Do not disassemble the battery charger. Only Teledyne FLIR-authorized and trained personnel should service the battery charger. For more information, contact Support.

Battery disposal

- If the battery is not damaged, dispose of it safely, according to local regulations.
- If there is any damage to the battery, follow these precautions:

- If there was a severe landing or crash that caused battery damage, contact Support.
- Do not use or ship the damaged battery.
- Keep the damaged battery outdoors. Immerse it in a bucket of sand to reduce the risk of fire.
- Contact a local hazardous materials disposal service to dispose of the damaged battery.

FCC compliance statement

XL batteries comply with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

OVERVIEW

Delivering a broad range of mission capabilities, in a wide set of environments, the SkyRanger R70 redefines what's possible with a small Unmanned Aircraft System.

About the components

The SkyRanger R70 comes with the following components:

Component	Description
Aircraft	The aircraft body manages all flight operations, including stabilization, navigation, camera operations, and monitoring. The aircraft includes a memory card slot for a Class 10 SD memory card. You should always format your memory cards for the SkyRanger R70 as exFAT. If you do not, videos and pictures on the memory card might not show the correct date and time. For memory cards formatted as exFAT, the maximum size is 2 TB. For memory cards not formatted as exFAT, the maximum size is 64 GB. There is a protector plate to cover the payload connector when the aircraft is not in use, or you are flying with no payload attached. If you are shipping the aircraft, the protector plate must be in place. The aircraft comes equipped with built-in cameras, including four downward-facing navigation cameras and one front EO/IR camera. You cannot change the pitch of the front EO/IR camera. If you are using a Block 2 aircraft, the aircraft body has an accessory port for tethered operations and an Ethernet and power port for communications.
Legs	The four legs attach to the aircraft body and provide stable landing gear. All four legs have compasses, and two legs have antennas.
Propulsion arms	Each of the four propulsion arms that attach to the aircraft body includes a motor and a fixed pitch propeller. Each arm is also equipped with LED lights. The propulsion arms with the white-tipped propellers contain sonar sensors. Each arm is color-coded to match the appropriate arm receptacle on the aircraft body. When possible, you should fly with the Heavy Lift - Long Endurance (HL-LE) or HL-LE V2 arms. However, you can also fly with the arms that use 18.5 inch

Component	Description
	propellers.
Tablet and charger	The Windows-based tablet supplied with the system comes with the Mission Control Station (MCS) application already installed. Use only the tablets authorized by Teledyne FLIR.
Base station and charger	The base station and its antennas provide a long-distance communication link between the tablet and the aircraft. The base station includes a charging port, a USB port, an Ethernet port, two long-range communications antennas, two short-range communications antennas, a built-in GPS antenna, a built-in pressure sensor, a tripod mount, and a port that you can use to connect an external GPS antenna. It also includes two extra antennas.
Payload	You can select the correct payload for your operations and change to a new payload without turning off the aircraft. The aircraft supports the Osprey payload, which you can use to carry and deliver objects. Certain payloads include a memory card slot for a Class 10 SD memory card (up to a maximum of 64 GB). You should format the payload memory cards that you use with the aircraft as exFAT. Use only the payloads authorized by Teledyne FLIR. For more information on the capabilities of your payload, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for the Operating Manual for the payload.
Batteries	The aircraft operates using four lithium-ion batteries. Your system might also come with extra batteries. You can purchase XL batteries to extend your flight time to a maximum of 59 minutes.
Battery charger	The system comes with a battery charger to charge up to four batteries at a time. You can also purchase an 8-Bay Battery Charger to charge more batteries in a shorter period of time. For more information on the batteries, see "Battery care and storage " on page 12.
Battery diverter	The system comes with a battery diverter, which you can use to drain a battery to below 30%. You must drain the batteries before shipping them. For more

Component	Description
	information, see "Drain an aircraft battery using the battery diverter" on page 360.
Replacement kits	The system also comes with propeller and arm latch replacement kits.

1. LIDAR module on a Block 2 aircraft
2. Front EO/IR camera on a Block 1 aircraft
3. Front EO/IR camera on a Block 2 aircraft

Block 1 aircraft and Block 2 aircraft

When lifting the aircraft, do not lift it by the front EO/IR camera or the LIDAR module.

Teledyne FLIR provides the system components in a sturdy mission case. Always use this case to transport and store the components.

Double-system kits are also available.

You can purchase additional accessories separately, such as a joystick for the tablet or additional payloads. For more information on the available accessories, see "Accessories" on page 389.

Get ready to fly the aircraft

Use the following task list to prepare for flight. For more information on each task, see the reference topics provided.

You can use this task list if you need to remember the steps required before flying the aircraft. If you have not flown recently, however, review all the reference topics in detail before your flight.

Task	Reference topic
Review your location and the local weather information	-

Task	Reference topic
Assemble the aircraft	"Assembling the aircraft" on the next page
Turn on the base station	"Turn on the base station" on page 45
Turn on the tablet	"Turn on the tablet" on page 30
Turn on the aircraft	"Turn on the aircraft" on page 50
Connect the tablet to the base station	"Connect the tablet to the base station's Wi-Fi network automatically" on page 48 or "Connect the tablet to the base station using an Ethernet connection" on page 49
Download maps	"Download base maps" on page 46
Set up the system for a flight	"Set up the system for a flight" on page 53
Check the status of the aircraft	"Check the status of the aircraft" on page 59
Review the GPS connection for your aircraft	"Check the aircraft's GPS connection strength" on page 61
Check the status of the tablet and the base station	"Check the status of the tablet" on page 62 and "Check the status of the base station" on page 63
Check your flight settings and behaviors	"Check flight settings and behaviors" on page 54

Contact SkyRanger Support

- If you are a current customer, visit our Customer Self-Service Portal at https://selfservice.teledyneflir.com.
- Call:
  - USA customers: +1 602-883-8287. Press 4.
  - International customers: +1 519-489-6726. Press 4.
- Email the Support team at skyrangersupport@teledyne.com.

ASSEMBLING THE AIRCRAFT

Before assembling the aircraft, remove the aircraft body, legs, and payload that you're going to use from the mission case. Close the top layer of the mission case. You can use this layer (where the legs and propulsion arms are stored) as a working surface. It provides a more stable surface to work on when the aircraft rests on its batteries.

Remove the batteries from the aircraft

The aircraft comes with the batteries already inserted but the batteries might not be fully charged. Before flying, remove these batteries and charge them.

Before your system is shipped, foam inserts are placed at the bottom of each battery compartment (between the battery connector and the battery.) Before inserting fully charged batteries to fly the aircraft for the first time, remove these foam inserts.

1. On any battery in the aircraft, lift the gray battery latch.
2. If the battery is locked in place, twist the battery latch counterclockwise. The battery pops up.

3. Remove the battery from its battery compartment.
4. Repeat steps 1 to 3 for the remaining batteries.

Check the power level of an aircraft battery

The lights on the side of the battery provide information about the battery's power level. You can check the lights when a battery is on or off the charger.

You should always check the power level of the batteries before each flight.

On the side of a battery, press  .

1. First LED
2. LED lights

- Five lights indicate approximately 81% – 100% charge.
- Four lights indicate approximately 61% – 80% charge.
- Three lights indicate approximately 41% – 60% charge.
- Two lights indicate approximately 21% – 40% charge.
- One light indicates approximately 3% – 20% charge.
- If the battery is less than 2%, the first LED blinks.

Charge the aircraft batteries

You can use the battery charger that is provided with your system to charge four batteries at a time.

✓ With the 8-Bay Battery Charger, you can charge up to eight batteries at a time. For more information, contact your Teledyne FLIR representative.

1. Plug the power cord for the battery charger into its power adapter.
2. Plug the power adapter cord into the battery charger.

3. Plug the power cord into a power outlet.
4. Place each battery into a slot in the battery charger.

5. If necessary, to lock the battery in place, twist the gray battery latch counterclockwise, push down on the battery, and then release the gray battery latch.

The lights on the side of the batteries show the battery level. The light representing the highest charge level blinks to indicate that the battery is charging.

When the batteries are fully charged, all five lights appear on the side of the battery. If the lights do not appear, press  . Contact Support if the lights do not appear after exceeding the approximate charge times outlined in "Care for the aircraft batteries" on page 12.

If the light on the battery charger flashes, there might be a problem with the charger itself. For more information, contact Support.

Insert the batteries into the aircraft

When you have a set of fully charged batteries, you can insert them into the aircraft.

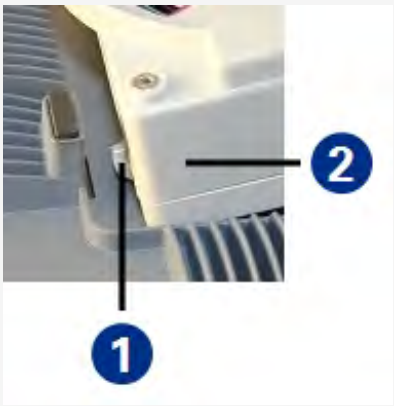
When inserting the batteries, do not press down too firmly. Doing so can damage the aircraft body.

1. Holding the fully charged battery straight up and down (not slanted), insert it into the battery compartment on the top of the aircraft body.
2. To lock the battery in place, twist the gray battery latch counterclockwise, push down on the battery, and then release the gray battery latch.
3. Push the gray battery latch down until you hear it lock into place.
4. Repeat steps 1 to 3 for the remaining batteries.

After inserting a battery, if a question mark appears on the aircraft's LCD screen and does not disappear after a few seconds, remove the battery. If necessary, clean the battery compartment of any dust or debris. Then insert the battery again.

Attach the payload

1. Rest the aircraft body upside down (so that the batteries face down) on the top layer of the mission case.
2. Rotate the payload latches.
3. If necessary, remove the protector plate.
4. Insert the two pegs on the payload into their slots in the payload compartment.



1. Peg on the payload
2. Payload body

5. Lay the payload body down flat into the payload compartment.
6. Rotate both payload latches until they click in place.

Attach the legs

The aircraft comes with four legs and each one is marked with dots. Each receptacle on the aircraft body is also marked with dots. You must match the number of dots on the leg to the number of dots on the receptacle. The dots on the legs and receptacles are raised so that you can feel them if you are assembling the aircraft in the dark.

As you add weight to the system (such as when flying with XL batteries or heavier payloads), you should use legs with retention hooks and use Heavy Lift – Long Endurance arms with retention slots. For more information on these arms and legs, contact your Teledyne FLIR representative.

1. Match the number of dots on the leg to a receptacle with the same number of dots.

2. Push the leg into the receptacle until you hear it click into place.
3. Repeat steps 1 and 2 for the remaining three legs.
4. Turn the aircraft over and stand it on its legs.

If you attach a leg that needs a software upgrade, the upgrade starts automatically. For more information, see "Update the components individually" on page 339.

Attach the propulsion arms

The propulsion arms are color-coded. Attach the propulsion arms with the white-tipped propellers into the arm receptacles with black and silver trim. Attach the propulsion arms with black propellers (no white tips) into the arm receptacles with all black trim. You cannot attach the wrong

color arm to the wrong color receptacle.

If your mission kit comes with HL-LE arms, always use these arms when flying with payloads that weigh more than 1 kg / 2.2 lb. You should also use these arms if you are flying with XL batteries.

1. On the propulsion arm, make sure that the latch and the lock are in the open position.

1. Lock
2. Latch

2. Hold the propulsion arm at a 45° angle.
3. If the propulsion arms have retention slots and the legs on your aircraft have retention hooks, perform the following actions:
    a. Align the slots in the arm with the hooks on the leg of the aircraft.

1. Retention slots on propulsion arm
2. Retention hooks on leg

    b. Ensure that the slots are pushed back on the leg so that they rest securely in the hook of the leg.
4. Bring the arm up and into the receptacle.

5. Rotate the latch clockwise until you hear it click into place.

6. Rotate the lock clockwise. The lock must be in place to fly the aircraft.

7. Repeat steps 2 to 6 with the other propulsion arms.

If you attach a propulsion arm that needs a software upgrade, the upgrade starts automatically. For more information, see "Update the components individually" on page 339.

USING THE TABLET

With the tablet, you can use MCS to control and observe the flight. Your system might come with the FZ-G1 tablet or the FZ-G2 tablet.

1. Ethernet connection port
2. Stylus
3. Charging port
4. USB and HDMI ports
5. Power button

FZ-G1 tablet

1. Charging port
2. Ethernet port
3. Stylus
4. Ethernet, USB-A, and USB-C ports
5. Power button

FZ-G2 tablet

Both tablets have both a touchscreen interface and a stylus. Typically, you want to use the stylus, so that you have more precise control over the aircraft's movements.

The tablets also have an onscreen keyboard that you use to type information, such as passwords and file names.

Ethernet and USB ports are also available on each tablet. On the FZ-G1 tablet, the Ethernet port is along the top of the tablet. The FZ-G2 tablet includes two Ethernet ports: one along the top and one along the side. The FZ-G1 tablet uses a USB-A port while the FZ-G2 tablet includes both USB-A and USB-C ports.

The FZ-G1 tablet includes an HDMI port so you can connect it to an external display. If you want to connect the FZ-G2 tablet to an external display, you must use the approved USB-C to HDMI adapter. For more information on purchasing this adapter, contact your Teledyne FLIR sales representative.

Because the tablets use Windows, many gestures are similar to other Windows-based applications for touchscreens. For example, you can select check boxes, tap icons, tap and hold items to access information, and browse through folders. Using the stylus, you can hover over icons and menus to access them. Many of the icons in MCS have tooltips. When you hover over the icon, the tooltip tells you what the icon does.

Other gestures might not be as familiar. For example, to enable some features, you must first make an icon active.

When using MCS, many of the settings that you select persist until you change them. Some settings, however, are reset to their default value when the flight is complete. For example, any flight settings or behaviors, height settings, land options, or units of measure that you configure remain unchanged after a flight, but the speed of the aircraft resets after you land. You must always confirm all settings before a flight, but this check is especially important if multiple operators fly the same aircraft. During a flight, you should also pay attention to any other settings that might persist from a previous flight.

✓ To make it easier to use the stylus with the tablet, lock the tablet's screen orientation to Landscape mode. In the Windows display settings, turn on **Rotation lock**. Set the **Orientation** drop-down list to **Landscape**.

Turn on the tablet

On average, the battery on the tablet lasts for 2 hours from a full charge.

On the front of the tablet, press and hold the Power button for 2 seconds.

✓ To save battery life, turn off the screen if you are not using it. To turn off the screen, press the **Power** button for 2 seconds again. To turn off the tablet, press and hold the **Power** button for 5 seconds.

Right-tap the screen

On the stylus, hold the button that is closest to the tip of the stylus and tap the screen.

Calibrate the stylus

You can calibrate the stylus, so that the software selects the exact spot that you tap on the screen. When you calibrate the stylus, Windows learns how you hold the stylus and how you tap the screen.

1. Right-tap  .
2. Tap **Search**.
3. In the **Search** field, type **Calibrate**.
4. Tap **Calibrate the screen for pen or touch input**.
5. In the **Tablet PC Settings** dialog box, tap **Calibrate**.
6. Tap **Pen input**.
7. Tap the crosshairs in each of the four corners.
8. Tap **Yes**.
9. Tap **OK**.

Turn off Windows Press and Hold settings

In rare cases, you might not be able to open MCS if the Windows version on the tablet uses Press and Hold settings for the stylus. You must turn off these settings to continue.

1. Right-tap  .
2. Tap **Search**.
3. Type **Control Panel**.
4. Tap Enter.
5. In the **Control Panel**, tap **Pen and Touch**.
6. On the **Pen Options** tab, tap **Press and hold**.
7. Tap **Settings**.
8. Clear the **Enable press and hold for right-clicking** check box.
9. Tap **OK**.

Open MCS

Perform one of the following actions:

- Using the stylus, tap  .
- If the MCS icon does not appear on the tablet's desktop, tap  > **FLIR**> **FLIR MCS**.

About the MCS screen

Each corner of the MCS screen has an interactive element.

- In the lower-left corner of the screen,  appears. Use this icon to configure connections in the **Available Aircraft** dialog box and to access the **System Configuration** dialog box.
- In the lower-right corner of the screen,  appears. Use this icon to open the **Actions** menu where you can access flight planning and other tools.
- In the upper-left corner of the screen,  appears. Use this icon to show the primary video panel.
- In the upper-right corner of the screen, the compass rose appears.

MCS screen

1. Video panel
2. Aircraft icon
3. Base station location
4. White ring showing Maximum Range
5. Access **Available Aircraft** dialog box
6. Stop the motors and notifications
7. Compass rose
8. Home position
9. Access **Actions** menu

Use the onscreen keyboard

1. In the Windows task bar, tap  .
2. To type, tap the characters with the stylus.
3. To close the keyboard, tap **X**.

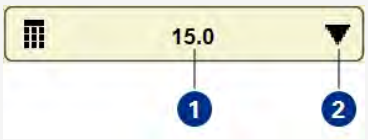
Set numeric values in fields

In certain dialog boxes, such as the **Height Settings** dialog box that appears before taking off, you set numeric values for certain fields. For these fields, you can select from preset options, or you can set custom values.

Select preset numeric values

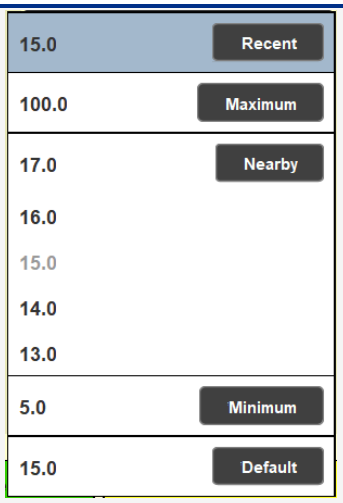
When setting numeric values in MCS, you can select from a number of preset values. Depending on the numeric field, the presets include recent selections, the maximum and minimum values for the field, values that are close to your current selection, and the default value for the field.

1. Perform one of the following actions:
   - Tap the number in the number field.
   - On the right side of a number field, tap ▼.



1. Number field
2. Open presets

2. In the drop-down list, select one of the preset values.

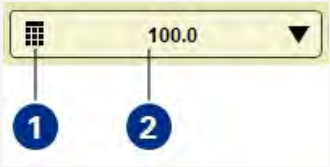


Set custom numeric values

When setting numeric values in MCS, you can use a calculator-like interface to set a custom numeric value.

The arrows in the calculator-like interface and the **Apply** button are not available if you reach the maximum or minimum range for the field.

1. On the left side of a number field, tap .



1. Open calculator-like interface
2. Number field

2. In the dialog box, perform one or more of the following actions:
   - To set a specific value, tap the number keys.
   - To increase a number, tap .
   - To decrease a number, tap .
   - To switch to a negative number, tap so the icon changes to .
   - To clear the value and type a new one, tap .
3. Tap **Apply**.

If you are using the number keys to set a value, to delete the last character, tap . To delete the entire value, tap .

Cut, copy, or paste text in fields

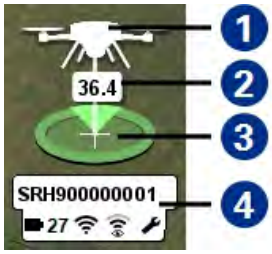
In MCS, you can cut, copy, or paste text in fields where you type text.

1. In a text field, highlight the text that you want to cut, copy, or paste over.
2. Right-click the text.
3. Perform one of the following actions:
    - To cut the text, tap **Cut**.
    - To copy the text, tap **Copy**.
    - To paste over the currently selected text, tap **Paste**.

In text fields, you can also use the standard Windows keyboard shortcuts for cut, copy, and paste.

About the aircraft icon

The aircraft appears in MCS as an icon on the screen. The aircraft icon includes the aircraft itself, the aircraft height, and the aircraft shadow. You can use the aircraft icon to adjust its height during a flight. The height of the aircraft appears below the aircraft icon. The aircraft shadow shows where the aircraft is located on the map. You can use it to move the aircraft to a different location.



1. Aircraft icon
2. Aircraft height
3. Aircraft shadow
4. Aircraft label

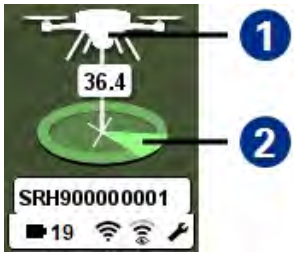
The aircraft icon

When the aircraft is on the ground, the location of the front EO/IR camera (or the front of the aircraft) appears as a white triangle in the aircraft shadow. If you are using a camera payload, the white triangle shows the direction that the camera payload is facing.

1. Aircraft icon
2. Location of the front EO/IR camera or direction of the camera payload (aircraft on the ground)

White triangle on aircraft shadow

As soon as you tap the aircraft icon to take control of the aircraft, the white triangle changes to a green triangle in the aircraft shadow.



1. Aircraft icon
2. Location of the front EO/IR camera or direction of the camera payload (aircraft in the air)

Green triangle on aircraft shadow

If the aircraft is off the current view of the map, the off-map aircraft icon appears, pointing toward the aircraft. The aircraft name appears below the off-map aircraft icon, so that you know which aircraft is not within your current view. If the aircraft is the active one, a green shadow appears below the aircraft icon.

✓ You can center the map on an off-map aircraft, or group of aircraft, by tapping the off-map aircraft icon.

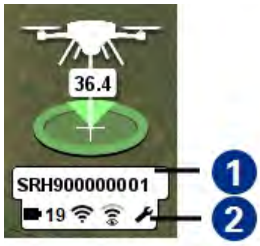
Off-map aircraft icon

For more information on the MCS screen when you are flying multiple aircraft, see "Fly multiple aircraft at the same time" on page 211.

If communications are lost for more than two minutes, the aircraft icon disappears from the map. When communications are re-established, the aircraft icon appears on the map again. To continue the flight, you must tap the aircraft icon to take control of the aircraft.

About the aircraft icon label

The label below the aircraft icon has two parts: the aircraft information label and aircraft status label.



1. Aircraft information label
2. Aircraft status label

Aircraft icon label

The aircraft information label provides more information about the aircraft, such as its name, current GPS position, or the distance from the aircraft to the home position. You can change this label to show the information that you want to see.

The aircraft status label provides the following information about the current status of the aircraft:

- The number of minutes remaining on the current batteries.
- The wireless signal strength.
- The strength of the aircraft's GPS connection.
- If GPS-Denied Visual Navigation is available to the aircraft, information about the quality of the visual navigation connection.

- Potential issues with the amount of flight time remaining. If the temperature of the batteries increases to a point where the remaining flight time is lower than the remaining capacity of the batteries, is replaced with .

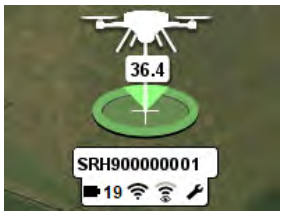
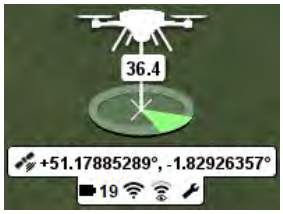
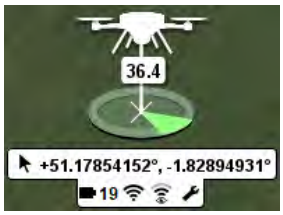
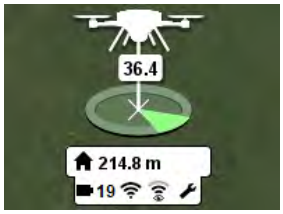
For more information, see "Check the quality of the aircraft's visual navigation lock" on page 71.

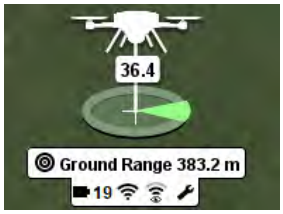
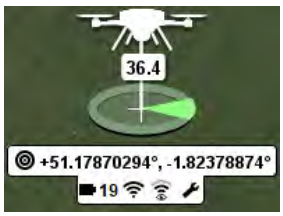
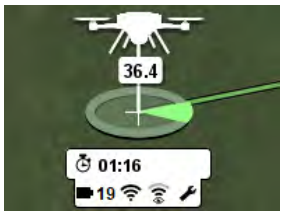
Change the aircraft information label

1. Tap the aircraft information label.
2. Continue to tap the aircraft information label until it shows the option that you want.

Aircraft information label options

The following options are available for the aircraft information label:

Label	Description
	This label shows the aircraft's name. When the aircraft is in motion, this label changes to show the aircraft's speed.
	This label always shows the current GPS position of the aircraft. When the aircraft is in visual navigation mode, the label shows the aircraft's estimate of its GPS position.
	This label always shows the current GPS position of the cursor on the map. If you added elevation terrain data to your map, this label shows the current GPS position of the cursor, followed by the ground height above sea level.
	This label always shows the distance from the aircraft to the home position.

Label	Description
	This label always shows the lateral distance from the aircraft to the active camera target.
	This label always shows the GPS position of the active camera target.
	This label always shows the estimated time (in mm:ss) until the aircraft arrives at a location. If the location is within 0.5 m / 1.6 ft, **N/A** appears in the label.

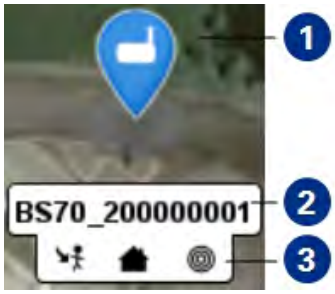
Copy GPS coordinates

You can use the aircraft's information label to copy the aircraft's GPS coordinates. After you copy them, you can paste them into other areas of MCS, such as the **Go To Location** field when downloading maps.

1. Change the aircraft information label to show the GPS coordinates.
2. Right-tap the aircraft information label.
3. Tap .

About the base station icon

The base station appears in MCS as an icon on the screen. The base station icon includes a blue marker to indicate the base station itself, as well as a label. The label has two parts: the information label and the status label.

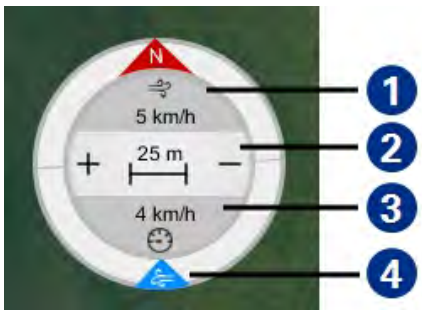


1. Base station
2. Information label
3. Status label

The base station icon

Use the compass rose

The compass rose is in the upper-right corner of the MCS screen. Besides helping to orient the map, the compass rose provides you with information about the current wind speed and direction, as well as the speed of the aircraft. You can also use the compass rose to zoom in and out of the map.



1. Wind speed
2. Map scale
3. Aircraft speed
4. Wind direction
   (In this case, the wind is blowing from the south.)

Compass rose

The top of the compass rose shows the wind speed. It updates dynamically during a flight. The blue triangle around the outside of the compass rose indicates the wind direction. The wind direction appears as the direction that the wind is blowing from.

The bottom of the compass rose shows the maximum speed that you set for the aircraft. The aircraft might fly at a speed lower than what appears in the compass rose if it is flying into the wind.

Rotate the map using the compass rose

You can rotate the map to align yourself better with the position of the camera, the aircraft, or terrain features, such as roads.

In the compass rose, drag the N arrow around.

Reset the compass rose arrow to point north

Perform one of the following actions:

- Double-tap the arrow.
- Double-tap the ring around the compass rose.
- Tap and hold the ring around the compass rose.

Zoom into or out of the map

In the compass rose, perform one of the following actions:

- To zoom into the map, tap +.
- To zoom out of the map, tap —.

Change the map view

1. Tap and hold any point on the map.
2. Drag the map to a different location.

Center the map on the aircraft

You can center the map around the aircraft.

1. In the lower-right corner of the screen, tap  .
2. Tap  .

The map moves to the location of the aircraft. The aircraft remains centered on the screen and the map moves with the aircraft.

✓ If you are connected to a single aircraft, to center the map on the aircraft quickly, double-tap the stylus on an open space of the map. If you are connected to multiple aircraft, if you double-tap the stylus on an open space of the map, the position and zoom level of the map change to show all connected aircraft.

Stop centering the map on the aircraft

1. In the lower-right corner of the screen, tap  .

2. Tap  .

The map stops centering on the aircraft and no longer moves the map as the aircraft moves.

Move a dialog box

In MCS, you can move a dialog box or the calculator-like interface that appears when setting values in fields.

1. In MCS, open a dialog box or the calculator-like interface used to set values in a field.
2. Perform one of the following actions:
    - If the dialog box has a title bar, such as the **System Configuration** dialog box, tap and drag the title bar to a new location on the screen.
    - If the dialog box does not have a title bar, tap and hold any area of the dialog box that does not have an input field or a check box. Drag the dialog box to a new location on the screen.

✓ If you view the details for the aircraft's or base station's GPS or wireless network connection, or information about the aircraft batteries, when you drag the dialog boxes to a new location on the screen, they remain open so you can continue to view their contents. To close the dialog box, tap **X**.

PREPARING FOR FLIGHT

Before a flight, you should connect the tablet to the internet to download maps and airspace information, so that you have the correct information when the tablet is offline. Then, you should ensure that the tablet can connect to the base station's Wi-Fi network. You should also ensure that all components have been upgraded to the correct software version. See "Update the components individually" on page 339.

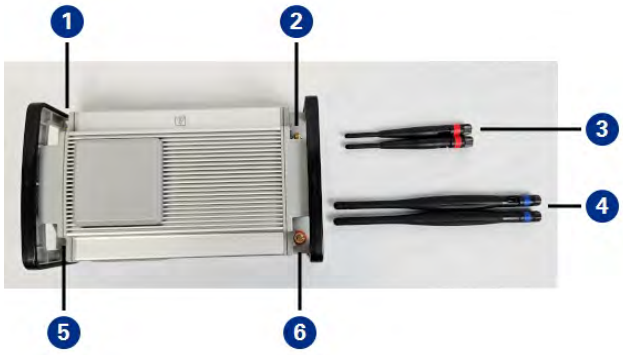
You might also want to connect the tablet to the base station or customize some MCS settings (such as your units of measure) in advance. Doing so can save time later when you are ready to fly the aircraft.

When you are ready to start a flight, you must set up the system appropriately and run through various preflight checks before taking off.

Assemble the base station

The base station comes with four removable antennas. The two tablet link antennas are installed straight up. The two aircraft link antennas are installed at a 45° angle. You must connect the correct type of antenna to the correct connector on the base station. If you connect the antennas incorrectly, communications issues can arise during a flight.

> The pictures below show the aircraft link antennas as shorter than the tablet link antennas. However, some systems might include aircraft link antennas that are the same length as the tablet link antennas.



1. Connector for tablet link antenna
2. Connector for aircraft link antenna
3. Tablet link antennas
4. Aircraft link antennas
5. Connector for aircraft link antenna
6. Connector for tablet link antenna

Base station and its antennas

✓ If, after your previous flight, you stored the base station with the antennas folded down, you do not need to assemble the base station before your flight.

The base station also includes a built-in GPS antenna.

1. Attach an aircraft link antenna to the aircraft link connector that is on a slant.
2. Attach the other aircraft link antenna to the other aircraft link connector.
3. Attach a tablet link antenna to the tablet link connector that is straight up.
4. Attach the other tablet link antenna to the other tablet link connector.

After connecting all the antennas, the base station should appear like the following picture:

1. External GPS antenna connector
2. Charger port
3. Ethernet port
4. USB port
5. LCD screen

Adjust the antennas

After you connect the antennas, you can adjust them using the antenna hinge.

1. Point an antenna straight.
2. Using the antenna hinge, gently push the antenna forward and adjust it in the correct direction.
3. Using the antenna node, tighten the antenna.
4. Repeat steps 1 to 3 for the remaining antennas.

Turn on the base station

After you attach the antennas to the base station and adjust them, turn the base station on. Since the base station is the main connection point of the system, turn it on before turning on the aircraft or the tablet.

On the side of the base station, beside the LCD screen, press and hold  until the LCD screen turns on.

It takes approximately 30 seconds for the base station to be ready to use. The name of the base station, its SSID, and the battery level appear on the base station's LCD screen.

⚠ If the base station battery reaches a critical temperature, the LED on the base station flashes red. If this appears, land the aircraft. Allow the base station to cool down before resuming your flight.

Connect the tablet to the internet

Some configuration steps require an internet connection.

✓ For a faster, uninterrupted connection, use an Ethernet connection.

Connect using a Wi-Fi network

1. In the Windows notification area, tap  .
2. Select a Wi-Fi network that reaches the internet.
3. Type or paste the password for the Wi-Fi network.
4. Tap **Connect**.

Connect using an Ethernet connection

1. At the top of the tablet, open the cover for the Ethernet connection.
2. Connect an Ethernet cable to the tablet.
3. Connect the cable directly to your network router.

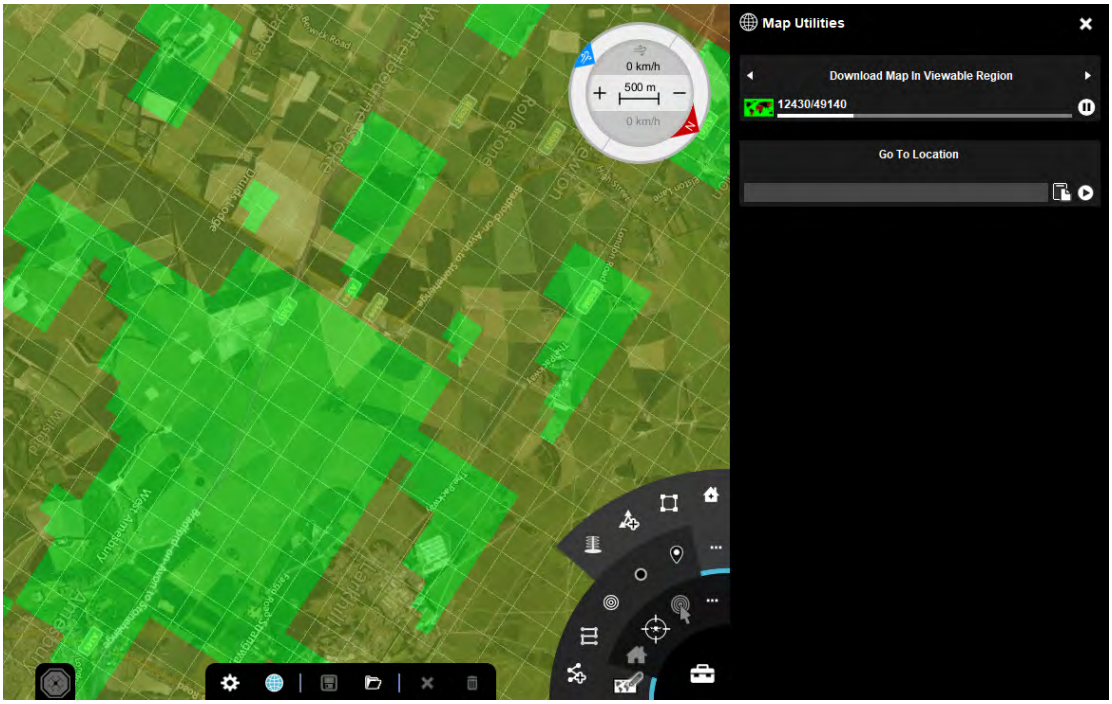
Download base maps

Most online sources have pre-rendered maps available in various levels of detail. The maps use tiles, so that they can retrieve and show the map quickly. Each time that you change the map location or the zoom level, the software updates the map using these tiles.

Before flying the aircraft, ensure that you have connected the tablet to the internet and downloaded the maps required for your area of operation.

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap  . A dialog box with the map options appears on the right side of the screen.
4. Perform one or more of the following actions:
   - Tap and drag the map to the area of interest.
   - In the dialog box, in the **Go To Location** dialog box, type or paste the GPS coordinates for the area of interest. Tap  .
5. At the top of the dialog box, perform one of the following actions:
   - To download the map tiles for all zoom levels around any specified point of interest, tap  once to select **Download Around Points of Interest**.
   - To download the map tiles for the area that is currently visible, tap  twice to select **Download Viewable Region**.
6. Tap  .
7. Perform one or more of the following actions:
   - To pause the download, tap  .
   - To resume the download, tap  .
   - To highlight downloaded tiles in green, tap  .

As the software downloads the map tiles, the progress bar indicates the number of tiles stored and the number of tiles remaining. If you select a green highlight for downloaded tiles, any tile downloaded appears in green. Smaller green tiles show that the software has also downloaded lower levels of the map.



✓ After the download completes, to reload the tiles, tap .

Download airspace information

You must ensure that you have the correct airspace information for the country that you are flying in. When you have this information, during takeoff, the software shows the name and contact details for nearby airports or other restricted areas. Check the local airspace regulations to determine if you need to contact the restricted areas to inform them of your flight.

You can only use the airspace information for one country at a time.

To download airspace information, you must connect the tablet to the internet. See "Connect the tablet to the internet" on page 45.

When you download airspace information, the software caches it on the tablet. Any local airspace warnings appear in the **Preflight Checks** dialog box that appears during takeoff.

1. In the lower-left corner of the screen, tap .

2. Tap  .
3. Tap  .
4. On the **Preferences** tab, ensure that the **General** tab is selected.
5. Set the **Airspace Region** drop-down list to the country that you are flying in.

The tablet downloads the airspace information.

To refresh the airspace information, set the **Airspace Region** drop-down list to **None**. Close the dialog box and open it again. Set the **Airspace Region** drop-down list to the country that you are flying in. MCS downloads the airspace information again.

Connect the tablet to the base station

The tablet and base station use a Wi-Fi network to connect. In most cases, this connection uses the default Wi-Fi network password and is set up for you before the system is shipped. If necessary, you can connect the tablet to the base station manually using the Network Setup Tool.

However, for increased security, you should change the password for your base station's Wi-Fi network after you receive your system. After changing the password, you must reconnect the tablet to the base station. For more information, see "Change the password for the base station's Wi-Fi network" on page 325 and "Reconnect the tablet to the base station's Wi-Fi network" on page 356.

You can also use an Ethernet connection to connect the tablet to the base station.

Connect the tablet to the base station's Wi-Fi network automatically

By default, the tablet and the base station connect over a Wi-Fi connection. In most cases, the tablet and base station connect automatically.

If you purchased a second tablet from Teledyne FLIR, you need to connect it to the base station's Wi-Fi network manually.

1. Turn on the base station.
2. If it is not already on, turn on the tablet. When the tablet establishes the connection, in the Windows notification area,  appears. Wait for this indicator to appear before starting flight preparations.

You can also use MCS to check that the tablet and base station are connected. In the lower-left corner of the screen, tap  . If the tablet and base station are connected, beside the base station icon,  appears.

Connect the tablet to the base station's Wi-Fi network manually

If the base station and the tablet do not connect automatically, you can connect manually using the Network Setup Tool to create a profile for the base station's Wi-Fi network. When you use this tool, it provides an example name to show you the type of information that you need to provide. Do not use the example provided. The name of the base station will always start with "BSH" but the serial number of your base station is unique.

You can only use the Network Setup tool if you have not changed the default Wi-Fi network password for your base station. If you changed the password, see "Reconnect the tablet to the base station's Wi-Fi network" on page 356.

1. Write down the nine numbers that appear after BSH on the label on the bottom of the base station.
2. Tap  > **FLIR** > **Network Setup Tool**.
3. In the dialog box, type **BSH**, followed by the nine numbers that you copied.
4. Tap **OK**.

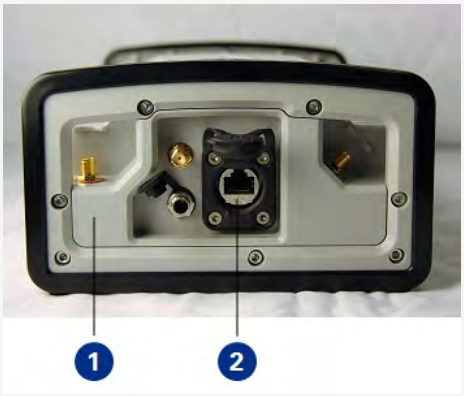
The tool creates the Wi-Fi network profile for the base station and the tablet should connect to the base station's Wi-Fi network.

Connect the tablet to the base station using an Ethernet connection

In some cases, such as when flying in areas of high radio frequency (RF) interference, you might want to connect the tablet to the base station using an Ethernet connection, instead of a wireless connection.

You might also need to connect to the base station using an Ethernet connection if you changed the default Wi-Fi network password. For more information, see "Reconnect the tablet to the base station's Wi-Fi network" on page 356.

1. Connect an Ethernet cable to the tablet.
2. On the end of the base station, lift the cover for the Ethernet port.



1. Base station
2. Ethernet port

3. Connect the Ethernet cable to the base station. The tablet and base station should connect automatically.
4. When connected using an Ethernet connection, for additional security, perform the following actions to turn off Wi-Fi connections on the tablet:
   a. Right-tap .
   b. Tap **Search**. The onscreen keyboard appears.
   c. In the **Search** field, type **Wi-Fi**.
   d. Tap **Change Wi-Fi Settings**.
   e. In the **Wi-Fi** section, tap **On**. The tablet turns off Wi-Fi connections.

Turn on the aircraft

Before you turn on the aircraft, double-check that the batteries are secure and verify that the propulsion arms are connected to the correct receptacles. If you are using a camera payload, ensure that the payload latches are secure. See "Assembling the aircraft" on page 22.

On the aircraft, press and hold until the LCD screen turns on.

The aircraft completes an initialization sequence, and, if you are using a camera payload, it also initializes. During initialization, the camera payload moves around. Ensure that there is enough clearance between the aircraft and the ground to allow the payload to move around freely.

✓ While you wait for the aircraft and payload initialization sequence to complete, turn on the tablet if you haven't already done so. See "Turn on the tablet" on page 30.

In MCS, if you are using a camera payload, and you are viewing the payload's video stream, the following image appears in the primary video panel:

When only the video stream appears in the primary video panel, the payload initialization is complete. It takes approximately 2 to 3 minutes for the sequence to complete.

If the payload does not initialize completely due to environmental conditions, you can use manual takeoff initialization mode to have the payload complete its initialization. For more information, see "Enable manual takeoff initialization mode" on page 196.

Connect MCS to the aircraft

You can connect MCS to any aircraft that is available on the base station's network.

1. Verify that your tablet is connected to the base station.
2. In the lower-left corner of the screen, tap . In the **Available Aircraft** dialog box, all aircraft detected on the base station's network appear.
3. Beside the name of the aircraft, tap **Connect**.

After you connect to the aircraft, a green bar appears on the left side of the **Available Aircraft** dialog box to indicate that the aircraft is the active aircraft in MCS. If you connect to multiple aircraft, you can use the **Available Aircraft** dialog box to determine which aircraft is the active aircraft.

If the aircraft does not appear in the list of available aircraft, you might need to connect the base station to the aircraft again. See "Pair an aircraft with a base station" on page 356.

Disconnect the aircraft from MCS

1. In the lower-left corner of the screen, tap  .
2. Beside the name of the aircraft, tap **Disconnect**.

Set your units of measure

You can set the units of measure that you want to use for distance, height, speed, map scale, and temperature in MCS. Each option can be set independently of the others. For example, you can set your distance measurement to an imperial measurement, but your speed measurement to a metric measurement.

When you set your units of measure, the new settings become the default.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Preferences** tab, ensure that the **General** tab is selected.
5. In the **Units of Measure** field, tap **Configure**.
6. Use the drop-down lists to set your units of measure.
7. To close the **Units of Measure** dialog box, tap **X**.

You can also set your units of measure directly from the **Height Settings** dialog box during the takeoff process. For more information, see "Take off" on page 66.

Ensure the software is up-to-date

Before flying the aircraft, ensure that the software on the tablet matches the software on the aircraft and base station.

In the lower-left corner of the screen, tap  .

If the software does not match, **Update System** appears beside the name of the aircraft. See "Update the system" on page 338.

Set up the system for a flight

When you are ready to fly the aircraft, set up the system appropriately, including positioning the base station, assembling and starting the aircraft, and checking the system status.

Position the base station and aircraft

It is important to position the base station properly to ensure good communications between it and the aircraft.

Keep a distance of at least 30 cm / 12 inches between the base station and anyone in the area.

1. Position the base station greater than 1 m / 3 ft off the ground, such as on a tripod or the roof of a vehicle.
2. Adjust the base station's antennas so that they point straight out at 45°.
3. Place the aircraft upright on level ground, at least 3 m / 10 ft away from the base station.
4. If necessary, remove the lens cap from the camera payload.

All possible measures should be taken to avoid flying the aircraft directly over the base station. There is a weak connection zone directly above the base station.

Establish orientation

Use the compass rose to help orient yourself before a flight. See "Use the compass rose" on page 40.

1. Position the aircraft so that the camera is pointing in the direction that you want to fly.
2. Ensure a clearance of at least 5 m / 16 ft around the aircraft.
3. In MCS, drag the north arrow on the compass rose to rotate the map into the proper position for your flight. Typically, you want the camera to point toward the top of the screen.

While orienting yourself, observe the following items:

- Determine if there are any obstacles that could interfere with takeoff, flight, or landing.
- Estimate the height required to clear all obstacles in and around the flight path.
- Measure the likelihood that the aircraft needs to stay at a high altitude to return home.

These considerations can affect your flight settings and behaviors.

Check flight settings and behaviors

You must review the aircraft flight settings and flight behaviors each time you fly to ensure that they are appropriate for the current flight.

It is crucial that you check your flight settings and behaviors before every flight. They set the parameters for the flight, including the aircraft's Minimum Safe Height (MSH), its Maximum Range, and its response when a non-fatal warning appears. If you do not review these settings before each flight, the aircraft might not fly as you expect. Crashes can occur as a result.

1. In the aircraft status label, tap  . A dialog box with the aircraft settings appears on the right side of the screen.
2. On the **Flight Settings** tab, set the parameters for the flight.
3. Tap the **Behaviors** tab.
4. On the  tab, set the flight behaviors for takeoff and landing.
5. Tap the  tab.
6. Set the flight behaviors for returning home.
7. To close the dialog box, in the upper-right corner, tap  .

Flight settings

You can configure the following settings for a flight. All heights that you configure in the flight settings are relative to the aircraft's height at takeoff.

Setting	Description
Maximum Height	This field sets the maximum height that the aircraft can fly at. Follow any rules dictated by the airspace management authorities in your region.
Minimum Safe Height (MSH)	This field sets the MSH for the flight, which should be a minimum of 15 m / 49 ft above the tallest obstacle in the flight area. When the aircraft flies home automatically, it ascends to this height before flying home. If it is already above this height, it maintains its current height while returning home, unless you change the height manually. The aircraft also uses this field to calculate the amount of battery

Setting	Description
	power required to return home.
Minimum Height	This field sets the Minimum Height that the aircraft flies at. Because this setting is relative to the aircraft's height at takeoff, it is always less than or equal to zero. If you plan to fly lower than the aircraft's height at takeoff, set the **Minimum Height** to a negative number.
Maximum Range	This field sets the maximum distance away from the aircraft's home position that the aircraft can fly. On the map, this range appears as a white circle. If you change the Maximum Range, the new Maximum Range appears on the map as a blue circle while the change is pending. The current Maximum Range remains as a white circle. When the aircraft can change the Maximum Range to the new value that you set, the blue circle changes to white and the previous white circle no longer appears. When the change is pending, on this tab, the background of the **Maximum Range** field appears in blue. If the aircraft cannot stay within this range for any reason, such as high winds, it starts an emergency landing.
Battery Margin	This field sets the amount of flight time to keep in reserve before warning the operator. The system uses multiple flight conditions to calculate the remaining time. The recommended battery margin to keep in reserve is 5 minutes. If you anticipate complexities in the flight, such as high winds, far distances, poor visibility, or extreme temperatures, then you should increase this amount. When you increase the amount of battery margin, the overall flying time is lower, and the low battery warning appears earlier. When the aircraft calculates when to show this low battery warning, it includes the battery margin, but also includes the estimated time required to return home.
Non-Fatal Condition Response	This drop-down list sets the action that the aircraft should take automatically if a non-fatal condition (such as a low battery) occurs. You can select one of the following options:

Setting	Description
	• **Home and Land:** If the aircraft is below MSH, it ascends to MSH, flies to the home position, and lands. While it is ascending, you cannot move the aircraft horizontally. If the aircraft is within 10 m / 33 ft of its home position, it does not ascend to MSH. If the aircraft is at or above MSH, it flies to the home position and lands. **Home and Land** is the default value for this field. • **Hover in Place:** The aircraft hovers in its current position. • **Home and Hover:** If the aircraft is below MSH, it ascends to MSH, flies to the home position, and hovers at MSH. If the aircraft is already above MSH, it flies to the home position at its current height and hovers there, unless the height is changed manually.
LED Mode	This field sets the mode for the LED lights on the propulsion arms. You can select one of the following options: • **Off:** The aircraft does not have LED lights on during the flight. • **Red:** The aircraft uses red LED lights on each propulsion arm. • **Green:** The aircraft uses green LED lights on each propulsion arm. • **IR:** The aircraft uses infrared (IR) lights on each propulsion arm. • **Nav:** The aircraft uses green and red navigation LED lights. Using the front EO/IR camera as the front of the aircraft, the red lights appear on the left side and the green lights appear on the right side. If you select **Off**, you can set the **LED Mode for Vision Operations** drop-down list to use the LEDs for vision operations, such as when landing on a target, when the aircraft enters visual navigation mode, or for both operations. You can also turn off this option. If you select **Red**, **Nav**, or **Green**, the aircraft automatically uses the LEDs in the same way when it is landing on a target or when it is in

Setting	Description
	visual navigation mode.
LED Mode (On Error)	This field sets the mode for the LED lights if an error occurs during a flight. You can select one of the following options: • **No Change:** The aircraft uses the current settings for the LED lights. • **Off:** The aircraft turns off the LED lights. • **On (Red):** The aircraft turns on the LED lights and the lights quickly flash red.
Base Station Pressure Correction	If you clear this check box, the base station's pressure sensor is not used. For more information, see "Turn off the base station's pressure sensor" on page 328.
Gimbal Speed Yaw	This field sets the sensitivity and responsiveness of the gimbal inputs for the yaw of the camera, as a percentage of the default setting (100%). If you set a value lower than 100%, the gimbal responds slower to inputs. If you set a value higher than 100%, the gimbal responds quicker.
Gimbal Speed Pitch	This field sets the sensitivity and responsiveness of the gimbal inputs for the pitch of the camera, as a percentage of the default setting (100%). If you set a value lower than 100%, the gimbal responds slower to inputs. If you set a value higher than 100%, the gimbal responds quicker.
Aircraft Body Port Power Output	If you are using a Block 2 aircraft, selecting this option enables power output for the power port on the aircraft. You must select this check box if you attach an accessory to the power port that requires power supplied by the aircraft. For more information, see "Enable power output for the power port on the aircraft" on page 64.

Flight behaviors

You can configure the following behaviors for a flight. All heights that you configure in the behaviors are relative to the aircraft's height at takeoff.

Setting	Description
Takeoff and Landing Behaviors	
Takeoff Height	This drop-down list sets the height that the aircraft should ascend to after takeoff. After the aircraft reaches this height, it begins the flight optimization process.
Takeoff Initialization Mode	This drop-down list sets whether the aircraft performs an automatic initialization as part of the takeoff process or if it completes a manual initialization before taking off. For more information on manual initialization, see "Enable manual takeoff initialization mode" on page 196.
Auto Ascend After Takeoff	If you select this check box, the aircraft ascends automatically after it takes off. First, it ascends to the specified **Takeoff Height** before ascending to the specified **Auto Ascend Height**. As the aircraft ascends between these two heights, it completes the flight optimization process.
Auto Ascend Height	This drop-down list specifies the height that the aircraft should ascend to automatically.
Target Landing Mode	This drop-down list sets the mode for target landing. You can select one of the following options: • **Disabled:** The aircraft does not attempt to land on a target and the options for target landing do not appear in MCS. This option is the default option for this drop-down list. • **Optional:** If the aircraft can acquire a target, it lands on the target. • **Required:** The aircraft must always land on a target. For more information on landing on a target, see "Using target landing" on page 223.
Target Landing Mat	This drop-down list sets the type of landing target that you are using when landing on a target. For more information, see "Configure target landing" on page 224.
Reverse Thrust on Target Land	If you clear this check box, the motors do not spin up in the reverse direction to stabilize the aircraft after landing on a target. For more information, see "Turn off reverse motor spin up after landing on target" on page 225.

Setting	Description
Use Outgoing SafeRoute	If you select this check box, the aircraft uses a specified SafeRoute when taking off. For more information, see "Select the outgoing SafeRoute for taking off" on page 188.
Use Incoming SafeRoute	If you select this check box, the aircraft uses a specified waypoint list when returning home. For more information, see"Select the incoming SafeRoute for returning home" on page 189.
Home Behaviors	
Home Speed	This field sets the speed that the aircraft flies home at. The aircraft uses this field to calculate the battery power required to fly home.
Don't Yaw When Returning Home	If you select this check box, the aircraft does not yaw to face the most efficient flight direction as it returns home. You might want to select this check box if you attach a non-camera payload to the aircraft.

Check the status of the aircraft

Before flying, ensure that you have sufficient battery in the aircraft, that the GPS signal quality is strong, and the aircraft has a good connection to the base station. You should also verify that there is enough available memory on the aircraft and payload memory cards.

Monitor the battery and memory levels closely. If the aircraft does not have sufficient battery, a non-fatal warning appears. The aircraft performs the action that is set in the **Non-Fatal Condition Response** drop-down list in the aircraft flight settings. If a memory card does not have enough space during a flight, a warning appears, and the aircraft stops taking new pictures or videos.

For information on how to check the aircraft odometer, see "Check the flight time" on page 330.

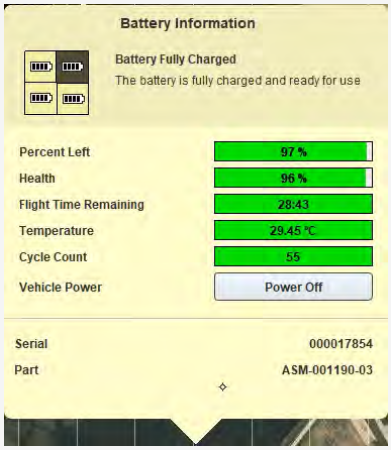
Check aircraft battery information

You can use the aircraft's status label to check the aircraft's battery level.

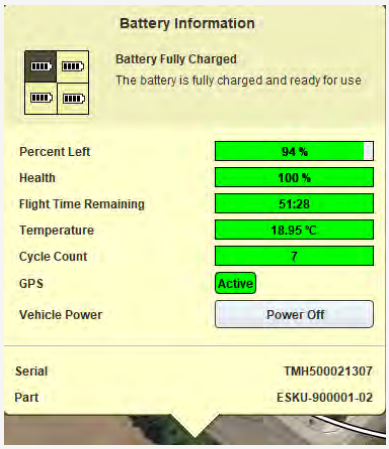
Set up the aircraft so the aircraft's LCD screen is closest to you. When you do, the position of the batteries in the **Battery Information** dialog box corresponds to the position of the batteries in the aircraft.

If you are using XL batteries, you can also use the aircraft's status label to check the GPS status of each battery. Only one XL battery at a time has an active GPS connection.

1. In the aircraft status label, review the number of minutes remaining in the flight. If less than 10 minutes remain, the number of minutes and the number of seconds remaining appear.
2. To view more information about a battery, in the aircraft status label, tap .
3. In the **Battery Information** dialog box, tap the appropriate battery icon.



4. If you are using XL batteries, review the GPS status of each battery.



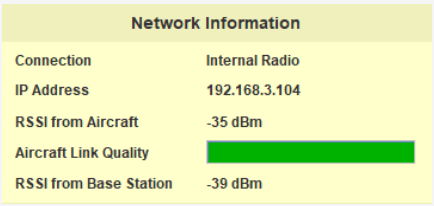
If a battery has a cycle count greater than 400 or health lower than 80%, a battery warning appears. In the warning, appears for the battery with the cycle count or health issue. Replace the battery before taking off. Dispose of the battery safely so it is not used in any future flights.

Check the aircraft's wireless signal strength

You can also use the aircraft's status label to check the aircraft's wireless signal strength.

1. In the aircraft status label, review for the wireless signal strength.

2. To view more information about the connection, tap . The **Network Information** dialog box appears.

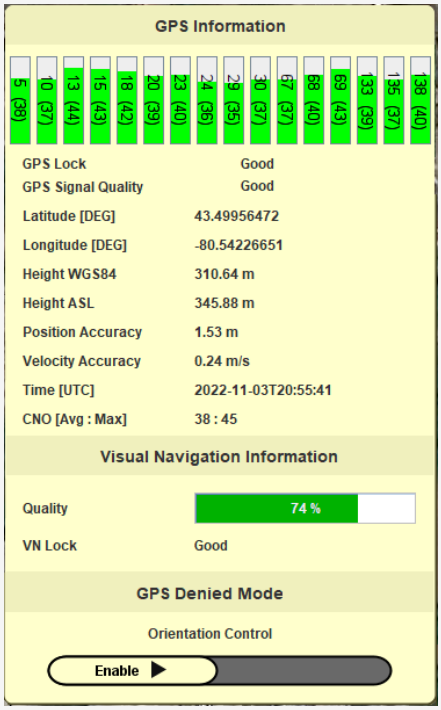


Check the aircraft's GPS connection strength

The aircraft's status label also provides information on the quality of the aircraft's GPS connection.

Perform one or more of the following actions:

- In the aircraft status label, review or for the GPS connection strength.
- For more information about the connection, tap or . In the **GPS Information** dialog box, the GPS satellite information and visual navigation information appears.



Verify the visual navigation status of the aircraft

Before a flight, you should verify that visual navigation is available to the aircraft. For more information on visual navigation, see "About visual navigation mode" on page 297.

If you are using a third-party payload or interposer developed using the Payload Development Kit (PDK), it must be compatible with visual navigation. For more information on whether the payload or interposer is configured to support visual navigation, contact your payload or interposer developer. In addition, the size of the payload or interposer affects the quality of the visual navigation lock. If you are using a large payload or interposer, the visual navigation lock is less accurate.

If visual navigation mode is available to the aircraft when it loses its GPS connection, some icons in the aircraft status label change. If you are in or might fly into an area with poor or no GPS coverage, you should monitor the status of the visual navigation lock closely.

1. Review the aircraft status label. If visual navigation mode is available to the aircraft and the visual navigation lock is good,  appears for the GPS connection strength.

2. To view more information about the quality of the visual navigation lock, tap  . The information appears at the bottom of the **GPS Information** dialog box in the **Quality** field.

If you check the quality of the aircraft's visual navigation lock and **Unsupported hardware configuration** appears, you have attached an incompatible PDK interposer or payload and the aircraft cannot use visual navigation. This message also appears if you attach the Osprey payload to the aircraft and have not yet opened the latch.

Check the aircraft's connection to the base station

You can use the **Available Aircraft** dialog box to verify that the aircraft is connected to the base station.

In the lower-left corner of the screen, tap  . In the **Available Aircraft** dialog box, all aircraft connected to the base station's network appear, along with their connection status. Below the aircraft's name, the IP address of the aircraft appears.

Check the status of the tablet

1. To view the remaining battery amount for the tablet, in the Windows notification area, hover over  .

2. Verify that the tablet is connected to the base station. See "Connect the tablet to the base station's Wi-Fi network automatically" on page 48.
3. To view the strength of the Wi-Fi connection between the tablet and the base station, in the Windows notification area, hover over .

Check the status of the base station

1. In the lower-left corner of the screen, tap . Information on the base station's status appears in the lower-left corner of the **Available Aircraft** dialog box.


2. To check the base station's battery information, beside , review the time remaining on the battery.
3. To check the base station's Wi-Fi signal strength, review .
4. To view more information about the connection, tap . The **Network Information** dialog box appears.
5. To check the strength of the GPS connection, review .
6. To view more information about the GPS connection, tap . In the **GPS Information** dialog box, the connection's GPS satellite information appears.

Set the takeoff height

You can set the height that the aircraft should ascend to after taking off.

If you are taking off in an area with magnetic interference, you should enable manual initialization mode. For more information, see "Enable manual takeoff initialization mode" on page 196.

1. In the aircraft status label, tap . A dialog box with the aircraft settings appears on the right side of the screen.
2. Tap the **Behaviors** tab.
3. On the tab, on the left side of the **Takeoff Height** field, tap .
4. Use the number keys to specify a height.

5. Tap **Apply**.

You can also configure the **Takeoff Height** during takeoff. For more information, see "Take off" on page 66.

Configure auto ascend before taking off

Before taking off, you can set the height that the aircraft should ascend to. The aircraft ascends to its takeoff height first and then ascends to the **Auto Ascend Height** that you specify. The default **Auto Ascend Height** is 15 m / 49 ft.

After the aircraft reaches its **Takeoff Height**, it rotates to complete its flight control optimization as it ascends to the **Auto Ascend Height** that you specify.

1. In the aircraft status label, tap . A dialog box with the aircraft settings appears on the right side of the screen.
2. Tap the **Behaviors** tab.
3. On the tab, select the **Auto Ascend After Takeoff** check box.
4. On the left side of the **Auto Ascend Height** field, tap .
5. Use the number keys to specify the height that the aircraft should ascend to.
6. Tap **Apply**.

You can also configure auto ascend as part of the takeoff process. For more information, see "Take off" on page 66.

Enable power output for the power port on the aircraft

If you are using a Block 2 aircraft, you can enable power output for the power port on the aircraft. You must select this check box if you attach an accessory to the power port that requires power supplied by the aircraft.

The option remains enabled if you restart MCS, restart the aircraft, or update the software.

Do not select this option when using the Tether Kit.

1. In the aircraft status label, tap . A dialog box with the aircraft settings appears on the right side of the screen.

2. On the **Flight Settings** tab, select the **Aircraft Body Port Power Output** check box.

When the option is selected, the port is powered and  appears on the aircraft's LCD screen.

Always clear this option before adding, removing, or changing the device attached to the power port.

Review checklists

Before a flight, review the mission and flight and emergency procedures checklists. See "Checklists" on page 378.

Configure advanced features before takeoff

You can enable some of the advanced features of the aircraft before taking off, including enabling Follow-Me, setting the home position as the base station / network node, and pointing the camera target at the base station / network node. For more information, see "Using advanced aircraft features" on page 183.

If you set these features before takeoff, you must acknowledge that they are enabled during the takeoff process.

Verify that the aircraft is ready for takeoff

Review the following notes before taking off:

- If you update the software on the aircraft before taking off, you must also update the propulsion arms, legs, batteries, and payload. The software upgrade for these components must complete before you can take off.
- You should always fly with an equal charge in the four batteries.

FLYING THE AIRCRAFT

Before starting a flight, ensure that you have properly assembled the aircraft, configured all flight settings and behaviors, and reviewed the appropriate checklists. You should also connect to Electronic Log Book (ELB) before the flight so that your flight information, including the mission, is tracked. See "Using ELB" on page 348.

When flying the aircraft, always start at the furthest point that you want to view. That way, the aircraft has less distance to travel when the battery level is lower.

Take off

When you are ready to start your flight, you take control of the aircraft and start the takeoff process. During this process, the aircraft performs various preflight checks to determine if the system is ready for flight. If the system is not ready for flight, you might need to cancel the takeoff process, adjust your system, and try to take off again. For more information, see "Notes about the takeoff process" on the next page.

If the regulatory region for your flight requires Remote ID, you must enable it for your flight. Depending on the region, you might also need to lock it. For more information, see "Using Remote ID" on page 341.

1. Complete the preflight checklist. For more information, see "Mission and flight checklist" on page 378.
2. To take control of the aircraft, on the map, tap the body of the aircraft icon.
3. Verify that the camera shows the video stream.
4. If you are connected to ELB, perform the following actions:
    a. In the **Select Pilot** dialog box, set the **Pilot** and **Mission** drop-down lists to the appropriate values for the flight.
    b. Tap **Continue**. The **Height Settings** dialog box appears.
5. In the **Height Settings** dialog box, perform one or more of the following actions:
    - If necessary, adjust the **Maximum Height**, **Minimum Safe Height**, **Auto Ascend after Takeoff**, **Takeoff Height**, and **Minimum Height** fields.
    - To change the unit of measure for height, tap the label for one of the fields. In the **Units of Measure** dialog box, set the **Height Measurement** drop-down list. Configure any other preferences for units of measure. In the upper-right corner of the dialog

box, tap **X**.

6. Tap **Continue**. The next dialog box that appears shows the aircraft's status and whether it is ready to take off.
7. In the dialog box, ensure that there is sufficient space available on the aircraft's memory card. If you are using a camera payload with a memory card, ensure that there is sufficient space on the payload's memory card.
8. If the aircraft is not ready to take off, review the results of the preflight checks and then perform one or more of the following actions:
    - To resolve any warnings, tap **Cancel**. Adjust the aircraft or software as necessary. Start the takeoff process again.
    - If you want to proceed with any minor warnings or acknowledge special circumstances for the flight, select the **Acknowledge Above Warnings** check box.
9. When the aircraft is ready to take off, tap **Spin Up**. The motors begin spinning.
10. Tap **Take Off**.

The aircraft takes off, ascends to its takeoff height, rotates to optimize flight control, and hovers in place. If you selected the **Auto-Ascend after Takeoff** check box, while the aircraft ascends to the auto-ascend height that you specified, it rotates to complete its flight control optimization.

If the flight control optimization was not ideal, a non-fatal warning appears. Land the aircraft. If possible, move it away from any metal objects and try to take off again. If the problem persists, contact Support.

If you are using a camera payload and it is blocked when you start to take off, it cannot initialize and  appears in the primary video panel. If this icon appears, continue with the takeoff process. The camera payload initializes when the aircraft is in the air.

Notes about the takeoff process

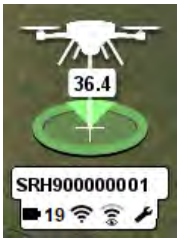
If issues arise, cancel the takeoff process, review the following notes, and try to take off again.

- If an **Upgrade Failure** message appears during the takeoff process, tap **Cancel**. Upgrade the aircraft and its components before trying to take off again. See "Update the system" on page 338.

- Verify that you assembled the aircraft in a supported configuration. If you are trying to take off with an unsupported configuration, or the system is too heavy, a warning appears and you should change the aircraft's configuration before continuing.
- If there is a greater than 5% difference in charge level between one or more of the batteries, a warning appears in the **Preflight Checks** dialog box during takeoff. Hover over each battery in the **Preflight Checks** dialog box to view the estimated charge level. If only one battery has a greater than 5% difference from the other three, the icon for that battery flashes. Change the battery before taking off.

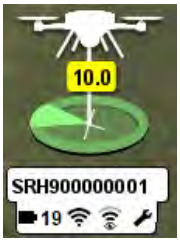
Adjust the aircraft’s height

On the map, the number that appears below the aircraft icon is the current height of the aircraft.



Aircraft at a height of 36.4

If you are flying at or below the aircraft's MSH, the height appears in yellow.

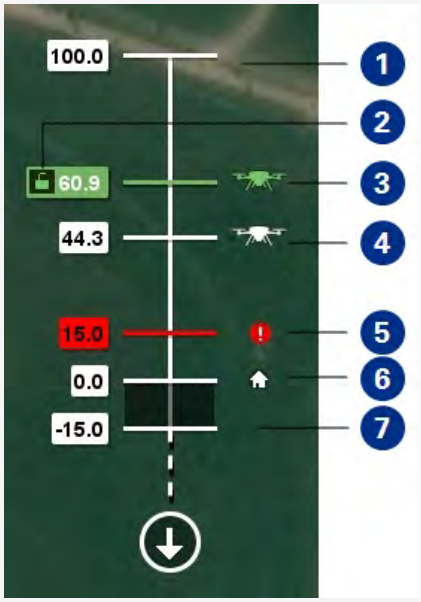


Aircraft below MSH

You can adjust the aircraft’s height using the height slider, the height adjustment arrows on the right side of the MCS screen, or the aircraft height label.

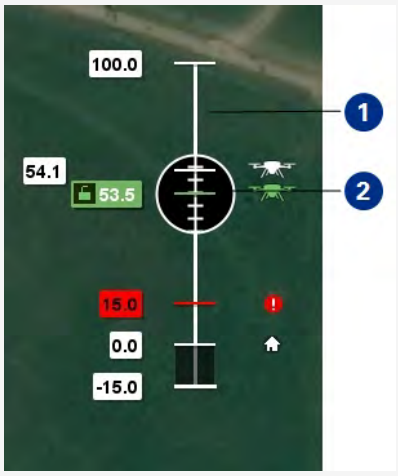
Adjust the aircraft's height using the height slider

1. Tap and hold the aircraft icon.
2. Using the height slider, adjust the height of the aircraft.



1. Maximum height
2. Lock desired height
3. Desired height
4. Current height
5. Minimum safe height
6. Aircraft's height at takeoff
7. Minimum height

3. To make finer adjustments to the height, when the aircraft is close to the desired height, continue to hold the stylus at the aircraft's height. The height slider magnifier appears.



1. Height slider
2. Height slider magnifier

4. Using the magnifier, adjust the height further.
5. When the aircraft reaches the height, release the stylus.

✓ The default range on the height slider is 0 to 100 m / 0 to 328 ft. To adjust this range, change the flight settings. See "Check flight settings and behaviors" on page 54.

Lock the aircraft's height

You can lock the height of the aircraft. When this is enabled, the aircraft ascends or descends to the desired height automatically.

1. Tap and hold the aircraft icon.
2. In the height slider, as you adjust the height of the aircraft, slide the stylus toward .
3. When appears, release the stylus.

Adjust the aircraft's height using the height adjustment arrows

1. To increase the aircraft's height, in the upper-right corner of the screen, below the compass rose, perform one of the following actions:
   - To increase the aircraft's height by 2 m / 6.6 ft, tap once.
   - To increase the aircraft's height continuously, tap and hold . When the aircraft reaches the desired height, release the stylus.
2. To decrease the aircraft's height, in the upper-right corner of the screen, below the compass rose, perform one of the following actions:
   - When above MSH, to decrease the aircraft's height by 2 m / 6.6 ft, tap once.
   - When below MSH, to decrease the aircraft's height by 0.5 m / 1.6 ft, tap once.
   - To decrease the aircraft's height continuously, tap and hold . When the aircraft reaches the desired height, release the stylus.

Adjust the aircraft's height using the aircraft height label

1. Tap the aircraft's current height.
2. In the calculator-like interface, use and or the number keys to set the height that you want to fly at.
3. Tap **Apply**.

Adjust the aircraft's speed

You can adjust the speed at which the aircraft flies.

If you are flying below 5.2 m / 16 ft, the speed is restricted to 3.6 km/h / 3 mph.

Perform one of the following actions:

- To adjust the speed quickly using the preset values of 4 km/h / 2 mph, 20 km/h / 12 mph, and 50 km/h / 31 mph, in the bottom half of the compass rose, tap the aircraft speed.
- To adjust the speed to a specific setting, in the bottom half of the compass rose, tap and hold the speed. Drag the stylus to set an exact speed.

When the aircraft lands, it resets the speed to 4 km/h / 2 mph to avoid any issues at the start of the next flight.

Check the quality of the aircraft's visual navigation lock

If visual navigation mode is available to the aircraft, some icons in the aircraft status label change. If you are in or might fly into an area with poor or no GPS coverage, you should monitor the status of the visual navigation lock closely. For more information on visual navigation, see "About visual navigation mode" on page 297.

Verify that the visual navigation icons appear in the aircraft status label.

Perform one of the following actions:

- If visual navigation mode is available, in the aircraft status label, tap .
- If the aircraft is already in visual navigation mode, in the aircraft status label, tap , , or .

At the bottom of the **GPS Information** dialog box, in the **Quality** field, the percentage and the color of the bar indicate the quality of the visual navigation lock.

The visual navigation lock can have one of the following states:

- If a green bar appears, the quality is good (above 50%). The aircraft might make some small lateral movements, but it will not wander away from its position. With a good visual navigation lock, or appears in the aircraft status label.
- If a yellow bar appears, the quality is poor (20% to 50%). The aircraft might make some small, circular motions that grow bigger in radius, and it could wander away from its position. With a poor visual navigation lock, appears in the aircraft status label.
- If a red bar appears, the quality is bad. The aircraft drifts in large circles that grow bigger in radius, and it wanders from its current position. If a red bar appears, the aircraft will enter recovery mode soon. With a bad visual navigation lock, appears in the aircraft status label.

If you check the quality of the aircraft's visual navigation lock and **Unsupported hardware configuration** appears, you have attached an incompatible PDK interposer or payload and the aircraft cannot use visual navigation. This message also appears if you attach the Osprey payload to the aircraft and have not yet opened the latch.

Control the aircraft's direction

You can fly the aircraft to any location on the map, within its Maximum Range.

To view the estimated time until the aircraft arrives at the desired location, tap the aircraft label until appears. The aircraft uses its current speed to estimate the length of time to fly to the location, but it does not include any time needed to increase or decrease its height.

1. Tap and hold the aircraft shadow.
2. Drag the aircraft shadow to the desired location on the map. A line appears to indicate the flight path.
3. When the aircraft reaches the desired location, lift the stylus.

If the aircraft reaches its Maximum Range before reaching the desired location, it stops traveling and hovers in place.

Control the direction using precision movement mode

You can use precision movement mode to make small horizontal adjustments to the aircraft's position while also adjusting the camera.

1. Right-tap the aircraft shadow. The map zooms in and a white circle appears.

2. Drag the aircraft shadow to the desired location.

✓ To exit precision movement mode, tap outside of the circle.

Fly the aircraft to a location on the map

You can specify a location on the map that you want the aircraft to fly to, such as a flight planning element.

1. Right-tap a flight planning element or a location on the map.
2. In the **Actions** menu, tap and hold for approximately one second.

When you release the stylus, the **Actions** menu closes, and the aircraft starts flying to that location.

✓ To view the estimated time that it takes to fly to the location, tap the aircraft label until appears.

Yaw the aircraft

You can yaw the aircraft to change the direction that the front of the aircraft is facing.

✓ MCS uses the location of the front EO/IR camera as the front of the aircraft.

Perform one of the following actions:

- If necessary, to open the primary video panel, in the upper-left corner of the screen, tap . In the primary video panel, drag the center reticle left or right. To make small yaw increments, tap a location in the primary video panel.
- Move the default camera target on the map. For more information, see "Use the default camera target" on page 96.

Assume manual control

Certain features of the aircraft allow it to fly in an automatic mode. If necessary, you can assume manual control.

Perform one of the following actions:

- During the flight, in the upper-right corner of the screen, tap .
- Tap and drag the aircraft shadow to a new location.

Return home

The default home position is the location that the aircraft took off from. Although you can land the aircraft in any location, typically, you return the aircraft to home before landing.

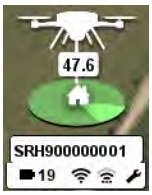
You can change the home position manually, or you can update the home position while landing. To change the home position manually, see "Move the home position" on page 213.

Perform one of the following actions:

- On the map, tap .
- In the lower-right corner of the screen, tap . Tap .

The **Aircraft Going Home** dialog box appears while the aircraft flies to its home position.

When the aircraft reaches its home, the aircraft shadow changes to include the Home icon.



The aircraft hovers in place and waits for further commands.

Notes about returning home

- If you enter flight planning mode while the aircraft is returning home, it does not stop and continues to go to the home position.
- If the aircraft is flying below MSH, it automatically starts ascending to MSH before returning home. If you do not want the aircraft to climb to MSH, clear the **Climb to Minimum Safe Height** check box. If you clear the check box, ensure that the flight path to the home position is clear of any obstacles.
- If the aircraft is flying at or above MSH, the aircraft uses its current height to return home.
- You can also control the aircraft's height manually as it flies home. See "Adjust the aircraft's height" on page 68.
- Although you can manually control the aircraft's height while it flies home, you cannot control its direction. To resume manual control of the aircraft's direction, in the **Aircraft Going Home** dialog box, tap **Cancel**.
- By default, as the aircraft flies to the home position, it yaws to face the most efficient flight direction. However, if you use a joystick, have an active camera target, or are tracking a target, the aircraft does not yaw when returning home. You can manually turn off yaw when returning home by changing your flight behaviors. For more information, see "Check flight settings and behaviors" on page 54.
- As the aircraft travels home, it flies at the speed that you configured in the **Home Speed** field of the flight behaviors. See "Check flight settings and behaviors" on page 54. If necessary, you can adjust the aircraft's speed using the compass rose.
- Some of the return home behaviors change if you use an incoming SafeRoute. For more information, see "Return home using a SafeRoute" on page 192.

Land the aircraft

You can land the aircraft using the map, using video assistance, or using the joystick. For more information on using the joystick, see "Land the aircraft using the joystick" on page 290.

Normally, you return the aircraft to home before landing. However, you can land the aircraft in a different location, such as landing it on a target or landing it at a land location that you specify on the map. For more information, see "Using target landing" on page 223 or "Land the aircraft at a land location" on page 142.

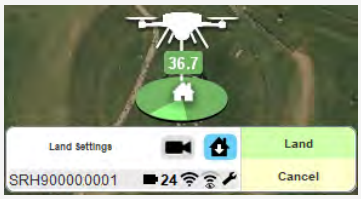
If you land the aircraft at a different location than where you took off from, the home position changes to the current position. Instead of waiting until the aircraft lands to change the home position, you can update home to the aircraft's landing location during the landing process. With this option selected, if you set the **Non-Fatal Condition Response** field in the aircraft flight settings to **Home and Land** or **Home and Hover**, the aircraft does not fly back to its previous home position if a non-fatal warning occurs.

If you select the option to update home while landing and then cancel the landing after it starts, the home position updates, even though you canceled the landing.

If you do not select the option to update the home position while landing, the aircraft flies to its previous home position if a non-fatal warning occurs (when the **Non-Fatal Condition Response** drop-down list is set to **Home and Land** or **Home and Hover**.) Confirm that the previous home position is a safe place to land and that the aircraft's battery level is sufficient to fly there.

Land the aircraft using the map

1. Perform one of the following actions:
   - In the upper-right corner of the screen, right-tap  .
   - Tap and hold the aircraft icon. In the height slider, drag the stylus to the  icon.
   - If the aircraft is at the home position, tap the aircraft shadow.
2. If you want to set the aircraft's landing location as the new home position, in the **Land Settings** dialog box, tap  so that the icon changes to  .
3. In the **Land Settings** dialog box, tap **Land**.



During landing, the aircraft descends slowly and MCS beeps to indicate that landing is in progress. The aircraft's height appears in red below the aircraft icon.

When the aircraft senses the ground, a spiral cone appears below the aircraft icon on the map and in the height slider. This cone indicates that the aircraft has reached ground sensor level. The cone remains with the aircraft icon while it senses the ground, usually when it is between 1 m and 4 m / 3 ft and 13 ft above the ground. Your speed is limited to 4 km/h / 2 mph when the spiral cone appears below the aircraft icon.

As the aircraft begins to land, the map zooms in automatically so you can make precise horizontal movements while the aircraft descends. If you do, the aircraft stops descending and moves horizontally in the direction that you indicate. When you release the stylus, the aircraft resumes landing at the new position. After the aircraft lands, the aircraft speed on the compass rose resets to 4 km/h / 2 mph.

You can cancel the landing before it completes. If you cancel, the aircraft stops descending and hovers in place. The map returns to the original zoom level. If you select the option to update home while landing and then cancel the landing after it starts, the home position updates, even though you canceled the landing.

Land the aircraft with video assistance

You can use the camera to help you find the right spot to land.

1. During landing, in the **Land Settings** dialog box, tap so that the icon changes to .
2. If you want to set the aircraft's landing location as the new home position, in the **Land Settings** dialog box, tap so that the icon changes to .
3. Tap **Land**. The primary video panel appears in full-screen mode.

4. Perform one or more of the following actions:
    - To move the aircraft to a precise location for landing, use the arrows.
    - To move the aircraft further, drag the reticle in the center of the screen to the new location.
    - To adjust the aircraft's height, on the right side of the screen, adjust the height slider.
5. Tap Land.
6. If necessary, perform one or more of the following actions:
    - To pause the landing, tap Pause.
    - To resume, tap Land.
    - To cancel the landing, tap Exit.

As the aircraft begins to land, you can make precise horizontal movements while the aircraft descends. If you do, the aircraft stops descending and moves horizontally in the direction that you indicate. When you release the stylus, the aircraft resumes landing at the new position.

If you select the option to update home while landing and then cancel the landing after it starts, the home position updates, even though you canceled the landing.

> In an emergency, you can stop the aircraft immediately. The motors shut off and the aircraft falls from its current height to the ground. In the toolbar of the primary video panel, tap three times within three seconds, with a deliberate pause between each tap. If you do not tap three times, the aircraft continues as normal. See "Stop the motors" on page 363.

Use the aircraft to check the batteries

You can use the aircraft to check the power level and status of the batteries. You might want to do this after a flight to determine if there is enough battery power to continue flying.

1. On the aircraft, press twice. The approximate charge level and health percentage of the first battery appears at the bottom of the aircraft's LCD screen.
2. Continue to press to view the charge level and health for the remaining batteries in the aircraft.

To return to the screen with the estimated overall battery level and the name of the aircraft, press .

If one or more batteries has a health lower than 100%, the overall battery level does not appear as 100%, even if all four batteries are fully charged.

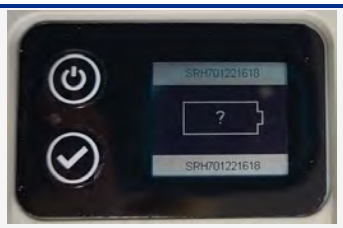
Change the aircraft batteries

You should always fly the aircraft with an equal charge in the four batteries. The system uses the charge level of the lowest battery to estimate the remaining flight time. If your flight is long, you might need to land the aircraft to change batteries. You can replace the aircraft batteries while the aircraft is powered on and on the ground.

When you change the aircraft batteries, remove and replace them in a clockwise or counterclockwise direction, so that you can make sure that you replace all the depleted batteries.

1. On any battery in the aircraft, lift the gray battery latch.
2. Twist the battery latch counterclockwise. The battery pops up.

3. Remove the battery. If the aircraft is on, a question mark appears on the aircraft's LCD screen.



4. Holding the fully charged battery straight up and down (not slanted), insert it into the battery compartment on the top of the aircraft body.
5. To lock the battery in place, twist the gray battery latch counterclockwise, push down on the battery, and then release the gray battery latch.
6. Push the gray battery latch down until you hear it lock into place. When there are four batteries in the aircraft, the question mark on the aircraft's LCD screen changes to show the estimated overall battery level for the four batteries combined.
7. Repeat steps 2 to 6 for the remaining batteries.

USING THE CAMERAS

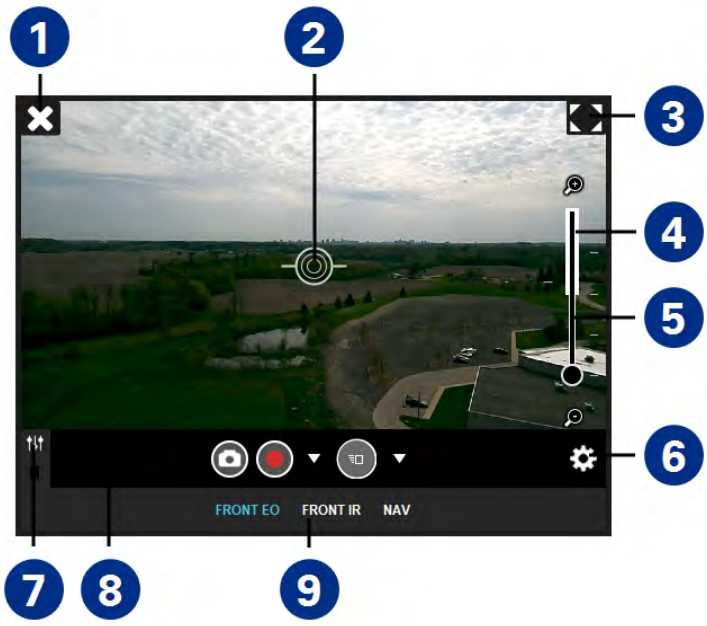
The aircraft comes with built-in cameras, including four downward-facing navigation cameras and a front EO/IR camera. You can also attach a camera payload to the aircraft.

Additional features are available when you attach a camera payload to the aircraft, such as ZoomSnaps. You can also customize different camera settings for the payload that you are using. For more information on the capabilities of your payload, visit the Customer Self-Service Portal at https://selfservice.teledyneflir.com to read the Operating Manual for your payload.

Show the primary video panel

In the upper-left corner of the screen, tap .

The primary video panel appears.



1. Close the primary video panel
2. Reticle
3. Switch to full-screen mode
4. Digital zoom controls
5. Optical zoom controls
6. Video panel settings
7. Manual camera settings
8. Video panel toolbar
9. Switch cameras

Close the primary video panel

1. Hover over the primary video panel.
2. In the upper-left corner of the primary video panel, tap .

Dismiss messages in the primary video panel

Status information and warning messages appear at the top of the primary video panel. These messages might indicate the initialization or upgrade state of the camera payload that you are using or the status of the memory card. The messages also provide information on the capture interval for AutoGrids and AutoSnaps. Status messages appear in green and warning messages appear in red.

Multiple messages can appear on top of each other. Dismiss the current message to ensure that there are no other messages below it.

At the top of primary video panel, tap X.

If you dismiss the notification, it does not reappear, unless the circumstances that caused the message occur again.

Switch cameras

During a flight, you can switch between the cameras. If you switch the camera when the aircraft is moving, it can take a few seconds for the video stream to change.

Some camera features are not available when using the navigation cameras or the front EO/IR camera.

In the primary video panel, perform one of the following actions:

- If you are using a Block 1 aircraft, to switch to the front EO/IR camera, tap **FRONT**.
  

- If you are using a Block 2 aircraft, to switch to the EO stream of the front EO/IR camera, tap **FRONT EO**.
  

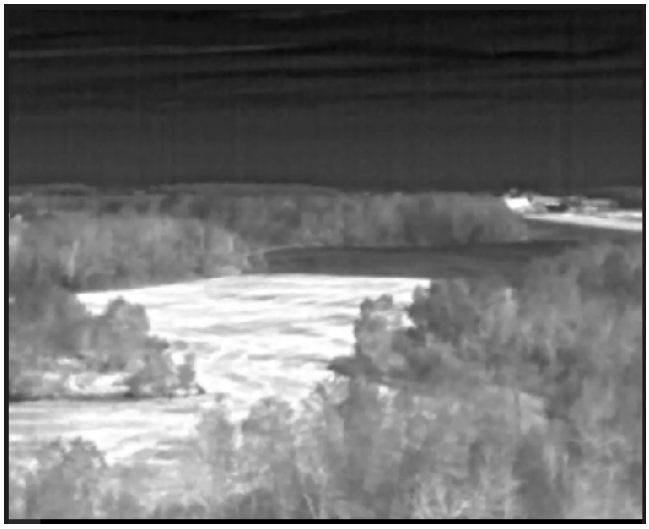
- If you are using a Block 2 aircraft, to switch to the IR stream of the front EO/IR camera, tap **FRONT IR**.
  

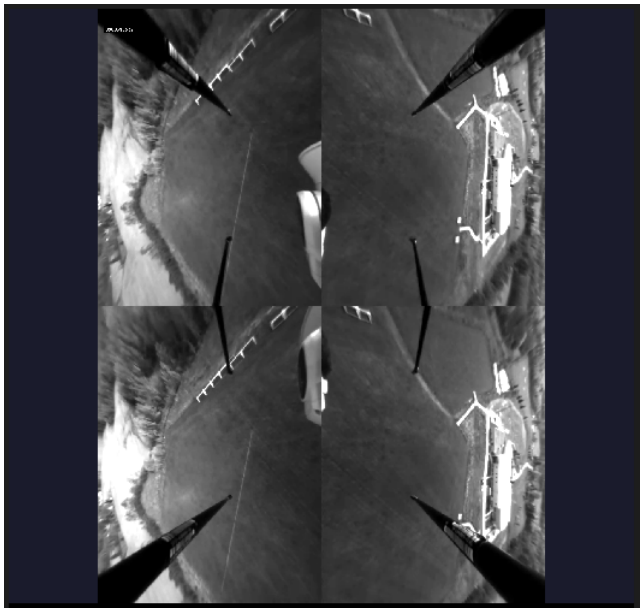
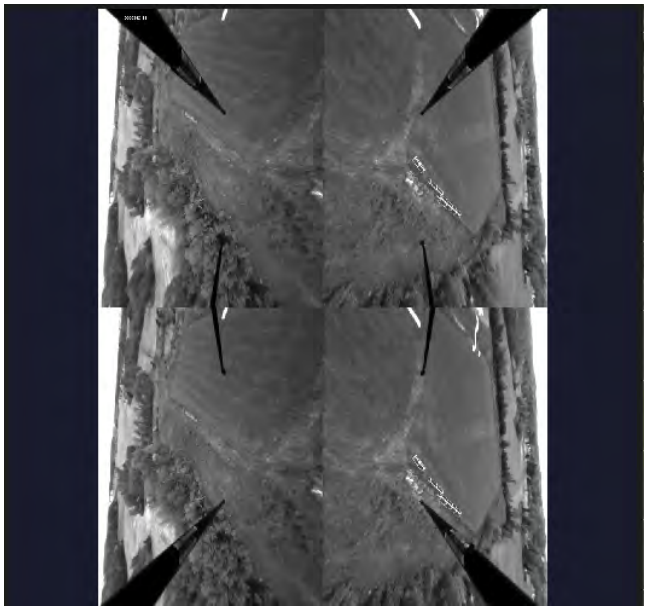
- To switch to the navigation cameras, tap **NAV**.
  

- To switch to the camera payload, tap the name of the payload or payload stream.

About the camera views

The following examples show the video panel for each of the built-in cameras:

Camera	Example
Block 1 front EO/IR camera (in EO camera mode)	
Block 2 front EO/IR camera (EO stream)	
Block 2 front EO/IR camera (IR stream)	

Camera	Example
Block 1 navigation cameras	
Block 2 navigation cameras	

When you switch to the navigation cameras, the shape of the video panel changes to a rectangle. The video stream is split into four, so that you can view the stream from each of the cameras.

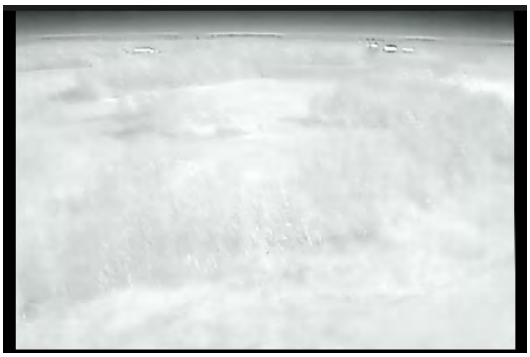
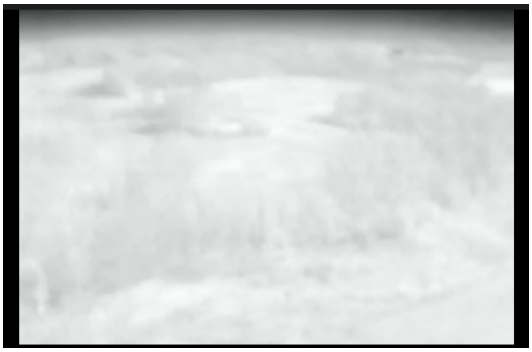
Switch front EO/IR camera modes on a Block 1 aircraft

If you are using a Block 1 aircraft, the front EO/IR camera supports multiple camera modes, including EO mode, fuse mode, IR mode, and picture-in-picture (PIP) mode.

1. Switch to the front EO/IR camera.
2. To select a camera mode, tap  .
3. To select a different camera mode, tap the icon again.

Available camera modes

If you are using a Block 1 aircraft, the following camera modes are available for the front EO/IR camera:

Icon	Camera mode	Description	Example
	EO mode	The EO video stream appears in full color mode.	
	Fuse mode	The IR video stream appears, enhanced with the EO video.	
	IR mode	The IR video stream appears.	

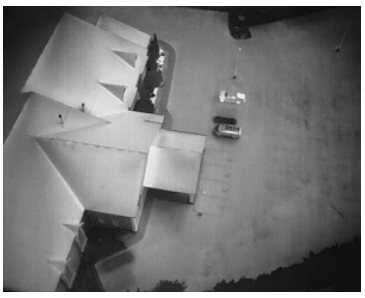
Icon	Camera mode	Description	Example
	PIP mode	The EO video stream appears and a second video stream (in IR mode) appears in the upper-right corner of the video panel.	

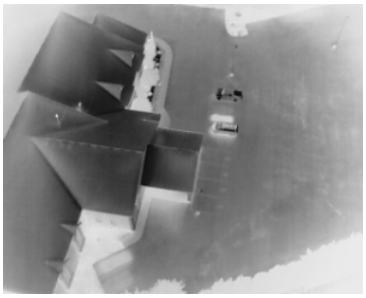
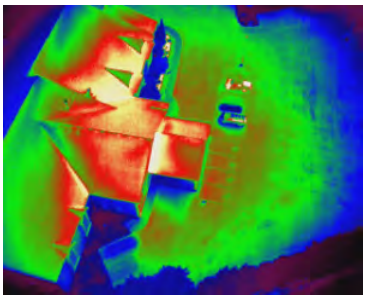
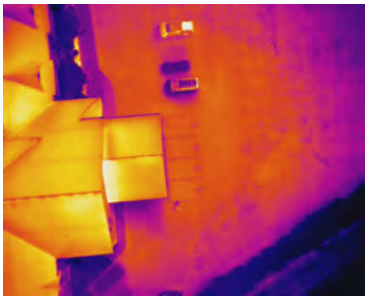
Change IR color palettes

1. In the primary video panel, perform one of the following actions:
   - If you are using the front EO/IR camera of a Block 1 aircraft, tap  until  appears.
   - If you are using the front EO/IR camera of a Block 2 aircraft, tap **FRONT IR**.
2. In the toolbar of the primary video panel, tap  .
3. To select a different color palette, tap the icon again.

Available color palettes

The following color palettes are available:

Icon	Color palette	Example
	White-hot	

Icon	Color palette	Example
 (Not available with the front EO/IR camera of a Block 1 aircraft)	Black-hot	
	Rainbow	
	Ironbow	

Enable digital zoom

Some cameras support digital zoom. Digital zoom uses the software to enlarge the view at the center of the video stream.

For some cameras, the option to support digital zoom is enabled already. However, for certain cameras, you must enable the option manually.

1. In the toolbar of the primary video panel, tap  .
2. Select the  **Enable Digital Zoom** check box.

If you turn off digital zoom, you cannot zoom the camera if you are using the IR stream of the Block 2 front EO/IR camera.

Change the zoom level

You can zoom level for your camera.

If your camera supports digital zoom, you might need to enable support for digital zoom first. For more information, see "Enable digital zoom" on the previous page.

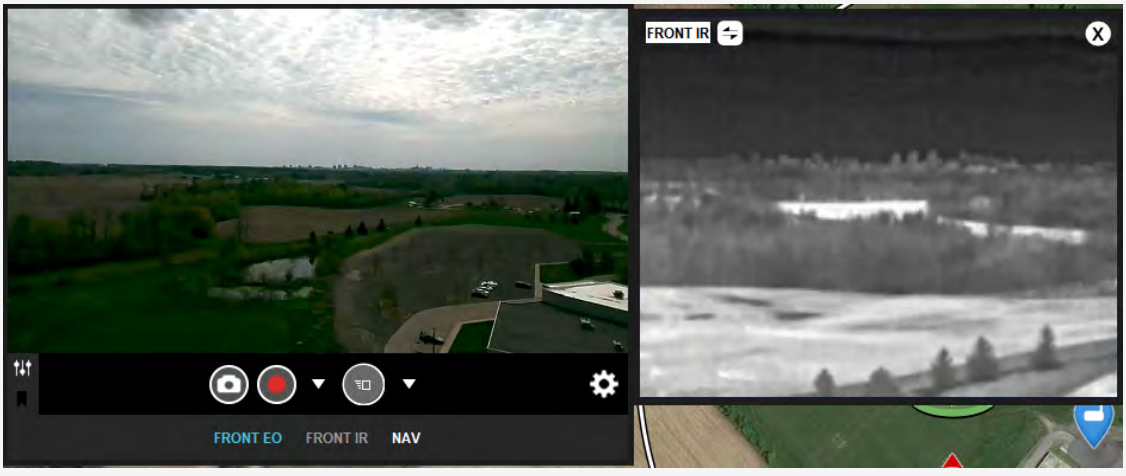
1. Hover over the primary video panel until the zoom controls appear.
2. In the zoom controls, perform one or more of the following actions:
   - Use the slider.
   - To zoom in, tap  .
   - To zoom out, tap  .

Open a MultiView video panel

You can open a MultiView video panel so that you can view an additional video stream from a second camera. For example, while flying the aircraft in a narrow space, you can use a MultiView video panel to view the video from the front EO/IR camera while also monitoring the video from the camera payload in the primary video panel.

You cannot control the aircraft or take pictures or videos in the MultiView video panel.

In the video panel, tap and hold the label for the camera that you want to appear in the MultiView video panel and drag the stylus onto the map.



The name of the camera that you selected appears at the top of the MultiView video panel.

In the primary video panel, you cannot switch to the camera that you are using in the MultiView video panel. Instead, you must swap the contents of the panels. For more information, see "Swap the contents of the primary and MultiView video panels" below.

Like the primary video panel, you can move the MultiView video panel and adjust its size. If you move the MultiView video panel, it cannot overlap the primary video panel.

Swap the contents of the primary and MultiView video panels

If you have a MultiView video panel open, you can swap the contents of the primary and MultiView video panels.

In the upper-left corner of the MultiView video panel, tap  .

Close the MultiView video panel

In the upper-right corner of the MultiView video panel, tap  .

Resize a video panel

You can resize the primary or MultiView video panel.

The camera that you are viewing determines how much you can resize the video panel. You cannot resize the video panel if you are viewing the navigation cameras.

1. Hover over the edge of the video panel.
2. When the arrows appear, tap and drag the arrows to increase or decrease the video panel's size.

You can also resize the primary video panel using its toolbar. Tap and hold the toolbar and drag it to resize the primary video panel.

View the primary video panel in full-screen mode

By default, the map appears in full-screen mode. You can minimize it so that the primary video panel appears in full-screen mode.

1. Hover over the primary video panel.
2. In the upper-right corner of the primary video panel, tap  .

Close the map

When the primary video panel is in full-screen mode, by default, the map appears.

In the upper-left corner of the map, tap ✖.

Show the map

If you close the map when the primary video panel is in full-screen mode, you can show it again.

With the primary video panel in full-screen mode, in the upper-left corner of the screen, tap  .

✓ If you change the default position of the primary video panel to the right side of the screen, and then switch to full-screen mode, the map appears on the right side of the screen. See "Change the default position of the primary video panel or map" on page 322.

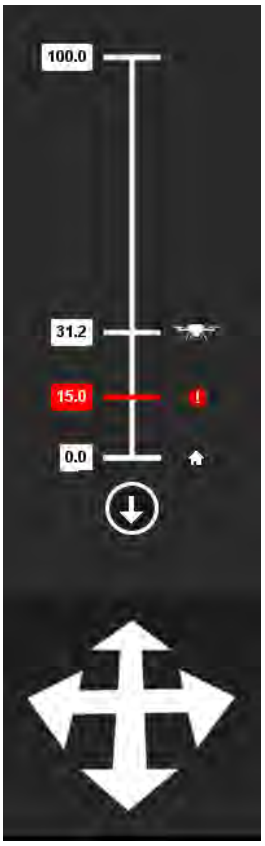
Turn on full-screen navigation controls

With full-screen navigation controls, you can move and land the aircraft while viewing the primary video panel in full-screen mode.

1. In full-screen mode, in the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap  so the icon changes to  .

Use full-screen navigation controls

When the primary video panel is in full-screen mode, navigation controls appear on the side of the primary video panel.



Full-screen navigation controls

With full-screen navigation controls, when you use the arrows to move the aircraft, the aircraft moves relative to the front of the aircraft (the location of the front EO/IR camera). It does not move in the direction that the map is facing.

If you land the aircraft when you are using full-navigation controls, you can update the home position to the aircraft's landing location during the landing process. For more information, see "Land the aircraft" on page 75.

1. View the primary video panel in full-screen mode.
2. Perform one or more of the following actions:
    - To increase or decrease the height, use the height slider.
    - To move the aircraft relative to the direction that the front EO/IR camera is facing, tap and hold an arrow direction.
    - To close full-screen navigation controls, click Exit.

Land the aircraft in full-screen mode

You can land the aircraft when the primary video panel is in full-screen mode.

> For more information on updating the home position to the aircraft's landing location during the landing process, "Land the aircraft" on page 75.

1. With the aircraft in full-screen mode, tap  .
2. Perform one or more of the following actions:
   - If you are landing on a target, ensure that  is selected.
   - If you want to set the aircraft's landing location as the new home position, tap  so that the icon changes to  .
   - To land with video assistance, tap  so that the icon changes to  .
3. Tap  .
4. Perform one of the following actions:
   - To pause the landing, tap  .
   - To resume the landing, tap  .
   - To cancel the landing, tap  .

Turn off full-screen navigation controls

1. In full-screen mode, in the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap  so the icon changes to  .

Close full-screen mode

If you are viewing the video panel in full-screen mode, you can switch back to viewing the map in full-screen mode.

1. Hover over the primary video panel.

2. In the upper-right corner of the primary video panel, tap .

Hide the reticle

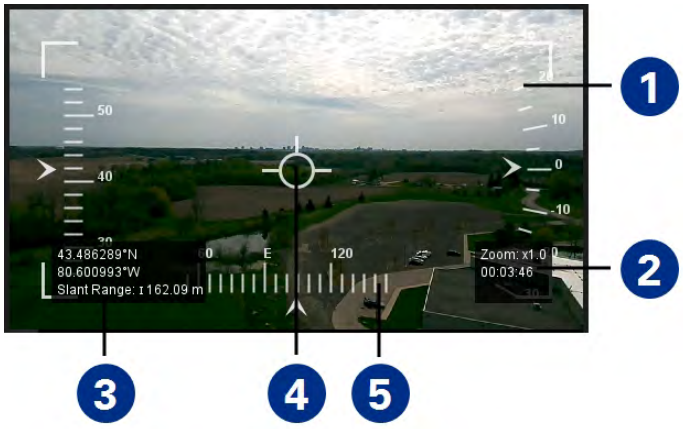
You might want to hide the reticle in the video panel if you do not want to use it to enable the default camera target.

1. In the primary video panel, tap .
2. Tap **View Options**.
3. Clear the **Show Target Reticle** check box.

If you hide the target reticle, you cannot use it to yaw the aircraft. To yaw the aircraft, tap and hold a point in the primary video panel.

Customize the video overlays

You can show video overlays in the primary video panel for any of the cameras. If you enable the overlays, you can customize which ones you want to appear and the color that they appear in. You cannot set unique video overlays for each camera.



1. Roll gauge
2. Text overlay - current zoom level and length of current flight
3. Text overlay - center point of the camera view and slant range
4. Crosshairs overlay
5. Heading gauge overlay

Video overlays

1. In the toolbar of the primary video panel, tap .
2. Tap **Overlays**.

3. Select the **Show Video Overlay** check box.
4. Select the overlays that you want to appear on the screen.
5. Select the color that you want for the overlays.

Notes about video overlays

- You can save the video overlays with the picture previews that appear on the tablet. For more information, see "Save overlays with picture previews" on page 100.
- If you turn on the text overlay, before you take off, the text overlay on the right side of the screen shows the length of time that the aircraft has been on. After you take off, the overlay shows the length of the current flight. When you land, the timer continues but resets when you take off again to show the length of the current flight.
- If you turn on the text overlay, the overlay on the left side of the screen shows the slant range from the camera lens to the center of the field of view of the camera. If you are using a camera payload, I appears before the slant range value.
- Since you cannot change the pitch of the front EO/IR, when you are viewing the video from that camera, the pitch overlay does not appear.

Change the color of video overlays

1. In the toolbar of the primary video panel, tap .
2. Tap **Overlays**.
3. Select a color.

Turn off the video overlays

1. In the toolbar of the primary video panel, tap .
2. Tap **Overlays**.
3. Perform one or more of the following actions:
    - To remove all overlays, clear the **Show Video Overlay** check box.
    - To remove a specific overlay, clear the check box for the overlay.

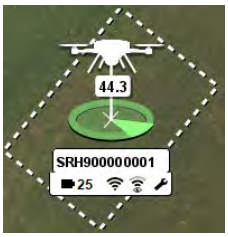
Point the camera

In the primary video panel, tap the screen.

The camera adjusts to point at the location that you tapped and the video stream for that location appears in the primary video panel.

If you are using a camera payload, on the map, the camera's field of view appears as a dotted line.

When the camera payload faces down, the camera's field of view appears as a rectangle under the aircraft shadow.



If you are using the front EO/IR camera and you point to a location in the primary video panel that is above or below the aircraft, you can only view the horizontal position of the point. You can only adjust the camera's view left or right. You cannot move the camera's view up or down.

Point the camera at any location on the map

1. Right-tap a location on the map.
2. In the **Actions** menu, tap .

The default camera target moves to that location on the map.

Use the default camera target

There are two types of camera targets in MCS: the default camera target and flight planning camera targets. When you take off, MCS adds the default camera target to the map. This camera target is always available on the map. If there are additional points on the map that you want to view, you can add flight planning camera targets. For more information, see "Using markers and flight planning camera targets" on page 145.

When you make a camera target active, the aircraft points the camera at that target and continues to do so, regardless of the direction that the aircraft is flying.

To enable the camera target using the video panel, the target reticle must be showing.

1. Perform one of the following actions:
   - On the map, tap  .
   - In the video panel, tap the center of the reticle.
   - In the lower-right corner of the screen, tap  . Tap  .Tap a location on the map.
2. Drag the camera target to a location on the map.

The camera rotates and points at the selected location. The camera centers the target position in the primary video panel.

If you use the default camera target, it is turned off automatically when you start landing the aircraft.

Set the height of the default camera target

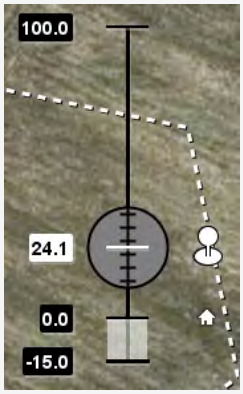
You can adjust the height of the default camera target using the height slider or the height label on the icon of the default camera target.

You can adjust the camera's pitch to change the height of the default camera target without moving the camera target's location. In the toolbar of the primary video panel, tap  . Select the  **Adjust Target Height** check box. If you move the reticle up or down, the aircraft adjusts the pitch of the camera to track the change in the active camera target's height but keeps the target in place on the map. With this option enabled, the height of the camera target appears above the reticle in the primary video panel. Without this option enabled, if you move the reticle up and down in the primary video panel, the aircraft adjusts the pitch of the camera and moves the position of the active target on the map.

The height of the default camera target only appears in the height label if the height is not zero.

Set the height of the default camera target using the height slider

1. Tap the default camera target so  appears on the map.
2. On the map, tap and hold the circle that appears above the default camera target icon.
3. Use the height slider to adjust the height.
4. To make further precise adjustments to the height, when the aircraft is close to the desired height, press and hold the stylus at the target's height. The height slider magnifier appears.

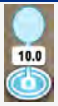


5. Using the magnifier, adjust the height further.

Set the height of the default camera target using the height label

1. Tap the default camera target so  appears on the map.
2. Tap the height label on the default camera target icon.
3. In the calculator-like interface, use ▲ and ▼ or the number keys to set the height that you want.
4. Tap **Apply**.

Remove the height from the default camera target

1. Tap the default camera target so 

appears on the map.

2. Perform one of the following actions:

   - To remove the height from the default camera target using the height slider, tap and hold the circle that appears above the default camera target icon. In the height slider, drag the stylus to the  icon.
   - To remove the height from the default camera target using the default camera target icon, tap the height label on the default camera target icon. In the calculator-like interface, tap  . Tap **Apply**.

The height of the default camera target returns to 0 and the height label is blank.

Return to camera panning mode

On the map, tap  .

The target icon turns black, and the camera can pan independent of targets.

You can also use the primary video panel to return to camera panning mode. In the primary video panel, tap the center of the reticle.

Refine the location of the active camera target

In the primary video panel, perform one or more of the following actions:

- To move the location of the active camera target, drag the reticle to the new location.
- To center the active target on a different location and adjust the target, tap a location.
- To turn off the active target and return to panning mode, tap the center of the reticle.

Each time that you adjust the active camera target's location in the primary video panel, it centers the camera in that location.

Take a picture

When you take a picture, the camera captures a full-resolution picture and stores it on the memory card.

You cannot take pictures with the navigation cameras.

In the toolbar of the primary video panel, tap  .

Use AutoSnaps

With AutoSnaps, the aircraft captures pictures automatically at pre-defined intervals. These intervals are configured by you and can be based on either time or distance.

You can use AutoSnaps with the front EO/IR camera. If you switch to a different camera (including the navigation cameras), the aircraft continues to take the AutoSnaps.

You must also have a memory card inserted into the aircraft.

Configure the AutoSnaps interval

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Photo** tab, in the **AutoSnaps** section, perform one of the following actions:
   - For a time-based interval, select the **Time-Based** option. Use the slider to set the time between pictures (in seconds).
   - For a distance-based interval, select the **Distance-Based** option. Use the slider to set the distance between pictures.

Turn on AutoSnaps

1. In the primary video panel, tap  .
2. Select the  **Turn On AutoSnaps** check box.

After you enable AutoSnaps,  changes to  . The aircraft begins to take AutoSnap pictures at the time or distance interval that you specified. AutoSnap status messages appear at the top of the primary video panel.

Turn off AutoSnaps

1. In the primary video panel, tap  .
2. Clear the  **Turn On AutoSnaps** check box.

To turn off AutoSnaps quickly, in the primary video panel, tap  .

Preview and download a picture

You can enable picture previews so that a thumbnail appears at the bottom of the primary video panel after you take a picture. With the previews, you can view and download the most recent picture or review all pictures. If you switch cameras, you can preview and download the most recent picture taken with that camera.

Thumbnails do not appear until you enable picture previews. If you take a picture and then enable picture previews, the thumbnail doesn't appear until you take another picture.

Enable picture previews

If you enable picture previews, thumbnails appear in the lower-left corner of the primary video panel.

Previews do not appear if you enable AutoSnaps or if you are flying an AutoGrid flight. See "Use AutoSnaps" on the previous page or "Using AutoGrids" on page 151.

1. In the toolbar of the primary video panel, tap  .
2. Tap **View Options**.
3. Select the  **Enable Snapshot Previews** check box.

When you take pictures, thumbnails appear in the lower-left corner of the primary video panel.

You can also enable picture previews on the **Camera** tab of the **System Configuration** dialog box.

Save overlays with picture previews

If you show video overlays, you can save them with the picture previews that appear on the tablet.

Overlays are saved on the tablet with the previews only. They are not saved with the picture on the memory card. If you download the picture, the overlays are not included.

1. In the toolbar of the primary video panel, tap  .
2. Tap **Overlays**.
3. Tap **Save On Snapshot Previews**.

The pitch, text, and heading gauge overlays, as well as the roll gauge, are saved with the picture previews.

If you are using any target tracking features, the target information is not saved with the picture previews.

View or download pictures

Perform one or more of the following actions:

- To preview a picture, tap the thumbnail.
- To download the picture, beside the thumbnail, tap . While the tablet downloads the picture, the icon changes to and a progress bar appears. When the software completes the download, the icon changes to .

After you download pictures, they are saved on the tablet. By default, they are saved in **C:\Users\user_name\FLIR_MCS\Downloads** To open this directory in Windows Explorer, tap . For more information on changing the default directory, see "Change the default folder for pictures and videos" on the next page.

Close picture previews

At the bottom of the picture, click **Close**.

Review all pictures

1. In the upper-right corner of the primary video panel, tap .
2. In the lower-left corner of the toolbar of the primary video panel, tap .
3. To browse through the available pictures, tap and .

When reviewing pictures, you cannot view the camera controls or the video stream.

Return to the video stream

After reviewing all pictures, you can return to the live video stream.

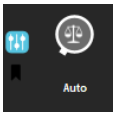
In the lower-left corner of the toolbar of the primary video panel, tap .

Change the default folder for pictures and videos

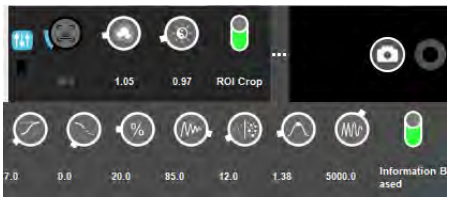
1. In the lower-left corner of the screen, tap .
2. Tap .
3. Tap .
4. Tap the **Media Downloads** tab.
5. In the **Video and Photo Directory** field, tap .
6. Navigate to the folder that you want to use.
7. Tap **OK**.

Configure the camera settings manually

If you are using a Block 2 aircraft, you can change the default camera settings manually for the front EO/IR camera. Each setting that you can configure appears as an icon in the **Camera Settings** menu of the toolbar of the primary video panel.



Camera Settings menu for the EO stream of the front EO/IR camera



Camera Settings menu for the IR stream of the front EO/IR camera

There are two types of camera settings: those with a dial icon and those with a toggle icon.

For the camera settings with a dial icon, you can set a specific value for the setting or select from a list of predefined values. The current value for the setting appears below the icon.

1. Camera setting
2. Current value

Camera settings dial icon

For the camera settings with the toggle icon, you can tap the icon to turn the setting on or off. When the setting is on, the icon is green. When the setting is off, the icon is gray.

1. Camera setting
2. Camera setting label

Camera settings toggle icon

Before configuring the camera settings manually, you must take control of the aircraft. To take control, on the map, tap the body of the aircraft icon.

1. In the toolbar of the primary video panel, switch to the camera that you want to use.
2. Tap .
3. To configure camera settings with a dial icon, perform one of the following actions:
   - To select a higher value or option, tap and hold the icon. Drag up across the icon or to the right across the icon.
   - To select a lower value or option, tap and hold the icon. Drag down across the icon or to the left across the icon.
   - To set a specific value for the setting, tap the value under the camera setting icon. In the calculator-like interface, use and or the number keys to set the value. Tap **Apply**.
   - To select a value or option from a predefined list, tap the value under the camera setting icon. Scroll to find the value or option that you want. Tap the value or option. Tap **Done**.
4. To configure camera settings with a toggle icon, perform one of the following actions:
   - To turn off the setting, tap .
   - To turn on the setting, tap .

When setting a specific value for a camera setting with a dial icon, to delete the last character, tap ⌫. To delete the entire value, tap ⊗.

Camera settings

You can configure the following camera settings for the front EO/IR camera of a Block 2 aircraft. For more information on how to configure these settings, see "Configure the camera settings manually" on page 102.

Setting	Description	Conditions when configuring
 White balance	This setting balances the effects of external lighting to maintain the natural appearance of colors in your picture or video. For more information about the white balance options, see "White balance options" on page 106.	You must be viewing the EO stream.
 Digital detail enhancement (DDE)	This setting affects the sharp details of the scene. When you set a high value, the camera enhances a higher degree of detail. When you set a negative value, the camera softens the pictures and videos. If you set a value of 0, the camera does not enhance any details.	You must be viewing the IR stream.
 Adaptive contrast enhancement	This setting adjusts the perceived brightness of the image. A value less than 1 maps a larger percentage of the scene to the lower 8-bit gray shades. A value greater than 1 maps a larger percentage of the scene to higher 8-bit gray shades.	You must be viewing the IR stream.
 ROI Crop	This setting controls how much of the content in the region of interest (ROI) is adjusted automatically by the other camera settings. By default, the ROI is cropped to the middle 50%.	You must be viewing the IR stream.
 Plateau value	This setting limits how much of the dominant portions, such as sky and ground, influence the gray shade allocation. Lower values distribute the shades to other parts of the image.	You must be viewing the IR stream.

Setting	Description	Conditions when configuring
 Tail rejection	This setting affects how detail is distributed in the histogram. A large value dedicates more detail and, therefore, more contrast to the central portion of the histogram at the expense of removing some detail in the really bright or dark areas.	You must be viewing the IR stream.
 Linear percent	This setting determines how much object detail the camera preserves. A higher value results in more detail visible in a given object, at the expense of differentiating temperature between objects. A lower value allows better differentiation between objects, at the expense of object detail.	You must be viewing the IR stream.
 Damping factor	This setting affects how quickly the automatic gain control adjusts to changing content in the field of view. Smaller values result in a faster response.	You must be viewing the IR stream.
 Detail headroom	This setting changes the level of detail in the video or picture. Higher values improve the detail in the bright and dark areas of the histogram but reduce the contrast in the medium brightness area.	You must be viewing the IR stream.
 Maximum gain	This setting limits the maximum slope of the mapping function. In a relatively uniform image, a high maximum gain value increases the contrast of the image at the risk of over-exposure. More apparent noise can also appear in the image. Lower values for maximum gain result in a less grainy, lower-contrast picture or video.	You must be viewing the IR stream.
 Smoothing factor	This setting affects which portion of the scene is attenuated or enhanced using DDE. A low value decreases the portion of the scene considered to be the more-heavily-weighted details.	You must be viewing the IR stream.

Setting	Description	Conditions when configuring
 Information Based	This setting gives scene elements with more detail more shades of gray and more contrast than elements with less detail. If you turn off this setting, more contrast appears between objects rather than within objects.	You must be viewing the IR stream.

White balance options

White balance option	Description
Auto	This setting adjusts the white balance automatically, so the colors appear natural.
Daylight	This setting adjusts for outdoor conditions on a fine day.
Incandescent	This setting adjusts for scenes lit by incandescent lighting.
Cool White	This setting adjusts for cool white fluorescent lighting.
Day White	This setting adjusts for day white fluorescent lighting.
Daylight 2	This setting adjusts for daylight fluorescent lighting.
Cloudy	This setting adjusts for a cloudy sky.

Record video

You can record and save videos from either the front EO/IR camera or the navigation cameras.

✓ To save space on the memory card, stop recording when flying to a destination. Instead, fly to the location that you want to record. When you reach the location, start recording again.

In the toolbar of the primary video panel, tap  .

Stop recording video

In the toolbar of the primary video panel, tap  .

Enable recording automatically on spin-up

If you enable this feature, the aircraft starts video recording as soon as it starts to spin up the motors.

If you enable this feature, the aircraft records video for the cameras that you select. For more information on selecting cameras, see "Select which cameras should record video" below. If you select a number of cameras, depending on the length of the videos, you can use a large amount of space on the memory card.

1. In the lower-left corner of the screen, tap .
2. Tap .
3. Tap .
4. On the **Preferences** tab, ensure that the **General** tab is selected.
5. Select the **Record Video on Spin Up** check box.

The camera automatically starts recording video when the aircraft starts to spin up the motors.

Select which cameras should record video

You can select which of the aircraft's cameras should record video. By default, MCS records the video from the attached camera payload only. Selecting two or more cameras uses extra resources and can affect the performance of certain features.

You must select at least one option. If you clear the check boxes beside all options, you cannot record video.

If you are recording video from both the camera payload and the front EO/IR camera, and the aircraft enters visual navigation mode or you want to land on a target, the aircraft pauses recording video from the front EO/IR camera. Recording video from the camera payload continues. Recording video from the front EO/IR camera resumes again when the aircraft exits visual navigation mode or if you cancel landing on the target.

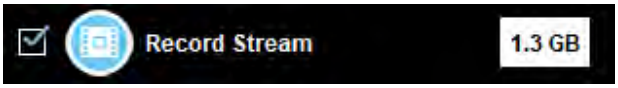
1. Take control of the aircraft.
2. In the primary video panel, beside , tap .
3. In the **Recording Cameras** dialog box, select the cameras that should record video.

Record the video stream

You can also create a local copy of the video stream that you see in the primary video panel on the tablet. You might want to record this video stream if it is not suitable to save the video to the memory card or you want to create a backup copy of the video stream.

1. In the toolbar of the primary video panel, tap .
2. Tap **View Options**.
3. Select the **Record Stream** check box.

When you record video, the tablet keeps a local copy. In the menu, beside the **Record Stream** option, the amount of space used by the current video stream and all previous video streams appears.



This feature can use a significant amount of space on the tablet, so you should monitor it closely to prevent affecting the tablet's performance. If the video stream takes up too much space, a warning appears, and you should manage the video stream files on your tablet. For more information, see "Manage your video stream files" on page 358.

✓ To manage the recorded streams on the tablet, tap the file size indicator beside the **Record Stream** check box. The tablet opens the folder where your videos are stored.

PLANNING FLIGHTS

You can create flight plans to have the aircraft navigate a pre-defined course. You can add any of the following flight planning elements:

Icon	Flight planning element	Description	Reference
	Waypoints	A waypoint flight path defines a sequence of specific locations that your aircraft flies to. In a list, you can specify an action for one waypoint in the list. You can also configure loiter settings for one or more waypoints in the list.	"Using waypoints, points of interest, and land locations" on page 122
	Points of interest (POIs)	POIs indicate points of interest on the map that you can fly to. You can configure loiter settings for a POI and convert POIs to land locations or drop points.	"Using waypoints, points of interest, and land locations" on page 122
	Land locations	Land locations allow you to specify precisely where you want to land the aircraft.	"Using waypoints, points of interest, and land locations" on page 122
	Markers	Markers are visual references on the map that note locations that you want to revisit or obstacles to avoid.	"Using markers and flight planning camera targets" on page 145
	Flight planning camera targets	Flight planning camera targets provide a location where you can point the camera.	"Using markers and flight planning camera targets" on page 145
	AutoGrids	An AutoGrid flight plan allows the aircraft to scan a defined area and take pictures at regular intervals.	"Using AutoGrids" on page 151

Icon	Flight planning element	Description	Reference
	Circular flight plans	With a circular flight plan, the aircraft orbits an object at pre-defined heights.	"Using circular flight plans" on page 163
	No-fly zones	No-fly zones denote regions which you do not want to fly over or the areas that you want to avoid.	"Using no-fly zones and flight perimeters" on page 169
	Flight perimeters	A flight perimeter is a visual indication of your flight's boundaries.	"Using no-fly zones and flight perimeters" on page 169

When you fly a flight plan with flight planning elements, the aircraft navigates automatically, leaving you free to operate the camera. See "Point the camera" on page 95.

When flying a flight plan, you can change the aircraft's height as you would during regular flights. You might want to increase the height to make more efficient use of your flying time. You might want to decrease the height to reduce the amount of time it takes to land after flying a flight plan. See "Adjust the aircraft's height" on page 68.

During a flight, tapping and holding a flight planning element makes it active. The icon turns blue, and a dashed line appears around the outside of it.

You can also save your flight plan so that you can repeat the same flight later or transfer the flight plan to another tablet.

When creating your flight plan, always verify that the flight planning elements are in the correct location before flying the flight plan. If you switch between simulator mode and real flight, flight planning elements can accidentally get created in different locations. Before continuing with the flight plan, ensure that flight plans do not have flight planning elements that cross continents or oceans.

Use flight planning mode

To create a flight plan, you must be in flight planning mode.

1. In the lower-right corner of the screen, tap  .
2. Tap  .

In flight planning mode, you select the flight planning elements that you want to add.

1	Flight perimeter	8	POI
2	Flight planning camera target	9	Expanded flight planning menu showing the **Edit** tab for waypoints
3	Pop-up menu beside flight planning element	10	AutoGrid
4	Land location	11	Marker
5	Circular flight plan	12	Flight planning toolbar
6	No-fly zone	13	Flight planning menu
7	Waypoint list		

Always exit flight planning mode after creating or changing your flight plan. Certain features are not available when you are in flight planning mode. For more information, see "Exit flight planning mode" on page 121.

Create a flight plan

You can create a flight plan using any of the flight planning elements in the flight planning menu. For more information on creating flight plans, see the following sections:

- "Create a waypoint, waypoint list, POI, or land location" on page 123.
- "Add a marker" on page 145.
- "Add a flight planning camera target" on page 146
- "Create an AutoGrid" on page 151.
- "Create a circular flight plan" on page 163.
- "Define a no-fly zone" on page 170.
- "Define a flight perimeter" on page 170.

Save a flight plan

You can save a flight plan to fly it again at another time.

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. In the flight planning toolbar at the bottom of the screen, tap  .
4. In the **Save Flight Plan** dialog box, select a folder.
5. Type a file name for the flight plan.
6. Tap **Save**.

Load a flight plan

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. In the flight planning toolbar at the bottom of the screen, tap  .
4. In the **Load Flight Plan** dialog box, navigate to the folder where you saved your flight plan.

5. Select a plan.
6. Tap **OK**.

The flight planning elements in the flight plan appear on the map.

Import a list of coordinates

You can import a list of coordinates that is saved in .csv (UTF-8) or .txt files. When you import this list, you associate the coordinates with a type of flight planning element. The .csv or .txt file must include the coordinates, but it can also include flight planning element labels and heights. The coordinates that you include can use Deg, DTM, DMS, UTM, or MGRS coordinate systems.

When you import a list, the software treats the first row of data as a heading row. If you have coordinates, labels, or heights in the first row, the software does not import them. You must have a heading row in your file before importing.

The list of coordinates that you import cannot have more than 150 sets of coordinates.

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. In the flight planning toolbar at the bottom of the screen, tap  .
4. In the **Load Flight Plan** dialog box, navigate to the folder where you saved the .csv or .txt file.
5. Select the file.
6. Tap **OK**.
7. In the **Import Coordinates** dialog box, perform one of the following actions:
    a. In the **Format** drop-down list, select the format for the coordinates.
    b. In the **Feature Type** drop-down list, select the type of flight planning element that you want to import the coordinates as.
8. Tap **Continue**.
9. In the **Import Coordinates** dialog box, select the type of data to import from each column in the file.
10. Tap **OK**.

The flight planning element that you selected appears at the location of every coordinate that was in the .csv or .txt file.

If the list that you import contains heights, but you import the data to a flight planning element that does not support heights (such as markers), the height data does not appear.

Use AutoZoom

If your flight plan has many flight planning elements that are close to one another, AutoZoom helps you select the correct element.

By default, AutoZoom is enabled.

1. On the map, hover over an area with many flight planning elements.
2. Tap the map. The area expands to show all the flight planning elements.

You can also use AutoZoom when viewing the map outside of flight planning mode, if the flight planning elements are close together.

Turn off AutoZoom

1. In the lower-left corner of the screen, tap .
2. Tap .
3. Tap .
4. On the **Preferences** tab, ensure that the **General** tab is selected.
5. Clear the **Enable AutoZoom** check box.

If you turn off AutoZoom, MCS can still zoom into an area of the map at times. For example, whenever you right-tap a flight planning element, MCS zooms in. To close this zoom, tap outside the circle.

Add a label to a flight planning element

You can add a label to flight planning elements to help identify them quickly.

When adding a label to a circular flight plan or the corner of an AutoGrid, you can only add text.

1. In the lower-right corner of the screen, tap .
2. Tap .
3. On the map, tap a flight planning element, such as a waypoint.
4. Beside the flight planning element, tap .
5. Perform one of the following actions:
    - If you selected the waypoint, circular flight plan, POI, or land location element, tap the **Properties** tab. Tap the **Label** tab.
    - If you selected the AutoGrid element, select a corner point on the grid. Tap the **Properties** tab. Tap the **Label** tab.
    - If you selected the marker, target, no-fly zone, or flight perimeter element, tap the **Label** tab.
6. Perform one or more of the following actions:
    - To add text to the label, tap . Ensure that the **Show Label Only** check box is selected. In the **Label** field, type the label text. Tap .
    - To show location information in the label, tap . Select the **Show Location** check box.
    - To show distance information in the label, tap . Select either the **Show Distance to Aircraft**, **Show Distance to Home**, or **Show Distance to Target** check box.

On the map, the label information appears with the flight planning element.

Change or delete a label

1. In the lower-right corner of the screen, tap .
2. Tap .
3. On the map, tap a flight planning element, such as a waypoint.
4. Beside the flight planning element, tap .
5. Perform one of the following actions:
    - If you selected the waypoint, circular flight plan, POI, or land location element, tap the **Properties** tab. Tap the **Label** tab.
    - If you selected the AutoGrid element, tap a corner of the grid. Tap the **Properties** tab. Tap the **Label** tab.
    - If you selected the marker, target, no-fly zone, or flight perimeter element, tap the **Label** tab.
6. Perform one or more of the following actions:
    - To change the text in the label, in the field, type the new text. Tap .
    - To delete the label text, in the field, clear the text. Tap .
    - To change the location or distance information that appears in the label, tap . Select the check box for the information that you want to appear.
    - To remove the location or distance information from the label, tap . Select the **Show Label Only** check box.

✓ You can switch between all the options available for the label, including any text that you added. On the map, tap the label for the flight planning element. Continue to tap the label until it shows the option that you want. You can only view all available information if you did not select the **Show Label Only** check box.

Point the camera at any flight planning element

You can point the camera at any waypoint, drop point, POI, marker, land location, circular flight plan, or flight planning camera target in your flight plan.

1. On the map, right-tap a flight planning element.

2. In the **Actions** menu, tap .

The default camera target moves to the location of the flight planning element. If you move the default camera target, the original flight planning element remains on the map.

Add flight planning elements quickly

You can use the default camera target, the aircraft icon, or the map to add flight planning elements quickly.

If you use the map, the aircraft can be on the ground or in the air. If you use the default camera target or the aircraft icon, the aircraft must be in the air. If you want to add waypoints, drop points, POIs, or land locations while the aircraft is in the air, the aircraft must be stationary.

Add flight planning elements at the default camera target's location

You can add flight planning elements to the location of the default camera target.

✓ You can also add a POI at the default camera target's location using the menu in the lower-right corner of the screen. Tap . Tap and hold until the icon changes to . A POI is placed at the default camera target's location.

1. Tap the default camera target so appears on the map.
2. Right-tap the default camera target.
3. In the **Actions** menu, perform one of the following actions:
   - To add a waypoint at the default camera target's location, tap .
   - To add a drop point or drop and go home point at the default camera target's location, tap . In the **Add Action Waypoint** dialog box, set the **Action** drop-down list to **Drop Point** or **Drop and Go Home Point**. If necessary, change the **Drop Height** and **Drop Delay** fields. Tap **OK**.
   - To add a land location at the default camera target's location, tap . In the **Add Action Waypoint** dialog box, set the **Action** drop-down list to **Land Location**.
   - To add a go home point at the default camera target's location, tap . In the **Add Action Waypoint** dialog box, set the **Action** drop-down list to **Go Home Point**.

- To add a POI at the default camera target's location, tap  .
- To add a marker at the default camera target's location, tap  .
- To add a flight planning camera target at the default camera target's current location, tap  .

If you want to set a height for the waypoint, POI, or flight planning camera target that you add at the default camera target's location, you must move the default camera target to access the waypoint, POI, or flight planning camera target on the map. For more information on setting heights for waypoints, POIs, and flight planning camera targets, see "Set the height of a waypoint or POI" on page 130 or "Set the height of a flight planning camera target" on page 146.

Add flight planning elements using the aircraft icon

You can add flight planning elements to the aircraft's current location.

1. Right-tap the aircraft icon.
2. In the **Actions** menu, perform one of the following actions:
   - To add a waypoint, tap  .
   - To add a drop point or drop and go home point, tap  . In the **Add Action Waypoint** dialog box, set the **Action** drop-down list to **Drop Point** or **Drop and Go Home Point**. If necessary, change the **Drop Height** and **Drop Delay** fields. Tap **OK**.
   - To add a land location, tap  . In the **Add Action Waypoint** dialog box, set the **Action** drop-down list to **Land Location**.
   - To add a go home point, tap  . In the **Add Action Waypoint** dialog box, set the **Action** drop-down list to **Go Home Point**.
   - To add a POI, tap  .
   - To add a marker, tap  .
   - To add a circular flight plan, tap  . For more information, see "Create a circular flight plan during a flight" on page 164.

The flight planning element appears at the aircraft's current location. If you add a waypoint or POI, the software sets the height of the flight planning element to the current height of the aircraft.

> You can also right-tap the aircraft icon to loiter around that point. For more information, see "Loiter the aircraft quickly" on page 141.

Add flight planning elements using the map

You can add flight planning elements to any location on the map.

1. Right-tap the map where you want to add the flight planning element.
2. In the **Actions** menu, perform one of the following actions:
   - To add a waypoint, tap .
   - To add a drop point or drop and go home point, tap . In the **Add Action Waypoint** dialog box, set the **Action** drop-down list to **Drop Point** or **Drop and Go Home Point**. If necessary, change the **Drop Height** and **Drop Delay** fields. Tap **OK**.
   - To add a land location, tap . In the **Add Action Waypoint** dialog box, set the **Action** drop-down list to **Land Location**.
   - To add a go home point, tap . In the **Add Action Waypoint** dialog box, set the **Action** drop-down list to **Go Home Point**.
   - To add a POI, tap .
   - To add a marker, tap .

> You can also right-tap the map to move the aircraft to that location, point the camera there, or loiter around that point. For more information, see "Fly the aircraft to a location on the map" on page 73, "Point the camera at any flight planning element" on page 116, or "Loiter the aircraft quickly" on page 141.

Assume manual control when flying a flight plan

You can assume manual control at any time that the aircraft is flying a flight plan.

During the flight, perform one of the following actions:

- In the upper-right corner of the map, tap .

- Move the aircraft to another location on the map.
- Open the flight planning menu.

The aircraft stops flying the flight plan. To resume the flight plan, tap and hold a flight planning element in the flight plan.

Change the flight plan during a flight

You can change the flight plan while the aircraft is flying. If you change the flight plan, the aircraft pauses the flight automatically and hovers in place until you finish changing the plan.

1. During a flight, in the lower-right corner of the screen, tap  .
2. Tap  .
3. Add or remove any flight planning elements.
4. In the lower-right corner of the screen, tap  .
5. Resume flying the changed flight plan.

If you change a flight planning element and fly to any flight planning element on the map before MCS can synchronize the flight plan with the aircraft, an error appears. When MCS is synchronizing the flight plan,  animates.

Clear the flight plan

If you clear the flight plan, it deletes all flight planning elements from the current plan.

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. In the flight planning toolbar at the bottom of the screen, tap  .
4. Tap **Yes**.

Turn off quick flight planning

You might want to turn off quick flight planning if you find that you are right-tapping the map by mistake.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Preferences** tab, ensure that the **General** tab is selected.
5. Clear the **Enable Quick Flight Planning** check box.

If you turn off quick flight planning, you cannot right-tap the map to add flight planning elements quickly.

Exit flight planning mode

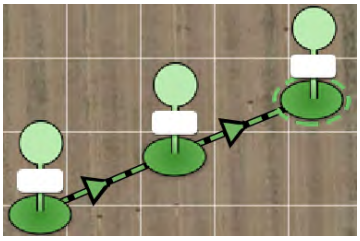
In the lower-right corner of the screen, tap  .

You can also take control of the aircraft or move the aircraft's location manually to exit flight planning mode.

USING WAYPOINTS, POINTS OF INTEREST, AND LAND LOCATIONS

You can create a flight plan made up of a single waypoint or a connected path of waypoints called a waypoint list. You could add a single waypoint to mark a location that you want to fly to or add a waypoint list to define the perimeter of an area under surveillance. In flight planning mode, waypoints appear on the map as a green circle and a white height label, above a green shadow. If you add a waypoint list, a green dotted line appears between the waypoints and includes arrows that point in the direction of travel. After you exit flight planning mode, waypoints and waypoint lists appear on the map in gray.

The waypoint icon



A waypoint list

You can also add POIs to the map. These individual points mark spots on the map that are of interest. POIs cannot be connected like waypoints. They are always individual points on the map. In flight planning mode, POIs appear on the map as a blue circle and a white height label, above a blue shadow. After you exit flight planning mode, the POIs appear on the map in gray.

The POI icon

You can specify a height for both waypoints and POIs. If you don't specify a height, the aircraft uses the height that it is currently flying at.

Land locations allow you to specify precisely where you want to land the aircraft. You might want to create a land location if the aircraft is far away from your takeoff location. By creating a land location, you can land the aircraft safely if a non-fatal warning appears, without having to return the aircraft to the home position.

After you land the aircraft at a land location, that location becomes the new home position automatically. You can also set the land location as home when you start flying to the land location. For more information, see "Land the aircraft at a land location" on page 142.

In flight planning mode, land locations appear as a blue dot with a house inside it. After you exit flight planning mode, land locations appear on the map in gray.

The land location icon

✓ When flying to waypoints, POIs, or land locations, the video panel shows the stream from your selected camera. If necessary, you can change cameras. See "Switch cameras" on page 82.

Create a waypoint, waypoint list, POI, or land location

You can create a waypoint or waypoint list, POI, or land location as part of your flight plan.

Create a waypoint or waypoint list

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the map, tap the location for the waypoint.
5. If necessary, set a height for the waypoint. For more information, see "Set the height of a waypoint or POI" on page 130.
6. If you are creating a waypoint list, perform the following actions:
    a. Tap the location of the next waypoint. A line, with the direction of travel, appears between the two waypoints.
    b. If necessary, set the height for the second waypoint.
    c. If necessary, add more waypoints.

7. Beside a waypoint, tap  .

8. On the **Edit** tab, perform one or more of the following actions:

    - If you are creating a waypoint list and want to connect your first and last waypoints to make a continuous flight path, select the **Continuous Waypoint Mode** check box. During the waypoint flight, the aircraft continues to fly the waypoints until you take control of the aircraft, or an error occurs.

    - In the **Waypoint Accuracy** field, use the slider to set how close you want the aircraft to be to the location of each waypoint. If you set the **Waypoint Accuracy** field to **Accurate**, the aircraft stops at each waypoint. If you set the **Waypoint Accuracy** field to **Fast**, the aircraft might cut corners to maximize speed.

    - If you set the **Waypoint Accuracy** field to **Accurate**, set the **Height Transitions** drop-down list. If you set this drop-down list to **Diagonal**, the aircraft changes its height as it flies between the waypoints. If you set this drop-down list to **Standard**, the aircraft changes its height after stopping at each waypoint.

    - If necessary, configure Autonomous Waypoint Mode settings for the waypoint or waypoint list. For more information, see "Create an autonomous waypoint or waypoint list" on the next page.

    - If necessary, set an action for the waypoint. For more information, see "Configure an action for a waypoint" on page 127. You can only configure an action for one waypoint in a list.

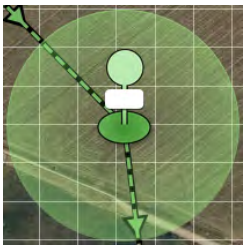
    - If necessary, configure the loiter settings for the waypoint. For more information, see "Configure loiter settings for a waypoint or POI" on page 131. You cannot configure an action for a waypoint and configure loiter settings for the same waypoint.

9. To add another waypoint or waypoint list, perform the following actions:

    a. In the lower-right corner of the screen, tap  .

    b. Repeat steps 3 to 9.

As you change the value in the **Waypoint Accuracy** drop-down list, green circles appear around each waypoint. These green circles show the estimated accuracy for each waypoint and are largest when you set the **Waypoint Accuracy** field to **Fast**. When you exit flight planning mode, these circles turn gray.



The green circles represent a sphere in three-dimensional space around the waypoint icon. If the **Waypoint Accuracy** drop-down list is set to **Fast**, this sphere occupies more three-dimensional space around the waypoint icon than if the **Waypoint Accuracy** drop-down list is set to **Accurate**.

If you set the **Waypoint Accuracy** setting for the waypoint list to something other than **Accurate**, the aircraft adjusts the setting for the last waypoint in the list to **Accurate**. The icon also changes to show that waypoint is set as **Accurate**.

If you set the **Height Transitions** drop-down list to **Diagonal**, and set the aircraft's speed to **Dash**, the aircraft flies at a maximum of 50 km/h / 31 mph when flying to or through the waypoint list.

Create an autonomous waypoint or waypoint list

If you want the aircraft to fly to a waypoint or fly a waypoint list without communications, you can create an autonomous waypoint or waypoint list.

The aircraft only activates Autonomous Waypoint Mode if it reaches the waypoint but hasn't completed the loiter or configured action, or if it is flying a waypoint list and hasn't completed the list.

1. In the lower-right corner of the screen, tap .
2. Tap .
3. Tap .
4. Create the waypoint or waypoint list.
5. Beside a waypoint, tap .
6. On the **Edit** tab, select the **Autonomous Waypoint Mode** check box.
7. In the **Autonomous Timeout** field, set the number of seconds that the aircraft should fly before it follows the action set in the **Non-Fatal Condition Response** drop-down list in the aircraft flight settings.

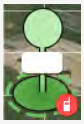
8. In the **Autonomous Radio Mode** drop-down list, perform one of the following actions:

    - If you do not want to change the aircraft radio behavior during the autonomous flight, select **No Change**.

    - If you want the aircraft radio to turn off for the autonomous flight and turn on again when the autonomous action is complete, select **Off While Executing**. The icon for the selected waypoint changes to indicate that the radio is off while the aircraft completes the autonomous flight.

    - If you want the aircraft radio to turn off for the autonomous flight and remain off, select **Off**. The icon for the selected waypoint changes to indicate that the radio is off.

Notes about creating autonomous waypoints or waypoint lists

- If you are flying in **Autonomous Waypoint Mode** and a non-fatal warning appears, the aircraft follows the action set in the **Non-Fatal Condition Response** drop-down list in the aircraft flight settings.

- If you set the **Autonomous Radio Mode** drop-down list to **Off** or **Off While Executing**, the aircraft radio turns off when the aircraft reaches the waypoint before it completes the loiter or configured action. If the aircraft is flying a waypoint list, the radio turns off when it reaches the waypoint list before it completes it. If you set the **Autonomous Radio Mode** drop-down list to **Off While Executing**, the radio turns on again after the autonomous action is complete.

- If you set the **Autonomous Radio Mode** drop-down list to **Off**, the aircraft radio remains off. When the aircraft battery power level is too low to continue flying, the aircraft completes the action set in the **Non-Fatal Condition Response** drop-down list in the aircraft flight settings. If you set this field to **Home and Hover** or **Hover in Place**, the aircraft does not land until a fatal error occurs. When the fatal error occurs, the aircraft initiates an emergency landing.

- If you set the **Autonomous Radio Mode** drop-down list to **Off**, you must restart the aircraft to turn the aircraft radio on again.

- If you want the aircraft to fly in Autonomous Waypoint Mode without interruption, set the **Autonomous Timeout** field to ∞. The aircraft continues to fly the flight plan until the battery power level is too low to continue flying. If you set the **Autonomous Radio Mode** to **No Change**, you can take control of the aircraft again to stop the autonomous flight.
- Setting the **Autonomous Radio Mode** field affects the aircraft radio only. It does not turn off the base station radio.

Configure an action for a waypoint

You can set one of the following actions for a waypoint:

Action	Aircraft behavior
Drop Point	When the aircraft reaches the waypoint, it drops any attached cargo.
Land Location	When the aircraft reaches the waypoint, it lands automatically.
Go Home Point	When the aircraft reaches the waypoint, it returns home.
Drop and Go Home Point	When the aircraft reaches the waypoint, it drops any attached cargo before returning home.

You can have several waypoints on the map, but, if you create a waypoint list, only one waypoint in the list can have an action configured for it. If there is already another action configured for a waypoint in the list, you must confirm that you want to change to the new action.

If you configure a waypoint as a drop point or a drop and go home point, you cannot set a drop height of zero. Setting a drop height of zero is equivalent to not setting a drop height. As a result, MCS uses the aircraft's current height.

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap the waypoint that you want to configure an action for.
4. Beside the waypoint, tap  .
5. On the **Edit** tab, in the **Action** drop-down list, perform one of the following actions:
    - If you want to configure the waypoint as a drop point, select **Drop Point**. The icon for the selected waypoint changes to indicate that it is a drop point.

- If you want to configure the waypoint as a land location, select **Land Location**. The icon for the selected waypoint changes to indicate that it is a land location.

- If you want to configure the waypoint as a go home point, select **Go Home Point**. The icon for the selected waypoint changes to indicate that the aircraft returns home when it reaches the waypoint.

- If you want to configure the waypoint as a drop and go home point, select **Drop and Go Home Point**. The icon for the selected waypoint changes to indicate that the aircraft drops cargo and then returns home when it reaches the waypoint.

6. If you configured the waypoint as a drop point or a drop and go home point, perform the following actions:

   a. In the **Drop Height** field, set the height for the aircraft when it drops the cargo.

   b. In the **Drop Delay** field, set the length of time that the aircraft should wait after arriving at the drop point or reaching the drop height before it drops the cargo.

✓ To configure an action for a waypoint quickly, on the map, right-tap the waypoint. Click . In the **Configure Waypoint Action** dialog box, set the **Action** drop-down list. If you select **Drop Point** or **Drop and Go Home Point**, set the **Drop Height** and **Drop Delay** fields. Tap **OK**.

Notes about configuring actions for waypoints

- If you configure an action for a waypoint but set the **Waypoint Accuracy** setting for the waypoint or waypoint list to something other than **Accurate**, the aircraft adjusts the setting to **Accurate** for the configured waypoint so it can complete the action.

- The aircraft can perform the configured action while connected to the base station's Wi-Fi network or during Autonomous Waypoint Mode. If the aircraft performs the action during Autonomous Waypoint Mode, it flies the flight plan autonomously and performs the configured action when it reaches the waypoint.
- You cannot configure an action for a waypoint and configure loiter settings for the same waypoint. If you set an action, and then enable loiter, MCS resets the **Action** drop-down list to **None**. If you enable loiter, and then configure an action, MCS clears the **Loiter Enabled** check box automatically.

Create a POI

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the map, tap the location for the POI.
5. If necessary, set a height for the POI. For more information, see "Set the height of a waypoint or POI" on the next page.
6. Beside the POI, tap  .
7. If necessary, configure the loiter settings for the POI. For more information, see "Configure loiter settings for a waypoint or POI" on page 131.

Convert a POI to a waypoint with an action

1. On the map, right-tap a POI.
2. Tap  .
3. In the **Convert to Action Point** dialog box, in the **Action** drop-down list, set the action for the waypoint. For more information, see "Configure an action for a waypoint" on page 127.
4. If you set the **Action** drop-down list to **Drop Point** or **Drop and Go Home Point**, set the **Drop Height** and **Drop Delay** fields.
5. Tap **OK**.

Set the height of a waypoint or POI

You can adjust the height of waypoints and POIs using the height slider or the height label on the waypoint or POI icon.

> When you set the height of a waypoint or POI, ensure that the aircraft can safely fly there at the height that you specify. If the height is below MSH, a warning appears before the aircraft flies to the waypoint, waypoint list, or POI.

The height of the waypoint or POI only appears in the height label if the height is not zero.

Set the height of a waypoint or POI using the height slider

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. On the map, tap and hold the circle that appears above the waypoint or POI.
4. Use the height slider to adjust the height.
5. To make further precise adjustments to the height, when the aircraft is close to the desired height, press and hold the stylus at the waypoint or POI height. The height slider magnifier appears.
6. Using the magnifier, adjust the height further.

Set the height of a waypoint or POI using the height label

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap the height label on the waypoint or POI.
4. In the calculator-like interface, use  and  or the number keys to set the height that you want.
5. Tap **Apply**.

Remove the height from a waypoint or POI

1. In the lower-right corner of the screen, tap  .
2. Tap  .

3. Perform one of the following actions:

    - To remove the height from the waypoint or POI using the height slider, tap and hold the circle that appears above the waypoint or POI icon. In the height slider, drag the stylus to the  icon.
    - To remove the height from the waypoint or POI using the waypoint or POI icon, tap the height label on the waypoint or POI icon. In the calculator-like interface, tap  . Tap **Apply**.

The height of the waypoint or POI returns to 0 and the height label is blank.

Configure loiter settings for a waypoint or POI

You can configure loiter settings for waypoints and POIs. When you add loiter settings, the aircraft does not fly to the location of the waypoint or POI. Instead, it flies a circle around the point. You might want to loiter around a point to conserve battery power or to observe a point from multiple angles.

When you configure loiter settings, you can set how the aircraft should fly around the loiter circle, including the radius for the circle, how many laps the aircraft completes, the speed that the aircraft flies, and the behavior of the camera payload during the flight. For more information, see "Loiter settings" on the next page.

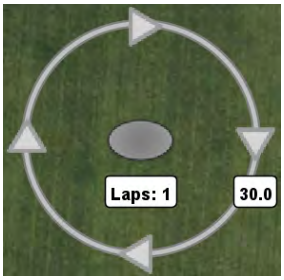
You can configure loiter settings for a single POI or waypoint. If you create a waypoint list, you can configure loiter settings for multiple waypoints in the list.

If you configure loiter settings for waypoints in a waypoint list, adjust the location of the waypoints to control how the aircraft enters and exits each loiter circle.

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap the POI or waypoint that you want to loiter around.
4. Beside the POI or waypoint, tap  .
5. On the **Edit** tab, select the **Loiter Enabled** check box. On the map, a circle appears around the waypoint or POI. A label with the default loiter settings appears below the waypoint or POI.
6. To change the radius of the circle, on the map, drag the point on the right side of the circle. You cannot make the circle smaller than 30 m / 98 ft.

7. To configure additional loiter settings, on the **Edit** tab, tap .
8. In the **Loiter Settings** dialog box, configure the other settings for how the aircraft should fly around the waypoint or POI. For more information, see "Loiter settings" below.
9. Close the **Loiter Settings** dialog box.

After you configure loiter settings for a waypoint or POI, the icon on the map changes to:



The label below the waypoint or POI shows the lap and speed behavior that you configured. The radius of the loiter circle appears on the right side of the circle.

Loiter settings

You can configure the following loiter settings for a waypoint or POI. If you change the **Lap Behavior** or **Speed Behavior**, the label below the waypoint or POI changes. Other settings appear on the **Edit** tab of the flight planning menu.

Setting	Description
Loiter Enabled	Select this check box to enable loiter.
Counterclockwise	Select this check box to fly counterclockwise around the waypoint or POI.
Radius	Set the radius for the loiter circle. You cannot set the radius to a value lower than 30 m / 98 ft.
Lap Behavior	Set how long the aircraft should fly the loiter circle. You can select one of the following options: • **Indefinite:** The aircraft flies the circle until you pause the flight or change the aircraft's direction. • **Fixed Count:** The aircraft flies around the circle for a set number of laps. When you select this option, a **Lap Count** field appears where you can set the number of laps that the aircraft should complete.

Setting	Description
	• **Fixed Time:** The aircraft flies around the circle for a set length of time. When you select this option, a **Loiter Time** field appears where you can set the number of seconds that the aircraft should fly.
Payload Behavior	Set what the payload should do while the aircraft is flying the loiter circle. You can select one of the following options: • **None:** The payload behavior is not affected by the loiter settings. • **Point Inward:** The payload points inward toward the center of the loiter circle. • **Point Outward:** The payload points outward away from the center of the loiter circle. • **Point Toward Flight:** The payload faces the direction of the flight.
Yaw Behavior	Set how the aircraft should yaw when flying the loiter circle. You can select one of the following options: • **None:** The yaw behavior of the aircraft is not affected by the loiter settings. • **Follow Payload:** The aircraft yaws so that it can maintain the specified payload behavior. • **Point Toward Flight:** The aircraft yaws so that the front of the aircraft always faces the direction of the flight. • **Eco:** The aircraft yaws in the most efficient way to maximize flight time.
Speed Behavior	Set the speed that the aircraft should use when flying the loiter circle. You select one of the following options: • **None:** The aircraft uses its current speed. • **Use Specified:** The aircraft flies around the loiter circle at a set speed. When you select this option, a **Speed** field appears where you can set the desired speed.

Setting	Description
	• **Eco:** The aircraft flies at the most efficient speed to maximize flight time.

Notes about configuring loiter points

- If you configure loiter for a waypoint but set the **Waypoint Accuracy** setting for the waypoint or waypoint list to something other than **Accurate**, the aircraft adjusts the setting to **Accurate** for the configured waypoint so it can complete the loiter.
- To make a single loiter point continuous, set the **Lap Behavior** field to **Indefinite**.
- You cannot configure an action for a waypoint and configure loiter settings for the same waypoint. If you set an action, and then enable loiter, MCS resets the **Action** drop-down list to **None**. If you enable loiter, and then configure an action, MCS clears the **Loiter Enabled** check box automatically.
- If the loiter point is in a waypoint list and there are additional waypoints after the loiter point, ensure that you set the **Lap Behavior** field to **Fixed Count** or **Fixed Time** so that the aircraft can exit the loiter circle and proceed to the next waypoint.
- If you are using a camera payload that cannot unlock the yaw of the camera payload from the yaw of the aircraft, the value set in the **Yaw Behavior** field takes precedence over the value set in the **Payload Behavior** field.
- The loiter circle cannot contain or cross a no-fly zone.

Create a land location

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the map, tap the location where you want to land the aircraft.
5. Beside the land location, tap  .
6. If you want the aircraft to continue flying to the land location if communications are limited or lost, perform the following actions:
    a. Select the **Autonomous Mode** check box.

b. In the **Autonomous Timeout** field, set the number of seconds that the aircraft should fly toward the land location before it follows the action set in the **Non-Fatal Condition Response** field in the aircraft flight settings.

If you want the aircraft to fly toward the land location in **Autonomous Mode** without interruption, set the **Autonomous Timeout** field to ∞. The aircraft continues trying to fly to the land location until the battery power level is too low, the aircraft lands at the land location, or you take control of the aircraft again. If you configure your land location in this way, ensure that you select the **Set as Home** check box when you start flying toward the land location. When the aircraft reaches the land location in autonomous mode, it starts landing there.

Change a waypoint, POI, or land location

1. In the lower-right corner of the screen, tap .
2. Tap .
3. On the map, tap the waypoint, POI, or land location that you want to change.
4. Perform one or more of the following actions:
   - To change the location of the waypoint, POI, or land location, tap and hold the icon for the flight planning element. Drag it to a new location.
   - To change the GPS coordinates, beside the waypoint, POI, or land location, tap . Tap the **Properties** tab. If necessary, tap the tab for your coordinates type. Use the numbers and directions on the screen to refine the GPS coordinates. Tap .
   - To copy the current coordinates, beside the waypoint, POI, or land location, tap . Tap the **Properties** tab. If necessary, tap the tab for your coordinates type. Tap .
   - To paste coordinates that you copied, beside the waypoint, POI, or land location, tap . Tap the **Properties** tab. If necessary, tap the tab for your coordinates type. Tap .

Change settings for a drop point or a drop and go home point

1. In the lower-right corner of the screen, tap .
2. Tap .
3. On the map, tap the drop point or drop and go home point that you want to change.

4. Beside the drop point or drop and go home point, tap .
5. On the **Edit** tab, perform one or more of the following actions:
    - To change the drop height, change the value in the **Drop Height** field.
    - To change the length of time that the aircraft should wait after arriving at the waypoint before it drops the cargo, change the number of seconds in the **Drop Delay** field.

Change settings for a loiter point

1. In the lower-right corner of the screen, tap .
2. Tap .
3. On the map, tap the loiter point that you want to change.
4. Beside the loiter point, tap .
5. On the **Edit** tab, beside the **Loiter Enabled** check box, tap .
6. In the **Loiter Settings** dialog box, adjust any of the settings. For more information, see "Loiter settings" on page 132.
7. Close the **Loiter Settings** dialog box.

✓ To turn off loiter, on the **Edit** tab, clear the **Loiter Enabled** check box.

Fly to a waypoint or POI

After you create a flight plan with waypoints or POIs, the aircraft can fly that flight plan automatically.

1. On the map, tap and hold a waypoint or POI so that the icon turns blue.

2. If your flight path crosses a loiter zone, in the warning that appears, perform one of the following actions:

- If it is safe to fly the aircraft through the loiter zone, in the warning dialog box, tap **Continue**.
- If it is not safe to fly the aircraft through the loiter zone, in the warning dialog box, tap **Cancel**. Manually fly the aircraft around the loiter zone so that the aircraft can approach the waypoint or POI from a different direction. Fly to the waypoint or POI again.

3. If you are flying to a waypoint, in the dialog box that appears, perform one or more of the following actions:
   - If you enabled Autonomous Waypoint Mode for the waypoint and you expect intermittent communications outages during the flight, to hide the notifications that appear when communications are lost and regained, select the **Hide notifications for lost communications** check box.
   - If you configured the waypoint as a land location and set the **Target Landing Mode** in the flight behavior to **Optional** or **Required**, clear the **Target Land** check box if you do not want to land on the target.
   - If you configured the waypoint as a land location and you want to set the land location as home, select the **Set As Home** check box.
4. After configuring the options in the dialog box, tap **Continue**.

The aircraft starts flying to the waypoint or POI.

If you configured an action for the waypoint, when the aircraft reaches that waypoint, it completes the action automatically. For more information on flights with waypoint actions, see "Notes about flights with waypoint actions" on page 139.

If you configured loiter settings for the waypoint or POI, the aircraft flies to the most efficient entry point of the loiter circle. It then flies around the waypoint or POI using the loiter settings that you configured. For more information on flights with loiter points, see "Notes about flying loiter points" on page 140.

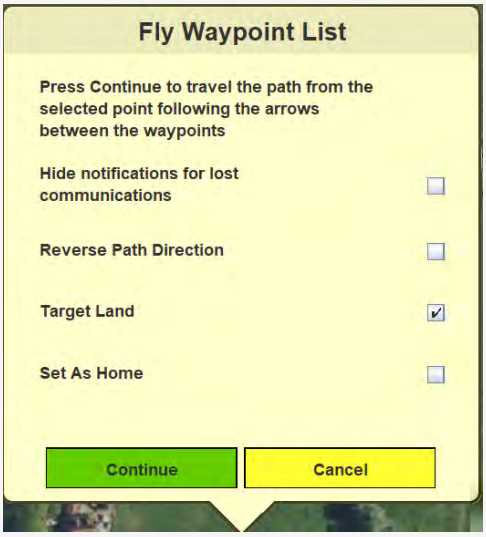
✓ To view the estimated time that it takes to fly to the waypoint or POI, tap the aircraft label until ⏱ appears. The aircraft uses its current speed to estimate the time to fly to the waypoint or POI, but it does not include any time needed to increase or decrease its height.

Fly a waypoint list

1. On the map, tap and hold a waypoint so that the icon turns blue. If your flight path crosses a loiter zone, a warning appears.

2. Perform one of the following actions:

    - If it is safe to fly the aircraft through the loiter zone, in the warning dialog box, tap **Continue**. When the aircraft reaches the waypoint, it hovers and waits. The **Fly Waypoint List** dialog box appears.



    - If it is not safe to fly the aircraft through the loiter zone, in the warning dialog box, tap **Cancel**. Manually fly the aircraft around the loiter zone so that the aircraft can approach the waypoint list from a different direction. Fly to the waypoint list again.

3. In the **Fly Waypoint List** dialog box, perform one or more of the following actions:

    - If you enabled Autonomous Waypoint Mode for the waypoint list, and expect intermittent communications outages during the flight, select the **Hide notifications for lost communications** check box to hide the notifications that appear when communications are lost and regained.

    - If you created a continuous waypoint list or you are flying to any waypoint after the first waypoint in the list, to fly in the opposite direction of the arrows, select the **Reverse Path Direction** check box.

    - If you configured a waypoint in the list as a land location and set the **Target Landing Mode** in the flight behaviors to **Optional** or **Required**, clear the **Target Land** check box if you do not want to land on the target.

    - If you configured a waypoint in the list as a land location and you want to set the land location as home, select the **Set As Home** check box.

4. Tap **Continue**.

The aircraft flies to the next waypoint automatically and continues to follow the flight plan.

Notes about flying waypoint lists

- If you created a continuous waypoint list, the aircraft continues to fly until you pause the flight, you manually change the aircraft's direction, or an error appears (such as a low battery power level.)
- If one of the waypoints in the waypoint list is outside Maximum Range or above Maximum Height, the waypoint is skipped.
- If any waypoints in a waypoint list do not have a height set, the aircraft uses the height of the last waypoint in the list with a height. If no height is set for any waypoints, the aircraft uses its current height.
- If you configured an action for a waypoint in the list, when the aircraft reaches that waypoint, it completes the action automatically. For more information on flights with waypoint actions, see "Notes about flights with waypoint actions" below.
- If you configured a waypoint in the list as a loiter point, when the aircraft reaches that waypoint, it completes the loiter as configured. For more information on flights with loiter points, see "Notes about flying loiter points" on the next page.
- If you created a continuous waypoint list but configured one of the waypoints in the list with a land location action, the aircraft does not continue to fly the waypoint list. It lands at the land location.

Notes about flights with waypoint actions

- If you configured a waypoint with a drop height, and the aircraft's current height is below the drop height that you set, it ascends to the specified height before traveling to the waypoint, dropping the cargo, and returning to its original height. If the aircraft's current height is above the drop height that you set, it flies to the waypoint first, then descends to the drop height, drops the cargo, and returns to its original height.
- If you configure a waypoint as a drop point or a drop and go home point and the aircraft does not have a drop-capable payload attached, a warning message appears. You must acknowledge the warning before the aircraft can continue. For more information on setting an action for a waypoint, see "Configure an action for a waypoint" on page 127.
- If you configure a waypoint in a waypoint list as a land location and, when prompted, you select the **Set as Home** check box, the home position changes when the aircraft leaves the waypoint before the land location waypoint.

Notes about flying loiter points

- If the loiter point is in a waypoint list and there are additional waypoints after the loiter point, the aircraft completes the circle based on what you set in the **Lap Behavior** field. If you set the field to **Fixed Count** or **Fixed Time**, the aircraft finds the most efficient exit point from the circle so that it can fly to the next waypoint. In some cases, the aircraft might fly backward to exit at the most efficient point.

- If you fly a waypoint list in the reverse direction, when the aircraft reaches a loiter point, it does not fly the loiter circle in reverse. It continues to fly in the direction of the arrows that appear around the point. To change the aircraft's direction, you must change the loiter settings and select the **Counterclockwise** check box. For more information, see "Loiter settings" on page 132.

- If you have an active camera target, the aircraft maintains the focus on the target, regardless of what is set in the **Payload Behavior** field. To maintain focus on the center of the loiter circle during the flight, position the default camera target at the location of the waypoint or POI.

- If any part of the loiter circle is beyond the Maximum Range of the aircraft, and you try to fly around the loiter point, a notification appears below the aircraft icon. You cannot start the flight around the loiter point. Reduce the size of the loiter circle so it remains within the aircraft’s Maximum Range.

- How fast the aircraft can fly around a loiter point is related to the radius of the loiter circle. The aircraft might not be able to reach the speed that you set if the radius of the loiter circle is too small.

- The aircraft does not fly around a loiter point at Dash speed, regardless of the radius of the loiter circle. If you do not set the **Speed Behavior** field, and you set the aircraft's speed to Dash speed, when you fly around a loiter point, the maximum possible speed for the aircraft is 50 km/h / 31 mph.

- If you set the **Speed Behavior** field to either a fixed speed or **Eco**, when the aircraft flies around the loiter point, the fixed speed that you selected or **Eco** appears in the compass rose in gray, along with  . You cannot change the speed using the compass rose. Instead, you must interrupt the flight around the loiter point and change the loiter settings.

- If you set the **Speed Behavior** field to **Eco**, the aircraft tries to maintain an airspeed as close to 27 km/h / 17 mph as possible. Depending on the wind direction and the radius of the loiter circle, MCS might show a different ground speed than expected (up to a maximum of 54 km/h / 34 mph). If the aircraft is downwind, and the wind is higher than 27 km/h / 17 mph, the aircraft can no longer fly at an efficient speed. The aircraft hovers in place until the wind

direction changes or reduces in strength. When the wind is lower than 27 km/h / 17 mph, the aircraft resumes its flight around the loiter point.

Pause a waypoint or POI flight

During the flight, perform one of the following actions:

- In the upper-right corner of the map, tap  .
- Move the aircraft to another location on the map.
- Open the flight planning menu.

The aircraft stops traveling and hovers in place. It can take a few seconds for the aircraft's momentum to stop.

To resume the flight, tap and hold the waypoint or POI again.

If you pause a flight in windy conditions, the aircraft might deviate from its flight path. The battery uses more power, and the flight time is shorter.

Loiter the aircraft quickly

You can use a flight planning element, the aircraft icon, or the map to loiter the aircraft quickly.

If you enable the default camera target, and then you loiter the aircraft quickly, and you set a payload behavior for the loiter, the aircraft continues pointing the camera at the default camera target. The specified payload behavior is not used.

1. Perform one of the following actions:
   - To loiter at a flight planning element, right-tap a waypoint, drop point, POI, marker, land location, circular flight plan, or flight planning camera target.
   - To loiter at the aircraft's location, right-tap the aircraft icon.
   - To loiter at a location on the map, right-tap the map.
2. In the **Actions** menu, tap  .
3. In the **Loiter Settings** dialog box, configure the settings for the loiter point. For more information, see "Loiter settings" on page 132.
4. Tap **OK**.

When you tap **OK**, the **Loiter Settings** dialog box closes, and the aircraft starts flying to that location.

To view the estimated time that it takes to fly to the location, tap the aircraft label until appears.

Land the aircraft at a land location

1. On the map, tap and hold a land location so that the icon turns blue.
2. If your flight path crosses a loiter zone, perform one of the following actions:
    - If it is safe to fly the aircraft through the loiter zone, in the warning dialog box, tap **Continue**.
    - If it is not safe to fly the aircraft through the loiter zone, in the warning dialog box, tap **Cancel**. Manually fly the aircraft around the loiter zone so that the aircraft can approach the land location from a different direction. Restart the landing.
3. In the **Land Location** dialog box, perform one or more of the following actions:
    - If you are flying below MSH, do not want to ascend, and have verified that the flight path is clear of any obstacles, clear the **Climb to Minimum Safe Height** check box.
    - If you set the **Target Landing Mode** in the flight behaviors to **Optional** or **Required**, clear the **Target Land** check box if you do not want to land on the target.
    - If you do not want to set the land location as the home position as soon as the aircraft starts flying there, clear the **Set as Home** check box.
4. Tap **Continue**.

If the aircraft is flying above MSH, it flies at its current height to the land location and lands.

If you selected the **Set as Home** check box, the land location changes to the home position immediately. Because there is a new home position, MCS recalculates the aircraft's Maximum Range, using the new home position as the center of that range. If the aircraft's current location is outside the updated Maximum Range, an error appears, and the aircraft does not fly to the land location.

If you selected the **Set as Home** check box but then cancel flying to the land location, the home position is still updated.

To set a land location as home quickly, on the map, right-tap a land location. Tap .

Pause landing at a land location

During the flight, perform one of the following actions:

- In the upper-right corner of the map, tap  .
- Move the aircraft to another location on the map.
- Open the flight planning menu.

The aircraft stops traveling and hovers in place. It can take a few seconds for the aircraft's momentum to stop.

To resume landing, tap and hold the land location again.

If you set the land location as the home position before you paused the landing, to resume landing at the same location, tap  .

Delete a waypoint, POI, or land location

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. On the map, tap the waypoint, POI, or land location that you want to delete.
4. In the flight planning toolbar at the bottom of the screen, tap  .
5. If you tapped a waypoint, perform one of the following actions:
   - To delete the selected waypoint, select **Remove Waypoint**.
   - To delete the waypoint list that the waypoint is a part of, select **Remove Waypoint List**.
   - To delete all waypoint lists on the map, select **Remove All Waypoint Lists**.
6. If you tapped a POI, perform one of the following actions:
   - To delete the POI, select **Remove Point of Interest**.
   - To delete all POIs on the map, select **Remove All Points of Interest**.
7. If you tapped a land location, perform one of the following actions:

- To delete the land location, select **Remove Land Location**.
- To delete all land locations, select **Remove All Land Locations**.

8. Tap **OK**.

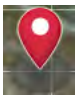
When you are in flight planning mode, you can also delete a single waypoint, POI, or land location quickly. Tap the waypoint, POI, or land location that you want to delete. Tap .

Delete a waypoint, POI, or land location quickly

1. On the map, right-tap the waypoint, POI, or land location that you want to delete.
2. In the **Actions** menu, perform one of the following actions:
   - To delete the selected waypoint, POI, or land location, tap .
   - If you selected a single waypoint with an action, to delete all single waypoints on the map with that action, tap .
   - If you selected a waypoint in a waypoint list, to delete the waypoint list that the waypoint is a part of, tap .
   - If you selected a POI or land location, to delete all POIs or land locations on the map, tap .

USING MARKERS AND FLIGHT PLANNING CAMERA TARGETS

Markers are visual references on the map. You can add markers to your flight plan to note locations that you want to revisit later or obstacles that you want to avoid. Markers appear on the map as a gray shadow with a red marker above it. When you exit flight planning mode, the marker icon does not change.



The marker icon

✓ If you want to mark something on the map, but do not want to fly there, add a marker. If you might want to fly to the location on the map, add a waypoint or a POI.

There are two types of camera targets in MCS: the default camera target and flight planning camera targets. When you take off, MCS adds the default camera target to the map. If there are additional points on the map that you want to view with the camera, you can add flight planning camera targets.

In flight planning mode, flight planning camera targets appear on the map as a black circle and white height label above a black and white target. When you exit flight planning mode, only the black and white target icon remains.

The icon for a flight planning camera target in flight planning mode

You can specify a height for camera targets. If you add a height, when you exit flight planning mode, the height appears in the center of the black and white target.

Add a marker

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap  .

4. On the map, tap the location for the marker.

Add a flight planning camera target

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. Tap a location on the map.
5. If necessary, set a height for the flight planning camera target. For more information, see "Set the height of a flight planning camera target" below.

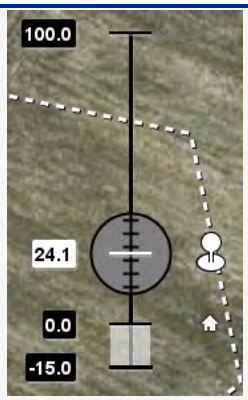
Set the height of a flight planning camera target

You can adjust the height of a flight planning camera target using the height slider or the height label on the icon of the flight planning camera target.

The height of the flight planning camera target only appears in the height label if the height is not zero.

Set the height of a flight planning camera target using the height slider

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. On the map, tap and hold the circle that appears above the icon for the flight planning camera target.
4. Use the height slider to adjust the height.
5. To make further precise adjustments to the height, when the aircraft is close to the desired height, press and hold the stylus at the height for the flight planning camera target. The height slider magnifier appears.



6. Using the magnifier, adjust the height further.

Set the height of a flight planning camera target using the height label

1. In the lower-right corner of the screen, tap .
2. Tap .
3. Tap the height label on the icon for the flight planning camera target.
4. In the calculator-like interface, use and or the number keys to set the height that you want.
5. Tap **Apply**.

Remove the height from a flight planning camera target

1. In the lower-right corner of the screen, tap .
2. Tap .
3. Perform one of the following actions:
   - To remove the height using the height slider, tap and hold the circle that appears above the icon for the flight planning camera target. In the height slider, drag the stylus to the icon.
   - To remove the height using the icon, tap the height label on icon for the flight planning camera target. In the calculator-like interface, tap . Tap **Apply**.

The height of the flight planning camera target returns to 0 and the height label is blank.

Point the camera at a flight planning camera target

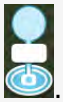
Although you can have multiple camera targets on the map, you can only point the camera at one at a time.

1. On the map, tap  so the icon changes to  .
2. To move the camera target, drag it to a location on the map.

When you tap a flight planning camera target, the default camera target moves to its location. If you move the default camera target, the original flight planning camera target remains on the map.

If you point the camera at a flight planning camera target with a height, the height of the default camera target changes to match. Then, if you change the height of the camera target, only the height of the default camera target changes. The height of the original flight planning camera target remains the same. If you want to change the height of the flight planning camera target, you must change the height using the flight planning menu. For more information, see "Set the height of a flight planning camera target" on page 146.

Return to camera panning mode

On the map, tap  .

The target icon turns black, and the camera can pan independent of targets.

You can also use the primary video panel to return to camera panning mode. In the primary video panel, tap the center of the reticle.

Change a marker or flight planning camera target

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. On the map, tap a marker or flight planning camera target.
4. Perform one or more of the following actions:
    - To change the location of the marker or flight planning camera target, tap and hold

the icon for the flight planning element. Drag it to a new location.

- To change the GPS coordinates, beside the marker or flight planning camera target, tap . If necessary, tap the tab for your coordinates type. Use the numbers and directions on the screen to refine the coordinates. Tap .
- To copy the current coordinates, beside the marker or flight planning camera target, tap . If necessary, tap the tab for your coordinates type. Tap .
- To paste coordinates that you copied, beside the marker or flight planning camera target, tap . If necessary, tap the tab for your coordinates type. Tap .

Delete a marker or flight planning camera target

1. In the lower-right corner of the screen, tap .
2. Tap .
3. On the map, tap the marker or flight planning camera target that you want to delete.
4. In the flight planning toolbar at the bottom of the screen, tap .
5. If you tapped a marker, perform one of the following actions:
   - To delete the marker, select **Remove Marker**.
   - To delete all markers on the map, select **Remove All Markers**.
6. If you tapped a flight planning camera target, perform one of the following actions:
   - To delete the flight planning camera target, select **Remove Target**.
   - To delete all flight planning camera targets that you added to the map, select **Remove All Targets**.
7. Tap **OK**.

If you delete a flight planning camera target, when you exit flight planning mode, the default camera target remains on the map.

✓ When you are in flight planning mode, you can also delete a single marker or flight planning camera target quickly. Tap the marker or flight planning camera target that you want to delete. Tap .

Delete a marker or flight planning camera target quickly

1. On the map, right-tap the marker or flight planning camera target that you want to delete.
2. In the **Actions** menu, perform one of the following actions:
    - To delete the marker or flight planning camera target, tap ✖.
    - To delete all markers or flight planning camera targets, tap 🗑.

USING AUTOGRIDS

With AutoGrids, you can create a flight plan that allows the aircraft to scan a defined area and take pictures at regular intervals. AutoGrids are useful when performing ground searches, or mapping or surveying large areas.

With an AutoGrid, the software creates a grid of waypoints for the area that you define. The software connects the waypoints using a series of lanes at an angle. By default, the lane angle changes whenever you change the shape of the AutoGrid, but you can set a specific lane angle, so that it is not updated automatically when the AutoGrid changes.

When flying an AutoGrid, the camera payload points straight down and, by default, the aircraft always rotates to face toward the next waypoint. The camera payload takes the pictures during the flight.

Using the parameters that you set, the software calculates the optimal flight path for the AutoGrid so that you receive the coverage that you need. These parameters affect the characteristics of the flight, such as the flight time, the speed of the aircraft, the number of pictures taken, and the memory requirements. As you change the parameters for the AutoGrid, the software automatically adjusts the flight to compensate. Even small changes to the parameters of your AutoGrid can have a significant effect on the flight, so adjust the parameters carefully.

✓ As part of the takeoff procedure, ensure that there is enough available memory on the memory card for the pictures taken during the AutoGrid.

When flying an AutoGrid, the video panel shows the stream from your selected camera. If necessary, you can change cameras. See "Switch cameras" on page 82.

✓ For more information on the capabilities of your payload, visit the Customer Self-Service Portal at https://selfservice.teledyneflir.com to read the Operating Manual for your payload.

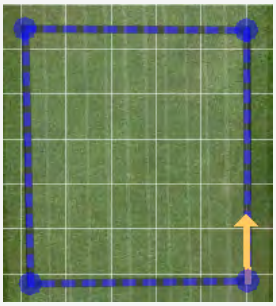
Create an AutoGrid

You can create an AutoGrid to define the area that you want to map.

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap  . A default AutoGrid appears on the map.
4. Perform one of the following actions:

- To change the size of the existing AutoGrid, drag the corners of the default AutoGrid until it covers the area that you want to scan.
- To add more points to the AutoGrid, tap the map. Drag the corners of the grid until it covers the area that you want to scan.

5. Select a point in the AutoGrid.
6. Beside the point, tap .
7. On the **Edit** tab, perform one or more of the following actions:
   - In the **Camera** field, verify that the correct camera appears.
   - In the **Height** field, use the arrows to set the height that the aircraft should fly at. The height that you select affects the resolution of the pictures taken.
   - To change the starting waypoint for the grid, tap **Change Start Point**. Continue to tap this button until you select the waypoint that you want to use. The starting waypoint appears with an orange arrow pointing in the direction of flight.



8. To set advanced settings, in the upper-right corner of the **Edit** tab, tap .
9. Perform one or more of the following actions:
   - To set the percentage of overlap between each row of pictures, set the **Sidelap** field.
   - To set the percentage of overlap between one picture and the next, set the **Frontlap** field.
   - To set the length of time between pictures, set the **Capture Interval** field.
   - To set the angle of the flight lanes that the aircraft flies to cover the grid, set the **Lane Angle** field. By default, this setting is set to an angle that best optimizes flight time based on the shape of the grid, but you might want to adjust it to account for wind.

- To lock the lane angle so that it doesn't change when the grid changes, tap  .

10. To configure additional advanced settings, in the upper-right corner of the **Edit** tab, tap  .
11. Perform one or more of the following actions:
    - To have the aircraft move laterally so that it faces the same direction throughout the entire AutoGrid flight, select the **Use Locked Orientation and Lateral Movement** check box.
    - If necessary, configure Autonomous Waypoint Mode settings for the AutoGrid. For more information, see "Create an autonomous AutoGrid" below.
12. At the top of the **Edit** tab, check if a warning or error appears.
13. If necessary, adjust the AutoGrid until the error disappears.

After you exit flight planning mode, the AutoGrid changes from a blue shape to a flight plan, showing the waypoints and lanes required to cover the area.

Notes about AutoGrid settings

- If you turned on AutoSnaps, during an AutoGrid flight, the time set in the **Capture Interval** field overrides the AutoSnaps interval that you set on the **Camera** tab of the **System Configuration** dialog box.
- After configuring the AutoGrid, note the height that you set for the flight. You must fly at this height to capture pictures at the proper resolution.
- Always check your surroundings to confirm that the height that you set is appropriate for your flight. When you create the AutoGrid, ensure that the aircraft can safely fly the AutoGrid at the height that you specify. If the height is below MSH, a warning appears before the aircraft starts the AutoGrid.
- If you are stitching pictures together after the flight, it is important to configure the **Sidelap** and **Frontlap** fields properly. Teledyne FLIR recommends a sidelap of 60% and a frontlap of 75%, but the settings depend on the quality of the pictures that you are looking for.

Create an autonomous AutoGrid

If you want the aircraft to fly an AutoGrid without communications, you can create an autonomous AutoGrid.

The aircraft only activates Autonomous Waypoint Mode after it starts the AutoGrid before it is completed.

1. In the lower-right corner of the screen, tap .
2. Tap .
3. Tap . A default AutoGrid appears on the map.
4. Perform one of the following actions:
    - To change the size of the existing AutoGrid, drag the corners of the default AutoGrid until it covers the area that you want to scan.
    - To add more points to the AutoGrid, tap the map. Drag the corners of the grid until it covers the area that you want to scan.
5. Select a point in the AutoGrid.
6. Beside the point, tap .
7. On the **Edit** tab, in the upper-right corner, tap .
8. Select the **Autonomous Waypoint Mode** check box.
9. In the **Autonomous Timeout** field, set the number of seconds that the aircraft should fly before it follows the action set in the **Non-Fatal Condition Response** drop-down list in the aircraft flight settings.
10. In the **Autonomous Radio Mode** drop-down list, perform one of the following actions:
    - If you do not want to change the aircraft radio behavior during the autonomous flight, select **No Change**.
    - If you want the aircraft radio to turn off for the autonomous flight and turn on again when the autonomous action is complete, select **Off While Executing**.
    - If you want the aircraft radio to turn off for the autonomous flight and remain off, select **Off**.

After you exit flight planning mode, the AutoGrid changes from a blue shape to a flight plan, showing the waypoints and lanes required to cover the area.

If you set the **Autonomous Radio Mode** to **Off While Executing**, the waypoints in the AutoGrid change to indicate that the radio is off while the aircraft completes the autonomous flight.

If you set the **Autonomous Radio Mode** to **Off**, the waypoints in the AutoGrid change to indicate that the radio is off.

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Notes about creating autonomous AutoGrids

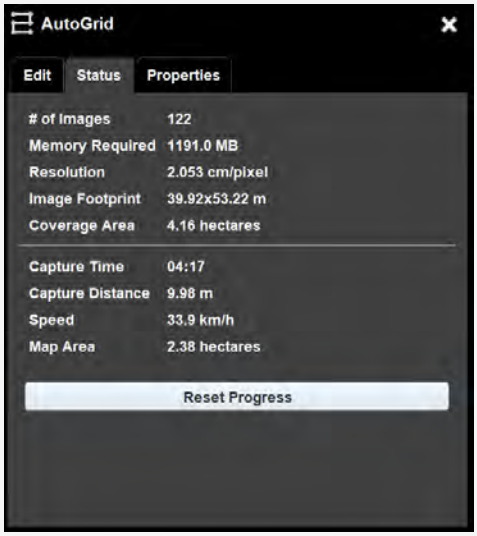
- If you are flying in **Autonomous Waypoint Mode** and a non-fatal warning appears, the aircraft follows the action set in the **Non-Fatal Condition Response** drop-down list in the aircraft flight settings. A **Resume** waypoint appears on the map so that you can return to the flight plan when possible.
- If you set the **Autonomous Radio Mode** drop-down list to **Off** or **Off While Executing**, the aircraft radio turns off when the aircraft starts the AutoGrid. If you set the **Autonomous Radio Mode** drop-down list to **Off While Executing**, the radio turns on again after the autonomous action is complete.
- If you set the **Autonomous Radio Mode** drop-down list to **Off**, the aircraft radio remains off. When the aircraft battery power level is too low to continue flying, the aircraft completes the action set in the **Non-Fatal Condition Response** drop-down list in the aircraft flight settings. If you set this field to **Home and Hover** or **Hover in Place**, the aircraft does not land until a fatal error occurs. When the fatal error occurs, the aircraft initiates an emergency landing.
- If you set the **Autonomous Radio Mode** drop-down list to **Off**, you must restart the aircraft to turn the aircraft radio on again.
- If you want the aircraft to fly in Autonomous Waypoint Mode without interruption, set the **Autonomous Timeout** field to ∞. The aircraft continues to fly the flight plan until the battery power level is too low to continue flying. If you set the **Autonomous Radio Mode** to **No Change**, you can take control of the aircraft again to stop the autonomous flight.
- Setting the **Autonomous Radio Mode** field affects the aircraft radio only. It does not turn off the base station radio.

View the status for an AutoGrid

After you create an AutoGrid, you can view information about the associated flight. You should review this information before flying to make sure that you can meet the parameters required to receive the coverage that you need.

1. In the lower-right corner of the screen, tap .

2. Tap .
3. Tap
4. Beside a corner of the AutoGrid, tap .
5. Tap the **Status** tab.
6. On the **Status** tab, review the AutoGrid status.



Because each camera payload has different characteristics, the length of time required to complete the AutoGrid changes with a different payload.

AutoGrid status fields

The following fields appear on the AutoGrid Status tab:

Field	Description
# of Images	This field shows the number of pictures required to cover the AutoGrid completely.
Memory Required	This field shows the amount of memory required to store the pictures.
Resolution	This field shows the resolution, in cm/pixel or in/pixel, for the pictures. This resolution determines the amount of detail available in the pictures. It is affected by the height that the aircraft flies during the AutoGrid. The maximum resolution is 0.1 cm/pixel / 0.04 in/pixel.

Field	Description
	To change the resolution measurement setting, change the **Distance Measurement** field when setting your units of measure. See "Set your units of measure" on page 52.
Image Footprint	This field shows the estimated area covered by a picture taken during the AutoGrid. If you increase the aircraft's height, the estimated area increases.
Coverage Area	This field shows the total area covered by the pictures taken during the AutoGrid.
Capture Time	This field shows the estimated time required to fly the AutoGrid. This time does not include the time required to take off, to fly to the first waypoint, or to fly home and land. If the estimated time is greater than 30 minutes, this field appears in orange. The capture time is determined by the capture interval that you set when you create the AutoGrid. This capture interval affects the speed that the aircraft flies during the AutoGrid. If you set a longer capture interval, the aircraft flies slower. If you set a shorter capture interval, the aircraft flies faster.
Capture Distance	This field shows the distance that the aircraft travels before taking the next picture.
Speed	This field shows the speed that the aircraft flies during the AutoGrid. While the aircraft is flying the AutoGrid, this speed temporarily overrides the speed that you set for the aircraft in the compass rose.
Map Area	This field shows the total area that the AutoGrid covers.

Change an AutoGrid

You can change the settings and dimensions for an AutoGrid before you fly it. If you want to change an AutoGrid after you start to fly it, you must reset the progress first. For more information, see "Reset the progress of an AutoGrid" on the next page.

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap  .

4. On the map, tap a corner point on the AutoGrid.
5. Perform one or more of the following actions:
    - To move the corner, on the map, drag it to a new location.
    - To change other settings for the AutoGrid, beside the AutoGrid corner, tap . Tap the **Edit** tab. Change any of the standard or advanced settings for the flight.

Restore the default settings for an AutoGrid

1. In the lower-right corner of the screen, tap .
2. Tap .
3. Tap .
4. Beside the AutoGrid, tap .
5. On the **Edit** tab, tap **Restore Defaults**.

If you changed the lane angle, you must tap on and off again to restore the lane angle to the default setting.

Reset the progress of an AutoGrid

1. During an AutoGrid, in the lower-right corner of the screen, tap .
2. Tap .
3. Tap .
4. Beside a corner of the AutoGrid, tap .
5. Tap the **Status** tab.
6. Tap **Reset Progress**.

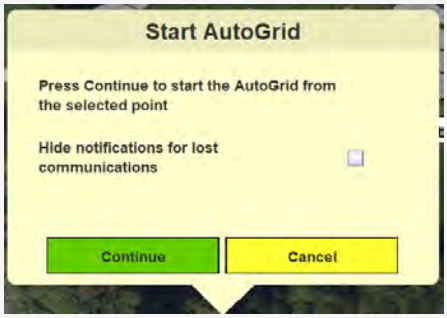
The aircraft deletes the progress made in the AutoGrid and resets the first waypoint as the starting point.

Fly an AutoGrid

Before flying an AutoGrid, ensure that you attach the correct payload to the aircraft and double-check the amount of memory available on the memory card. Ensure that the available memory is greater than the **Memory Required** field on the **Status** tab. If necessary, download or delete videos and pictures from the memory card so that you have enough memory for the flight.

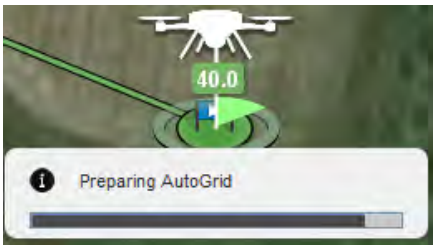
If you turn off location data, any pictures taken during the AutoGrid do not contain metadata. Without metadata, you might not be able to use the pictures in software programs that create image maps. If you want to create image maps, ensure that the location data is enabled before flying an AutoGrid.

1. Position the aircraft at the height that you set for the AutoGrid.
2. On the map, zoom in or out so that the entire AutoGrid is visible.
3. If your flight path could cross a loiter zone, ensure that it is safe to fly through the loiter zone. If it is not safe to fly the aircraft through the loiter zone, manually fly the aircraft around the loiter zone so that the aircraft can approach the AutoGrid from a different direction.
4. On the map, tap the waypoint labeled **Start**. The **Start AutoGrid** dialog box appears.



5. If you enabled Autonomous Waypoint Mode for the AutoGrid, and expect intermittent communications outages during the flight, to hide the notifications that appear when communications are lost and regained, select the **Hide notifications for lost communications** check box.
6. Tap **Continue**.

If the aircraft is below the height that you set for the AutoGrid, it ascends to the specified height before traveling to the start of the grid. If it is above the height that you set, it flies to the first waypoint in the AutoGrid and then descends to the specified height. **Preparing AutoGrid** appears on the screen.



When the aircraft has prepared the AutoGrid, it begins traveling through the waypoints. It follows the lane direction in the grid pattern and flies at the speed shown on the **Status** tab. You cannot change the aircraft's speed manually during the flight.

During the AutoGrid, the camera payload takes pictures at the specified capture interval. At the top of the primary video panel, the **Capture Time** field shows the estimated amount of time remaining (in mm:ss) to complete the AutoGrid.

When the aircraft reaches the final waypoint and takes the last picture, it hovers in place.

Tips for flying an AutoGrid

- To view the estimated time it takes to fly to the next waypoint in the AutoGrid, tap the aircraft label until appears.
- If the camera payload misses taking a picture, appears in the AutoGrid. Tap and hold to retake the picture. When the picture is available, appears.
- If your flight plan covers a large area, you might need multiple flights to complete it. If your AutoGrid requires multiple flights, a warning appears on the **Edit** tab. During the flight, if the battery begins to run low, bring the aircraft home and land it. Download the pictures from the aircraft's memory card, change the aircraft batteries, and resume the AutoGrid.

Pause an AutoGrid

During the flight, perform one of the following actions:

- In the upper-right corner of the map, tap .
- Move the aircraft to another location on the map.
- Open the flight planning menu.

The aircraft stops traveling and hovers in place. It marks the current position or a recent point on the flight path as a waypoint with the label **Resume**.

Resume an AutoGrid

1. Tap the **Resume** waypoint.
2. In the **Start AutoGrid** dialog box, tap **Continue**.

If you pause a flight, then tap a new waypoint or other flight planning element, the aircraft cancels the AutoGrid.

Delete AutoGrids

1. In the lower-right corner of the screen, tap .
2. Tap .
3. On the map, tap the AutoGrid that you want to delete.
4. In the flight planning toolbar at the bottom of the screen, tap .
5. Perform one of the following actions:
   - To delete the corner, select **Remove AutoGrid Point**.
   - To delete the entire AutoGrid, select **Remove AutoGrid**.
6. Tap **OK**.

When you are in flight planning mode, you can also delete an AutoGrid quickly. Tap the AutoGrid that you want to delete. Tap .

Delete AutoGrids quickly

1. Open the flight planning menu.
2. Tap .
3. On the map, right-tap a corner point on the AutoGrid.
4. In the **Actions** menu, perform one of the following actions:
   - To delete the selected corner, tap .
   - To delete the entire AutoGrid, tap .

5. Close the flight planning menu.

USING CIRCULAR FLIGHT PLANS

You can create a circular flight plan to have the aircraft orbit an object at pre-defined altitudes. You might want to use a circular flight plan to inspect a tall object, such as a cellular tower. With a circular flight plan, you determine the number of waypoints around the circle and the start and end heights to fly at. You also define how many steps are between the start height and the end height.

If you increase the number of waypoints in the circle, the circle is smoother, but the flight takes longer.

When flying circular flight plans, the video panel shows the stream from your selected camera. If necessary, you can change cameras. See "Switch cameras" on page 82.

Create a circular flight plan

You can create a circular flight plan to fly around objects at pre-defined heights.

You must fly circular flight plans below MSH so that the aircraft can ascend to MSH before flying home if a non-fatal condition arises during the flight. By ascending to MSH, the aircraft can avoid the object that you are orbiting. Always verify that the MSH and the maximum height values in your flight settings are higher than the ending height of your circular flight plan. For more information, see "Check flight settings and behaviors" on page 54.

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the map, tap the location for the center of your circle.
5. Beside the circular flight plan, tap  .
6. On the **Edit** tab, perform one or more of the following actions:
    - If you plan to fly around the object once to view something in the center of the circle, select the **Use Aircraft Height** check box.
    - If you plan to fly around the object multiple times to inspect the entire object, set the **Start Height** and **End Height** fields.
    - Set the radius of the circle. The radius cannot be smaller than 10 m / 33 ft and must be larger than the widest point of the object.

- Set the speed for the flight.
- To set the number of steps between the start height and the end height, in the **Step Count** field, adjust the slider.
- To set the number of waypoints around the circle, in the **Waypoint Count** field, adjust the slider.

The aircraft uses these settings to calculate the height needed for each trip around the object.

You can also use the map to configure the settings of the circular flight plan quickly. Add a circular flight plan. To adjust the radius of the circular flight plan quickly, drag the point on the right side of the circle. To change the start and end heights, use the slider at the top of the circle. To change the number of steps between the start height and the end height, tap + or -.

Create a circular flight plan during a flight

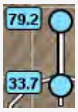
If you are flying the aircraft and discover an object that you want to view, you can create a circular flight plan quickly.

Before creating your circular flight plan, check your flight settings to ensure that the MSH and the maximum height values are higher than the end height of your circular flight plan. For more information, see "Check flight settings and behaviors" on page 54.

1. During a flight, right-tap the aircraft icon.
2. In the **Actions** menu, tap  . A circular flight plan with a default radius of 20 m / 66 ft appears on the map. The default starting height is the current MSH and the default ending height is the aircraft's current height.
3. Perform one or more of the following actions:
   - To set a different radius for the circular flight plan, at the widest point of the object, fly the aircraft away from the center. Right-tap the aircraft icon. Tap  . The distance that you flew becomes the radius of your circular flight plan. The radius cannot be smaller than 10 m / 33 ft and must be larger than the widest point of the object.
   - To set the aircraft's current height as the starting height of the circular flight plan, right-tap the aircraft icon. Tap  .
   - To change other options for the circular flight plan, such as the end height and the number of trips around the objects, open the flight planning menu. Change the options for the circular flight plan. See "Change a circular flight plan" on the next page.

✓ When creating the flight plan, right-tap the center of the circle to move the aircraft there, point the camera there, or loiter around that point. If you move the aircraft to the center of the circle, ensure that the aircraft is high enough to clear any objects at that location.

Change a circular flight plan

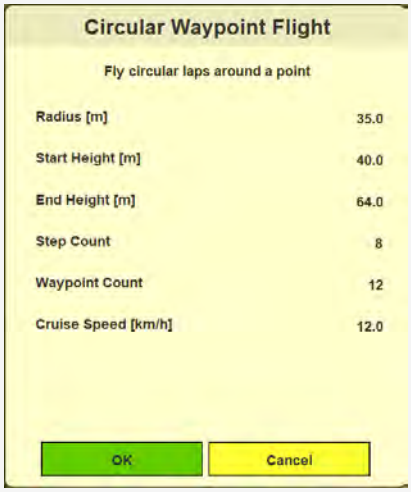
1. In the lower-right corner of the screen, tap .
2. Tap .
3. On the map, tap a circular flight plan.
4. Perform one or more of the following actions:
   - To move a circular flight plan, tap and hold the center of the circle. Drag the circle to a new location on the map.
   - To change the GPS coordinates of a circular flight plan, beside the circular flight plan, tap . Tap the **Properties** tab. If necessary, tap the tab for your coordinates type. Use the numbers and directions on the screen to refine the GPS coordinates for the circular flight plan. Tap .
   - To copy the current coordinates, beside the circular flight plan, tap . Tap the **Properties** tab. If necessary, tap the tab for your coordinates type. Tap .
   - To paste coordinates that you copied, beside the circular flight plan, tap . Tap the **Properties** tab. If necessary, tap the tab for your coordinates type. Tap .
   - To change the start and end height that you want the aircraft to fly, on the map, adjust the vertical points above the circle.
     

   - To change the radius of the circle, on the map, adjust the horizontal point beside the circle.
     

   - To increase or decrease the number of steps around the object, on the map, tap + or -.

Fly a circular flight plan

1. Position the aircraft at a safe height.
2. If your flight path could cross a loiter zone, ensure that it is safe to fly through the loiter zone. If it is not safe to fly the aircraft through the loiter zone, manually fly the aircraft around the loiter zone so that the aircraft can approach the circular flight plan from a different direction.
3. On the map, tap  .
4. In the **Circular Waypoint Flight** dialog box, tap **OK**.



The aircraft starts flying to the closest waypoint in the circle. When it reaches that waypoint, it positions the default camera target in the center of the circle and makes the default camera target active. The aircraft starts flying the circular flight plan, flying in a counterclockwise direction around the object. It uses the speed that you specified when you created the circular flight plan.

How fast the aircraft can fly around the circular flight plan is related to the radius of the circle. The aircraft might not be able to reach the speed that you set if the radius of the circle is too small.

When the aircraft reaches each waypoint in the circle, it slows down, pauses, and ascends if necessary, before flying to the next waypoint. The height of the default camera target also changes to adjust for the change in the aircraft's height.

On the map, the number of trips made around the object also appears in the center of the circle.

If necessary, you can move the camera to a different location without interrupting the circular flight plan, but you cannot point the camera at the base station or a network node.

Pause a circular flight plan

During the flight, perform one of the following actions:

- In the upper-right corner of the map, tap .
- Move the aircraft to another location on the map.
- Open the flight planning menu.

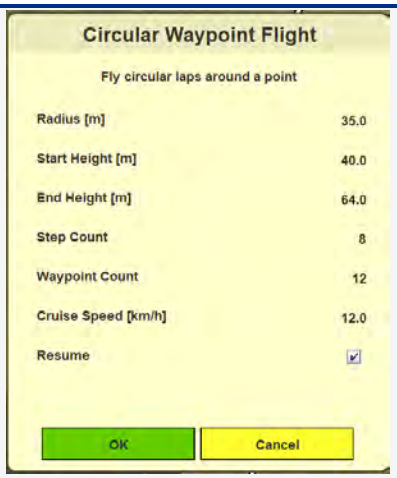
The aircraft stops traveling and hovers in place. A notification appears below the aircraft icon.

When you pause a circular flight plan, MCS makes the default camera target inactive. The default camera target also moves away from the center of the circular flight plan.

Resume or restart a circular flight plan

After you pause the flight, you can resume or restart it.

1. On the map, tap .
2. In the **Circular Waypoint Flight** dialog box, perform one of the following actions:
   - To continue the flight, tap **OK**.
   - To restart the flight, clear the **Resume** check box. Tap **OK**.



Delete a circular flight plan

1. In the lower-right corner of the screen, tap .
2. Tap .
3. On the map, tap the circular flight plan that you want to delete.
4. In the flight planning toolbar at the bottom of the screen, tap .
5. Perform one of the following actions:
   - To delete the circular flight plan, select **Remove Circular Flight Plan**.
   - To delete all circular flight plans on the map, select **Remove All Circular Flight Plans**.

✓ When you are in flight planning mode, you can also delete a single circular flight plan quickly. Tap the circular flight plan that you want to delete. Tap .

Delete a circular flight plan quickly

1. On the map, right-tap the circular flight plan that you want to delete.
2. In the **Actions** menu, perform one of the following actions:
   - To delete the circular flight plan, tap .
   - To delete all circular flight plans, tap .

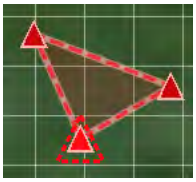
USING NO-FLY ZONES AND FLIGHT PERIMETERS

You can create no-fly zones to denote which regions you do not want to fly over or the areas that you want to avoid. There must be at least two points in a no-fly zone. You can only add markers and targets to no-fly zones.

> During a flight, the aircraft does not enter a no-fly zone, except if the no-fly zone is in the direct flight path to home.

On the map, in flight planning mode, a no-fly zone appears with red triangles at the corners and a dashed red line connecting the points. There must be at least two points in a no-fly zone.

After you exit flight planning mode, the no-fly zone appears in red with a solid red line connecting the points. The area inside the no-fly zone appears in red.

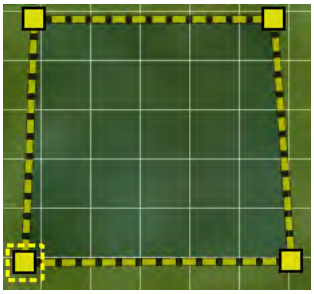


A no-fly zone

A flight perimeter is a visual indicator of your flight's boundaries. You can add a flight perimeter to your flight plan to remind you of the boundaries of a flight. There must be at least three points on a flight perimeter.

A flight perimeter is different than the **Maximum Range** that you configure in the aircraft flight settings. You cannot fly the aircraft beyond the aircraft's Maximum Range. A flight perimeter is only a visual reminder of the flight's boundaries. If necessary, you can fly beyond its limits.

On the map, in flight planning mode, a flight perimeter appears with yellow squares at the corners and a dashed yellow line connecting the points. After you exit flight planning mode, the flight perimeter appears in yellow with a solid yellow line connecting the points. The area outside the flight perimeter appears yellow.



A flight perimeter

Define a no-fly zone

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. Tap a location on the map for the first corner of the no-fly zone.
5. Repeat step 3 for the remaining corners.
6. To add another no-fly zone, perform the following actions:
    a. In the lower-right corner of the screen, tap  .
    b. Repeat steps 3 and 4 for the new no-fly zone.

Define a flight perimeter

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. Tap a location on the map for the first corner of the flight perimeter.
5. Repeat step 3 for the remaining corners.

Change a no-fly zone or flight perimeter

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. On the map, tap a corner of the no-fly zone or flight perimeter.
4. Perform one or more of the following actions:
    - To adjust the corner, drag it to a new location on the map.

- To add another corner to the no-fly zone or flight perimeter, tap the location on the map.

Delete a no-fly zone or flight perimeter

No-fly zones must include a minimum of two points and flight perimeters must include a minimum of three points. If you delete the second-last point of a no-fly zone or the third-last point of a flight perimeter, when you exit flight planning mode, the software deletes the remaining points.

1. In the lower-right corner of the screen, tap  .
2. Tap  .
3. On the map, tap a corner of the no-fly zone or flight perimeter that you want to delete.
4. In the flight planning toolbar at the bottom of the screen, tap  .
5. If you tapped the corner of a no-fly zone, perform one of the following actions:
   - To delete the corner, select **Remove No-Fly Zone Point**.
   - To delete the no-fly zone, select **Remove No-Fly Zone**.
   - To delete all no-fly zones, select **Remove All No-Fly Zones**.
6. If you tapped the corner of a flight perimeter, perform one of the following actions:
   - To delete the corner, select **Remove Perimeter Point**.
   - To delete the entire flight perimeter, select **Remove Perimeter**.
7. Tap **OK**.

✓ When you are in flight planning mode, you can also delete a single no-fly zone or a flight perimeter quickly. Tap the no-fly zone or flight perimeter that you want to delete. Tap .

Delete a no-fly zone or flight perimeter quickly

1. On the map, right-tap a point on the no-fly zone or flight perimeter.
2. In the **Actions** menu, perform one of the following actions:
   - To delete the point, tap .
   - To delete the entire no-fly zone or flight perimeter, tap  .

No-fly zones must include a minimum of two points and flight perimeters must include a minimum of three points. If you delete the second-last point of a no-fly zone or the third-last point of a flight perimeter, the software deletes the remaining points.

USING THE OSPREY PAYLOAD

You can attach the Osprey payload to the aircraft to carry or deliver cargo. The total weight that the system can carry changes depending on the arms that you use with the aircraft:

- If you are using the arms with 18.5 inch propellers, you can carry cargo weighing up to 2 kg / 4.4 lb.
- If you are using the HL-LE or HL-LE V2 propulsion arms, you can carry cargo weighing up to 3.5 kg / 7.7 lb.
- If you are using the HL-LE or HL-LE V2 propulsion arms and XL batteries, however, you can only carry cargo weighing up to 2 kg / 4.4 lb. You cannot fly with weights over 2 kg / 4.4 lb.

The total weight that the system can carry includes the weight of any interposers that you attach to the aircraft or anything that you attach to the interposer.

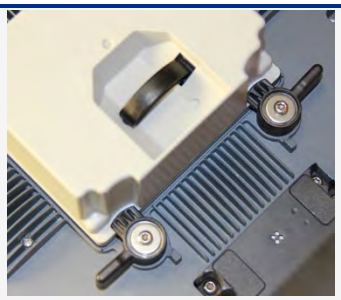
With the Osprey payload attached, the aircraft takes longer to increase or decrease its speed, regardless of whether it is carrying cargo. It also takes longer for the aircraft to reach a location and stop.

Visual navigation mode is not available when the Osprey payload is attached, and the latch has not been opened during the current flight. See "About visual navigation mode" on page 297.

Attach the Osprey payload

1. Insert the two pegs on the Osprey payload into their slots in the payload compartment.

2. Lay the Osprey payload body down flat into the payload compartment.
3. Rotate both payload latches until they click in place.



Load cargo

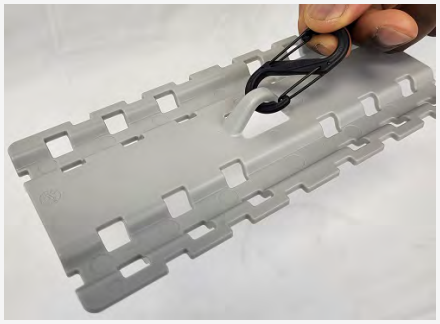
When the aircraft is on the ground, you can load cargo onto the Osprey payload.

The Osprey payload uses power from the aircraft to open and close the latch. Before loading cargo, ensure that the aircraft is turned on.

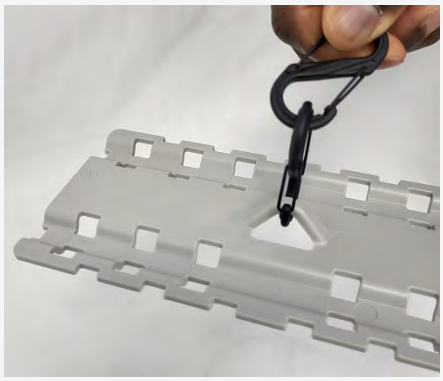
⚠ Do not attempt to load cargo onto the Osprey payload when the aircraft is in the air.

1. If the cargo needs a cargo plate, perform the following actions:

   a. Connect an S-clip to the cargo plate.

   b. Connect a second S-clip to the first clip.

   c. Load the cargo onto the cargo plate.

d. Secure the cargo to the cargo plate.

e. Hold the cargo plate by the S-clips. If the cargo plate tilts to one side, reload the cargo, centering the weight properly.

2. If the cargo does not need a cargo plate, attach the cargo to an S-clip.

3. Open the Osprey payload by pressing the button on the side.

4. Attach the S-clip to the Osprey payload latch.

5. Close the Osprey payload by pressing the button on the side.

Fly with cargo

After loading cargo onto the Osprey, you can fly the aircraft to the drop location.

With the Osprey payload attached, the aircraft takes longer to increase its height, especially if it is carrying heavy cargo.

1. Position the aircraft at a safe height.

2. In the primary video panel, switch to the front EO/IR camera.

3. Switch the camera to full-screen mode.
4. Adjust the aircraft's height and speed.
5. On the map, drag the aircraft shadow to the drop location.

If the cargo is too heavy, a **System Too Heavy** warning appears. If you dismiss or clear this warning, it does not appear again. You should either drop the cargo at the aircraft's current location or land the aircraft and adjust the weight of the cargo.

Drop cargo

You can use MCS to open the latch on the Osprey payload to drop cargo.

You can also customize buttons on the joystick to open the Osprey payload latch to drop cargo. See "Customize the buttons" on page 287. If you use a joystick button to open the latch, press and hold the button until the slider in the primary video panel opens.

In the primary video panel, slide  to the right.

The Osprey payload opens, the slider in the primary video panel turns green, and the cargo drops.

If the latch is obstructed and cannot open properly, the slider turns yellow, and an error icon appears. Using the stylus, move the slider to the left to close it. Try opening the latch again.

Drop cargo at a waypoint automatically

After you configure a waypoint as a drop point or drop and go home point, an aircraft with an Osprey payload attached can drop cargo automatically when it reaches that waypoint.

Before flying, verify that you have attached the Osprey payload to the aircraft and that the cargo is securely attached to the payload.

On the map, tap and hold the drop point or drop and go home waypoint so the icon turns blue.

When the aircraft reaches the waypoint, it ascends or descends to the specified height. If you specified a drop delay, the aircraft waits for that period of time before dropping the cargo and returning to its previous height.

If the aircraft is flying in Autonomous Waypoint Mode and it loses communications, it attempts to reach the specified drop height five times before registering the drop as a failed drop.

If you added a drop point and there is another waypoint in the flight plan, the aircraft flies to that waypoint automatically. If there isn't another waypoint in the flight plan, the aircraft hovers and waits for further instructions.

If you added a drop and go home point, after the aircraft drops the cargo, it returns to the home position.

Tips for flying with the Osprey payload

- During a flight, the aircraft can make small yaw movements that you don't command. If the movements continue, reduce the aircraft’s speed, or drop the cargo. You can also try landing the aircraft and adjusting the weight of the cargo.
- To increase the aircraft's stability during a flight, there is less stopping power whenever the Osprey payload is attached, even if there is no cargo loaded.
- Before taking off, ensure that the cargo rests on the ground. Having it rest on the ground prevents the legs from absorbing the cargo's weight during landing if the cargo wasn't dropped during the flight.
- When loading cargo, ensure that it does not interfere with the legs of the aircraft. It must not hang any lower than 10 cm / 4 inches below the legs. Long cargo can tilt up during a flight and could hit the aircraft’s propulsion arms, propellers, or legs.
- Do not pull on the cargo when it is attached to the aircraft.
- Long or heavy cargo, combined with certain flight maneuvers, can cause the aircraft the aircraft's position to fluctuate. To steady the aircraft's position, fly in a straight line or release the cargo.
- The aircraft might not reach its maximum speed when the Osprey payload is attached and the latch has not been opened during the current flight.
- For optimal performance, try to ensure that the aircraft stops traveling and hovers in place before dropping the cargo. If you must drop the cargo while the aircraft is moving, do not adjust the aircraft’s height or speed during the drop.
- If the cargo fails to drop, hover the aircraft in place before trying to drop the cargo again. If the problem persists, hover the aircraft in place for at least 10 seconds to allow it to stabilize. Then, resume your flight and try to drop the cargo again.
- During a flight, if you notice that the cargo drops unexpectedly, allow the aircraft to hover in place for 10 seconds so that it can stabilize. Then, resume your flight.

- If you land the aircraft after dropping cargo, move the aircraft to a different position to ensure that you do not land the aircraft on the dropped cargo.

Close the Osprey payload latch

You can use MCS to close the latch on the Osprey payload.

✓ You can also customize buttons on the joystick to close the Osprey payload latch. See "Customize the buttons" on page 287. If you use a joystick button to close the latch, press and hold the button until the slider in the primary video panel closes.

In the primary video panel, slide  to the left.

When the aircraft is in flight, if you do not close the Osprey payload manually, it closes automatically after approximately 5 seconds.

✓ If the latch is obstructed and cannot close properly, the slider turns yellow, and an error icon appears. Using the stylus, move the slider to the right to open it. Try closing the latch again.

USING ADVANCED CAMERA FEATURES

You can use some of the advanced camera features to take full advantage of the camera's capabilities. Before using these features, ensure that you are comfortable with flying and using the flight planning elements.

Additional advanced features, such as LiveMaps, additional target tracking features, target accuracy improvement, video measurement, the spot meter, isotherms, and independent aircraft yaw and camera yaw, are available when you attach a camera payload to the aircraft. For more information on the capabilities of your payload, visit the Customer Self-Service Portal at https://selfservice.teledyneflir.com to read the Operating Manual for your payload.

Enable metadata for videos

When recording video, you can include STANAG 4609 metadata with the recording. The aircraft saves the video on its memory card. For more information on the supported STANAG 4609 metadata, see "STANAG 4609 metadata" on page 385.

Enabling the option also streams your video from the base station with the embedded STANAG 4609 metadata.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. Tap the **Video** tab.
5. Select the **Enable Video Metadata** check box.
6. In the drop-down list, select the type of classification for your video.

Turn off stabilization for video stream mapping

By default, the software stabilizes the video stream. However, stabilization of the video might cause the camera's field of view to fluctuate. If you use the video with a third-party tool to map an area, this fluctuation can affect the quality of the mapping when processing the video after your flight. To improve the quality, you can turn off the stabilization for the flight.

Turning off stabilization for video stream mapping also turns off any target tracking features.

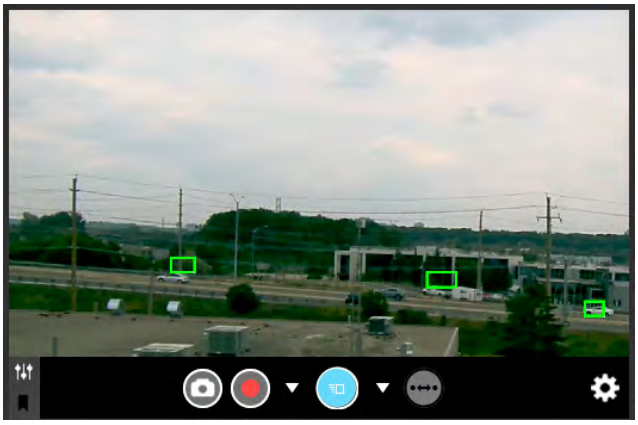
1. In the primary video panel, tap .
2. Tap **View Options**.
3. Clear the **Enable Stabilization** check box.

Monitor moving targets

You can use the moving target indicator (MTI) to highlight what is moving in the video stream.

In the toolbar of the primary video panel, tap .

The camera monitors the currently visible area for movement. In the primary video panel, a green rectangle appears around each moving object, up to a maximum of 30.



If you are viewing the EO stream of the front EO/IR camera in the MultiView video panel, the green rectangles continue to appear, but you can act on the targets in the primary video panel only.

If you are recording your video stream, you can include the target boxes in your recorded video. In the toolbar of the primary video panel, tap . Tap **View Options**. Select the **Record Tracking** check box.

Use target tracking

If you are using a Block 2 aircraft, you can track moving objects with the EO stream of the front EO/IR camera.

You can detect and monitor targets in the MultiView video panel, but you can act on the targets in the primary video panel only.

Because this feature relies heavily on the video panel, you might want to view the primary video panel in full-screen mode. See "View the primary video panel in full-screen mode" on page 89.

Tracking moving targets uses different cameras than landing on a target. When you track moving targets, the aircraft uses the front EO/IR camera to monitor what is moving in the video stream. When you land on a target, the aircraft uses its navigation cameras to lock onto the tags that appear on a landing target. You cannot use target tracking while the aircraft is landing on a target. For more information, see "Land on a target" on page 225.

When you use target tracking, the target information is not included in picture previews.

If you attach a camera payload to the aircraft, you can use additional target tracking features. For more information on the target tracking features for your payload, visit the Customer Self-Service Portal at https://selfservice.teledyneflir.com to read the Operating Manual for your payload.

Select a specific target to track

After setting up target tracking, you can select the specific object or area that you want to track.

In the primary video panel, tap inside a green rectangle.

After you select a target, the following icons appear in MCS:

Icon	Description
	This icon appears on the map at the target's approximate location.
	This icon appears on the map if a height was associated with the target that you were tracking.
	This icon appears in the primary video panel at the target's approximate location.
	These green corners appear in the primary video panel when you are in scene mode.
	These icons appear in the primary video panel and show the estimated current heading of the target and its current estimated speed. To use the estimated heading and estimated speed information effectively, enable the heading gauge overlay on the primary video panel. For more information, see "Customize the video overlays" on page 93.

Change what is being tracked

Perform one of the following actions:

- To move the existing rectangle on the target currently being tracked, tap and drag the rectangle to the new location.
- To follow a target at a different location, tap and drag the stylus to draw a rectangle around the new target.

Configure notifications for target tracking

You can enable notifications for motion. When MCS detects movement, a message appears under the aircraft shadow on the map and in the **Notifications** dialog box. See "Review notifications" on page 355.

1. In the toolbar of the primary video panel, tap ▼.
2. Select the **Notifications** check box.
3. Select the **Motion** check box.

Turn off target tracking

In the primary video panel, tap .

✓ To cancel active target tracking and just focus the camera at a location on the map, right-tap the map. In the **Actions** menu, tap  .

USING ADVANCED AIRCRAFT FEATURES

You can use the aircraft's advanced features, such as dual operator mode, in-air replacement, and Follow-Me to enhance your mission.

> ⚠ Before using advanced features, you (and any flight observers) should review all available documentation from Teledyne FLIR. Practice any non-standard procedures in a controlled environment first.

Turn off location data

In some situations, you might want to turn off location data if your aircraft is ever lost. If you turn off location data, it is not recorded in flight logs, as well as picture and video metadata. If you are using XL batteries, GPS information from those batteries is also not recorded.

You must configure this option before flying the aircraft.

> 📖 Without metadata, you might not be able to use your pictures in software programs that use this data to create image maps.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Preferences** tab, tap the **Advanced** tab.
5. Select the **Don't Record Location Data** check box.

GPS coordinates are no longer captured in flight log or picture and video metadata.

Clear all logs and GPS data

You can clear the logs from the base station and the aircraft's internal memory. The aircraft overwrites these logs, which deletes the GPS data. After you initiate this action, it can take several minutes to overwrite the data.

Using this option does not clear the pictures or videos on the memory card or any GPS data contained within those pictures and videos.

> 📖 The aircraft must be on the ground to clear the logs and GPS data. You cannot use this option when the aircraft is flying.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Preferences** tab, tap the **Advanced** tab.
5. Select the **Show Wipe Data Option** check box.
6. In the **System Configuration** dialog box, tap  .
7. On the **Connection** tab, tap **Wipe Data**.

Show the remote wake configuration button

To use the remote wake accessory to turn on a Block 2 aircraft, you must show the remote wake configuration button.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Preferences** tab, tap the **Advanced** tab.
5. Select the **Always Show Remote Wake Option** check box.

✓ After enabling this option, tap  . At the bottom of the **Connection** tab,  appears.

Manage MCS plug-ins

For some custom applications, you must use an MCS plug-in so you can interact with the application using MCS. You can add and remove plug-ins from MCS.

✓ For more information on creating plug-ins for MCS, see the Application Development Kit or the Payload Development Kit. For more information on using an MCS plug-in, see the documentation for the plug-in.

Add plug-ins to MCS

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. At the bottom of the tab, tap  .
5. Navigate to the location of the plug-in file.
6. Select the plug-in file.
7. Tap **OK**.

Turn off plug-ins

If you want to stop using a plug-in, you can turn it off without removing it from MCS.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. In the **Enabled** column, clear the check box beside the name of the plug-in.
5. In the dialog box, tap **OK**.
6. Restart MCS.

Remove plug-ins from MCS

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. Select the plug-in that you want to remove.
5. At the bottom of the tab, tap .

6. In the dialog box, tap **OK**.

7. Restart MCS.

Set the aircraft to Dash speed

When you set the aircraft to Dash speed, it uses the current wind speed to determine the speed necessary to reach its destination as quickly as possible. If you use a speed other than Dash speed, the aircraft might need to use more power to counteract the current wind speed. With Dash speed, however, the aircraft uses the wind to its advantage, which can reduce the amount of power that it takes to fly to a location.

In Dash speed, the aircraft flies as fast as possible up to a maximum airspeed of approximately 74 km/h / 46 mph. As a result, the ground speed is approximately 74 km/h / 46 mph plus or minus the current wind speed.

The aircraft does not faster than its maximum ground speed of 100 km/h / 62 mph.

Perform one of the following actions:

- In the bottom half of the compass rose, tap the aircraft speed through the presets. When you reach 50 km/h / 31 mph, tap the aircraft speed one more time.
- In the bottom half of the compass rose, tap and hold the speed. Drag the stylus to the end of the slider, until **Dash** appears.

Use Dash speed

After you set the aircraft to use Dash speed, you can use this speed when flying one of the following scenarios:

- Flying to a flight planning element such as a waypoint, POI, or land location.
- Flying to the start of an AutoGrid, but not when completing the AutoGrid.
- Flying to the start of a circular flight plan. You can fly the circular flight plan at Dash speed, but you must change the speed manually during the flight.
- Flying the aircraft to a location on the map (including flying to a location where you want to loiter the aircraft).

If you are flying the aircraft with the Osprey payload, and you have not opened the latch during the flight, Dash speed is not applied.

Perform one of the following actions:

- Tap and hold a flight planning element on the map, such as a waypoint, POI, or land location.
- In an AutoGrid, tap the **Start** waypoint. For more information, see "Fly an AutoGrid" on page 159.
- In a circular flight plan, tap  . For more information, see "Fly a circular flight plan" on page 166.
- Right-tap a location on the map. Tap and hold  for approximately one second. For more information, see "Fly the aircraft to a location on the map" on page 73.
- Right-tap a location on the map. Tap  . For more information, see "Loiter the aircraft quickly" on page 141.

The aircraft flies to the defined location using Dash speed. When Dash speed is applied,  appears below the speed in the compass rose. If  does not appear, the aircraft is not flying at Dash speed.

If you set the aircraft's speed to Dash speed and then drag the stylus on the map to control the aircraft's direction, the aircraft's maximum speed is 50 km/h / 31 mph.

Use SafeRoutes to take off and return home quickly

Using SafeRoutes can reduce the time that aircraft and operators spend in sensitive positions during takeoff and when returning home. If you use an outgoing SafeRoute during takeoff, you can ascend quickly, which reduces the time required to get the aircraft to a safe height at a safe distance from home. You can also use an incoming SafeRoute to descend quickly while returning home. As a result, your mission time increases since you are spending less time flying to and from your area of operation.

Waypoint lists that are used as SafeRoutes for taking off and returning home must include these characteristics:

- The waypoint list can only include a maximum of five waypoints.
- The waypoint list must use diagonal height transitions.

If you add an action or configure a loiter point for one of the waypoints in a waypoint list, or you make the waypoint list continuous or autonomous, those actions are not completed if you use the list as the outgoing or incoming SafeRoute.

For more information on creating waypoint lists, see "Create a waypoint or waypoint list" on page 123.

Select the outgoing SafeRoute for taking off

When you select an outgoing SafeRoute for taking off, you cannot select a waypoint list that includes waypoints with an action or loiter points, continuous waypoints, autonomous waypoints, or waypoints that use standard height transitions.

You cannot use an outgoing SafeRoute for taking off if you are flying the aircraft with the arms that use 18.5 inch propellers.

1. In the aircraft status label, tap  . A dialog box with the aircraft settings appears on the right side of the screen.
2. Tap the **Behaviors** tab.
3. On the  tab, perform one of the following actions:
    - Select the **Use Outgoing SafeRoute** check box. If you already created one or more valid waypoint lists, MCS selects a waypoint list for you and an animated yellow and black line appears between the home position and the first point in the list. The **Select Outgoing SafeRoute** dialog box also appears above the first point.
    - Select the **Use Outgoing SafeRoute** check box. If you already created a waypoint list but it is not valid, a dialog box appears, outlining what actions are removed from your waypoint list if you continue. To continue with the selected waypoint list, tap **OK**. An animated yellow and black line appears between the home position and the first point in the list. The **Select SafeRoute** dialog box also appears above the first point.
4. To use a different waypoint list, tap a waypoint in the list that you want to use. On the map, the animated yellow and black line changes to appear between the home position and the first point in the list that you selected. The **Select Outgoing SafeRoute** dialog box also changes to appear above the first point.
5. Perform one of the following actions:
    - If you want MCS to change the **Waypoint Accuracy** setting for your waypoint list automatically to optimize the flight for speed, in the **Select Outgoing SafeRoute** dialog box, select the check box. Tap **Done**.
    - If you want to open flight planning to view or change the **Waypoint Accuracy** setting for your waypoint list, in the **Select Outgoing SafeRoute** dialog box, tap  . In flight planning mode, view or change the slider. Exit flight planning mode.

- If you do not want to change the settings, in the **Select Outgoing SafeRoute** dialog box, tap **Done**.

Notes about selecting outgoing SafeRoutes

- If you have not created a waypoint list but select the option for an outgoing SafeRoute, MCS automatically creates a waypoint list with five waypoints and opens the flight planning menu. You can use this default waypoint list as is, or you can change the location of the waypoints in the list. For more information, see "Change a waypoint, POI, or land location" on page 135.
- If you select a waypoint list as an outgoing SafeRoute and set the same waypoint list as the incoming SafeRoute, the aircraft flies the waypoints in one direction when taking off and in the reverse direction when returning home.
- After you select an outgoing SafeRoute, it remains selected until you change it or turn it off. If you restart the aircraft, the outgoing SafeRoute remains selected.
- You cannot select an outgoing SafeRoute when the flight planning menu is open.
- You cannot select an AutoGrid as an outgoing SafeRoute.
- During takeoff, you cannot select an outgoing SafeRoute if the aircraft has not completed its flight control optimization.
- If you are flying multiple aircraft, you must select the outgoing SafeRoute for each aircraft.

Select the incoming SafeRoute for returning home

When you select an incoming SafeRoute for returning home, you cannot select a waypoint list that includes waypoints with an action or loiter points, continuous waypoints, autonomous waypoints, or waypoints that use standard height transitions.

⚠ You cannot use an incoming SafeRoute for returning home if you are flying the aircraft with the arms that use 18.5 inch propellers.

1. In the aircraft status label, tap . A dialog box with the aircraft settings appears on the right side of the screen.
2. Tap the **Behaviors** tab.
3. On the tab, perform one of the following actions:
    - Select the **Use Incoming SafeRoute** check box. If you already created one or more valid waypoint lists, MCS selects a waypoint list for you and an animated yellow and

black line appears between the home position and the first point in the list. The **Select Incoming SafeRoute** dialog box also appears above the first point.

- Select the **Use Incoming SafeRoute** check box. If you already created a waypoint list but it is not valid, a dialog box appears, outlining what actions are removed from your waypoint list if you continue. To continue with the selected waypoint list, tap **OK**. An animated yellow and black line appears between the home position and the first point in the list. The **Select Incoming SafeRoute** dialog box also appears above the first point.

4. To use a different waypoint list, tap a waypoint in the list that you want to use. On the map, the animated yellow and black line changes to appear between the home position and the first point in the list that you selected. The **Select Incoming SafeRoute** dialog box also changes to appear above the first point.
5. Perform one of the following actions:

   - If you want MCS to change the **Waypoint Accuracy** setting for your waypoint list automatically to optimize the flight for speed, in the **Select Incoming SafeRoute** dialog box, select the check box. Tap **Done**.
   - If you want to open flight planning to view or change the **Waypoint Accuracy** setting for your waypoint list, in the **Select Incoming SafeRoute** dialog box, tap . In flight planning mode, view or change the slider. Exit flight planning mode.
   - If you do not want to change the settings, in the **Select Incoming SafeRoute** dialog box, tap **Done**.

Notes about selecting incoming SafeRoutes

- You can select the incoming SafeRoute before or during your flight.
- If you have not created a waypoint list but select the option for an incoming SafeRoute, MCS automatically creates a waypoint list with five waypoints and opens the flight planning menu. You can use this default waypoint list as is, or you can change the location of the waypoints in the list. For more information, see "Change a waypoint, POI, or land location" on page 135.
- If you select a waypoint list as an incoming SafeRoute and set the same waypoint list as the outgoing SafeRoute, the aircraft flies the waypoints in one direction when taking off and in the reverse direction when returning home.
- If you select an incoming SafeRoute, the aircraft uses this SafeRoute whenever it returns home, including when it returns home if a non-fatal warning appears.

- After you select an incoming SafeRoute, it remains selected until you change it or turn it off. If you restart the aircraft, the incoming SafeRoute remains selected.
- You cannot select an incoming SafeRoute when the flight planning menu is open.
- You cannot select an AutoGrid as an incoming SafeRoute.
- If you are flying multiple aircraft, you must select the incoming SafeRoute for each aircraft.

Take off using a SafeRoute

After creating and selecting your outgoing SafeRoute, you can use it to take off.

If you configured an incoming or outgoing SafeRoute and the height of one or more waypoints in the path is below MSH or one or more waypoints are outside the aircraft's Maximum Range, warnings appear in the **Preflight Checks** dialog box during takeoff.

1. On the map, tap the body of the aircraft icon.
2. If you are connected to ELB, perform the following actions:
    a. In the **Select Pilot** dialog box, set the **Pilot** and **Mission** drop-down lists to the appropriate values for the flight.
    b. Tap **Continue**. The **Height Settings** dialog box appears.
3. In the **Height Settings** dialog box, confirm the height settings.
4. Tap **Continue**. The **Preflight Checks** dialog box appears.
5. If you can't view your outgoing or incoming SafeRoutes, move the **Preflight Checks** dialog box until you can view them on the map. For more information, see "Move a dialog box" on page 42.
6. Perform one or more of the following actions:
    - To open flight planning mode to review the settings for the waypoint list used for the outgoing SafeRoute, in the **Preflight Checks** dialog box, beside **Outgoing SafeRoute**, tap  .
    - If you configured an incoming SafeRoute, to open flight planning mode to review the settings for the waypoint list, in the **Preflight Checks** dialog box, beside **Incoming SafeRoute**, tap  .
7. In the **Preflight Checks** dialog box, review all other warnings or special circumstances for

the flight.

8. Select the **Acknowledge Above Warnings** check box.
9. When the aircraft is ready to take off, tap **Spin Up**. The motors begin spinning.
10. Tap **Take Off**.

✓ After taking off, adjust the aircraft's speed so it can fly the outgoing SafeRoute at the speed that you want.

Notes about flying with outgoing SafeRoutes

- If you configure an outgoing SafeRoute and enable the **Auto Ascend** option, the aircraft completes ascending first, before starting the outgoing SafeRoute.
- While the aircraft is flying the outgoing SafeRoute, you can take control and move the aircraft's position.
- The aircraft stops flying the outgoing SafeRoute if you open the flight planning menu.
- If any waypoints in the outgoing SafeRoute are outside the aircraft's Maximum Range or above the aircraft's Maximum Height, the outgoing SafeRoute is not used.
- You must reconfigure your outgoing SafeRoute if you move the home position.
- If you configure an outgoing SafeRoute and use in-air replacement, you cannot configure staging points for the replacement.
- If you configure an outgoing SafeRoute for an aircraft and want to use in-air replacement, if you configure the replacement aircraft to use the same outgoing SafeRoute, you must move the primary aircraft away from the last waypoint in list before starting the in-air replacement.
- If you take off in GPS Denied Mode, you cannot use an outgoing SafeRoute.
- If you take off in visual navigation mode, you can use an outgoing SafeRoute, but the visual navigation quality can be poor during flight control optimization and at low heights.

Return home using a SafeRoute

After creating and selecting your incoming SafeRoute, during a flight, you can use the incoming SafeRoute to return home.

Perform one of the following actions:

- On the map, tap  .
- In the lower-right corner of the screen, tap  . Tap  .

The aircraft follows the selected SafeRoute as it returns home. It flies at the **Home Speed** that you configured in the flight behaviors.

Notes about flying with incoming SafeRoutes

- While the aircraft is flying the incoming SafeRoute, you can take control and move the aircraft's position.
- The aircraft stops flying the incoming SafeRoute if you open the flight planning menu.
- If you configure an incoming SafeRoute, during your flight, in the aircraft status label, the amount of battery power remaining includes the estimated time that it takes to fly the incoming SafeRoute.
- If you are flying the aircraft below MSH and then return home, the aircraft ascends to MSH before starting the incoming SafeRoute. If the first waypoint in your incoming SafeRoute has a height set below MSH, the aircraft does not descend to that height. It does change its height for any subsequent waypoints in the SafeRoute. If no subsequent waypoints in the SafeRoute have height changes, the aircraft descends below MSH after it arrives at the waypoint.
- If you set a height for the first waypoint in the incoming SafeRoute, the aircraft uses diagonal height transitions to move to that waypoint as it returns home.
- If you select any waypoint in the incoming SafeRoute, the aircraft flies to that waypoint and then prompts you to continuing flying the remaining points in the waypoint list. If you do, the aircraft flies to the remaining points before it starts returning home.
- You cannot fly the waypoints in an incoming SafeRoute in the opposite direction.
- If any waypoints in the incoming SafeRoute are outside the aircraft's Maximum Range or above the aircraft's Maximum Height, the incoming SafeRoute is not used.
- If you configure an incoming SafeRoute for returning home, and the aircraft is within 10 m / 33 ft of a waypoint in the incoming SafeRoute, the aircraft flies to that waypoint instead of flying to the first waypoint in the incoming SafeRoute. If the aircraft is within 10 m / 33 ft of home, it returns home instead of flying the incoming SafeRoute.

- If you move the home position or update the home position during landing, MCS turns off the incoming SafeRoute automatically. MCS also turns off the incoming SafeRoute if you fly to a land location or a waypoint configured with a land location action, and you set those points as home.
- If you are using an incoming SafeRoute, have the base station / network node set as home, and the base station / network node is moving, the aircraft continues to update the home position as the base station / network node moves. If the last point in your incoming SafeRoute is a long distance from the home position, a low battery warning might appear earlier than anticipated. If you expect the home position of the base station / network node to move significantly, do not use an incoming SafeRoute.
- If you configure an incoming SafeRoute and use in-air replacement, you cannot configure staging points for the replacement.
- Incoming SafeRoutes are given a higher priority than no-fly zones. If there is a no-fly zone between the aircraft and the first point in your SafeRoute, the aircraft flies through the no-fly zone to reach the waypoint.

Use mesh networks

If you are using an external radio and you configure the aircraft to work in external radio mode, you can operate the aircraft within a mesh network. For radios that support broadcasting their GPS position, you can add nodes to the map. You can also change nodes or delete them.

The aircraft can interact with any node that is a part of the mesh network. For example, you can enable Follow-Me mode on the node so that the aircraft follows it. If you have multiple nodes in the mesh network, you can enable different actions for different nodes. For example, you can enable Follow-Me mode on one node but point a camera target at a different node.

For more information on using an external radio with the aircraft, contact Support.

A network node icon appears on the map at the location of the node. The marker includes an orange marker to indicate the node itself, as well as a label. The label has two parts: the information label and the status label.

1. Network node
2. Information label (which shows the node ID)
3. Status label

Add a mesh network node

When you add a mesh network node to MCS, the node appears on the **Connection** tab of the **System Configuration** dialog box. On the map, the node's GPS and battery information appears.

Before adding a mesh network node, you might need to connect the tablet to the aircraft's hidden network. For more information, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for "Connect a tablet to an aircraft's hidden Wi-Fi network."

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. In the **External Network** dialog box, in the **Type** drop-down list, select the type of mesh network.
4. Tap **Add New**.
5. Type the static IP address for the node on the mesh network.
6. Tap **OK**.

After adding the mesh network node, you might need to connect to it so that it appears on the map. In the lower-left corner of the screen, tap  . In the **Available Aircraft** dialog box, beside the name of the mesh network node, tap **Connect**. The mesh network node appears on the map.

Change the details for a node on a mesh network

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. In the **External Network** dialog box, select the node that you want to change.
4. Tap **Edit Selected**.
5. Change the details for the static IP address.
6. Tap **OK**.

Delete a node on a mesh network

1. In the lower-left corner of the screen, tap  .

2. Tap  .
3. In the **External Network** dialog box, select the node that you want to delete.
4. Tap **Delete Selected**.

Enable manual takeoff initialization mode

You can use manual takeoff initialization mode if the aircraft needs extra time to average out a level ground point, such as when taking off from a moving vessel. The aircraft can gather more information about a level ground point with a longer initialization time. For example, when taking off in a marine environment, set a longer initialization time to account for the motion of the waves. If taking off from a moving vessel, travel as straight as possible while the aircraft completes the manual initialization. The manual initialization might not succeed if the vessel turns during the process.

You can also enable manual takeoff initialization mode if you need to ignore magnetic interference during takeoff, such as when taking off from a metal surface. In this case, the aircraft bypasses the regular compass initialization, takes off, and calibrates the compass normally after it is in the air.

1. In the aircraft status label, tap  . A dialog box with the aircraft settings appears on the right side of the screen.
2. Tap the **Behaviors** tab.
3. On the  tab, set the **Takeoff Initialization Mode** drop-down list to **Manual**.

Take off with manual initialization

After you enable manual initialization, you can take off in this mode.

If the regulatory region for your flight requires Remote ID, you must enable it for your flight. Depending on the region, you might also need to lock it. For more information, see "Using Remote ID" on page 341.

1. Verify that the camera shows the video stream.
2. To take control of the aircraft, on the map, tap the body of the aircraft icon.
3. If you are connected to ELB, perform the following actions:
    a. In the **Select Pilot** dialog box, set the **Pilot** and **Mission** drop-down lists to the appropriate values for the flight.

b. Tap **Continue**. The **Height Settings** dialog box appears.

4. In the **Height Settings** dialog box, perform one or more of the following options:

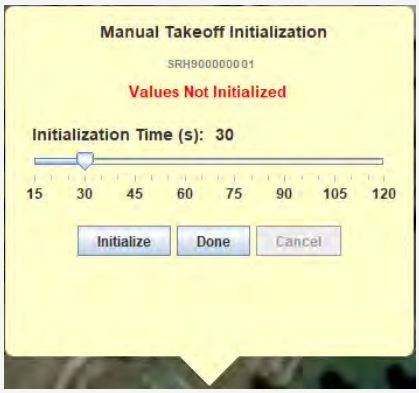
   - Confirm the height settings. If you are taking off in an area with magnetic interference, set the **Takeoff Height** to **5 m** / **16.4 ft**. If 5 m / 16.4 ft isn't possible, set the **Takeoff Height** to the highest possible height that is safe for your surroundings.

   - To change the unit of measure for height, tap the label for one of the fields. In the **Units of Measure** dialog box, set the Height Measurement drop-down list. Configure any other preferences for units of measure. In the upper-right corner of the dialog box, tap **X**.

5. Tap **Continue**.

6. In the **Manual Takeoff Initialization** dialog box, perform the following actions:

   a. Use the **Initialization Time** slider to set the length of time that the aircraft should use to find a level ground point.



   b. Tap **Initialize**. After the aircraft completes initialization, **Initialized** appears along with the time since initialization.

   c. Tap **Done**. The next dialog box that appears shows the aircraft's status and whether it is ready to take off.

7. If the aircraft is not ready to take off, review the results of the preflight checks and then perform one or more of the following actions:

   - To resolve the warnings, tap **Cancel**. Adjust the aircraft or software as necessary. Start the takeoff process again.

   - If you want to proceed with any minor warnings or acknowledge special circumstances for the flight, select the **Acknowledge Above Warnings** check box.

8. When the aircraft is ready to take off, tap **Spin Up**. The motors begin spinning.
9. Tap **Take Off**.

Use the system in dual operator mode

You can use the system in dual operator mode so that control of the aircraft, the payload, or both the aircraft and payload can alternate between multiple operators. Only one operator can be in control of the aircraft or payload at a time.

To use dual operator mode, you need a second device operating Windows 10 or Windows 11 and Java version 1.8 or later or a compatible Application Development Kit (ADK) application. Both devices must be running the same version of MCS as the aircraft and both devices must be connected to the same base station Wi-Fi network. For more information on setting up a second device, see "Set up a second device" below.

When you use the system in dual operator mode, you can also configure flight plan sharing so both operators can fly the same flight plan.

When using the system in dual operator mode, communication between operators is crucial. The operator with payload control can yaw the aircraft which affects the direction that the aircraft flies. If the operator with aircraft control does not know that the aircraft yaw changed, the aircraft can fly in a different direction than expected.

Set up a second device

To set up a second device, you must have the Wi-Fi network name and password for the base station that is used with the system. See "Copy the password for the base station's Wi-Fi network" on page 325.

1. On the second device, in the Windows notification area, double-tap  .
2. Select the base station's Wi-Fi network.
3. Type or paste the password for the network.
4. Tap **Connect**.

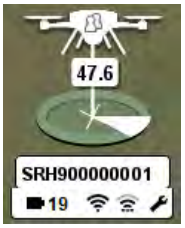
Connect to the aircraft

On the second device, you must connect to the aircraft.

1. In the lower-left corner of the screen, tap  .

2. Beside the aircraft name, tap **Connect**.

After connecting, the video stream appears. On the map, the dual operator icon appears with the aircraft icon:



Turn on flight plan sharing

1. In the lower-left corner of the screen, tap .
2. Tap .
3. Tap .
4. On the **Preferences** tab, ensure that the **General** tab is selected.
5. Select the **Share Flight Plans** check box.

If you have aircraft control, after you turn on flight plan sharing, the aircraft receives the flight plan from your tablet or device.

Select a flight plan

If you connect to the base station's Wi-Fi network, and a flight plan is available on the aircraft that is different than what appears on your device, a dialog box appears. The dialog box includes an illustration of the flight plan that is available on the aircraft.

1. If you have turned on flight plan sharing, in the dialog box, perform one of the following actions:
    - If you want to use the aircraft's flight plan, tap **Yes**.
    - If you want to use the aircraft's flight plan but you also want to keep your current flight plan, select the **Save my current flight plan** check box. Navigate to the location where you want to save your flight plan. Type a name. Tap **Save**. Tap **Yes**.
    - If you do not want to use the aircraft's flight plan, tap **No**.

- If you do not want to use the aircraft's flight plan and you want to turn off flight plan sharing, select the **Turn off flight plan sharing** check box. Tap **No**.

2. If you have not turned on flight plan sharing, in the dialog box, perform one of the following actions:

    - If you want to turn on flight plan sharing and use the aircraft's flight plan, tap **Yes**.
    - If you want to turn on flight plan sharing and use the aircraft's flight plan, but you also want to keep your current flight plan, select the **Save my current flight plan** check box. Navigate to the location where you want to save your flight plan. Type a name. Tap **Save**. Tap **Yes**.
    - If you do not want to turn on flight plan sharing and do not want to use the aircraft's flight plan, tap **No**.

If you have not turned on flight plan sharing, in the dialog box that appears, you can always use your selection and MCS won't prompt you again. In the dialog box, select the **Don't ask me again** check box.

Notes about flight plan sharing

- If flight plan sharing is on, the aircraft receives the flight plan from the tablet or device of the operator with aircraft control. The aircraft receives this flight plan as soon as the tablet or device takes control.
- If you are observing the flight or have payload control, and you choose to use the aircraft flight plan, any updates made by the operator with aircraft control are reflected on your device immediately. If you make any changes to the flight plan on your device, the changes are deleted if you receive an updated flight plan from the aircraft.
- If another operator has aircraft control and configures outgoing or incoming SafeRoutes. if you request aircraft control, you are prompted to accept the flight plan and the configured SafeRoutes. The SafeRoutes are only used if you have flight plan sharing enabled and you accept the flight plan from the aircraft when prompted.
- If the flight plan is not synchronized between the two devices, both operators could appear to have different outgoing or incoming SafeRoutes configured for the same aircraft. However, the aircraft flies the outgoing or incoming SafeRoute configured by the operator with aircraft control.

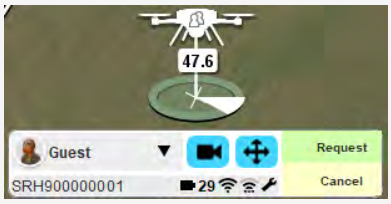
- If you select the **Don't ask me again** check box when confirming whether to enable flight plan sharing, you are not prompted again, even after closing and opening MCS or upgrading the software. If you want to be prompted again, contact Support.
- If you select the **Don't Record Location Data** check box on the **Advanced** tab of the **Preferences** tab of the **System Configuration** dialog box, the flight plan is not saved on the aircraft when you restart the aircraft. The flight plan does remain in MCS. When you open MCS again and take control of the aircraft, the aircraft receives the flight plan again.

Request control of the aircraft or payload

You can request control of the aircraft, the payload, or both the aircraft and payload.

If you connect MCS to ELB, you can specify your name in the request. When you do, the operator currently in control can see who is requesting control. If you take aircraft control, when the flight logs appear in ELB, your name appears as the operator for the duration of the flight where you had aircraft control. If you do not specify a name, **Guest** appears as the name of the operator.

1. Tap the body of the aircraft icon.
2. In the dialog box, perform one or more of the following actions:
   - If you connected MCS to ELB, in the drop-down list, select your name.
   - To request control of the payload, tap  so the icon changes to  .
   - To request control of the aircraft, tap  so the icon changes to  .
3. Tap **Request**.



The other operator receives a request for control. If the other operator approves the request, you have control over the aircraft, the payload, or both the aircraft and payload, depending on what you requested. If the other operator denies your request, you can continue to view the aircraft's position and the video stream on your device.

Notes about requesting control of the aircraft or payload

- If you are controlling the aircraft, you have full control of the aircraft's movements, including changing the aircraft's height and direction, flying flight plans, and landing the aircraft.
- If the other operator enabled flight plan sharing, when you request control of the aircraft's movement, you are prompted to use the flight plan that is already available on the aircraft. If you do not have flight plan sharing enabled already, you are prompted to turn it on and use the aircraft's flight plan. If you want to share flight plans with the other operator but also want to keep your flight plan, in the dialog box that appears, save your flight plan.
- If you are using Remote ID and you request control of the aircraft's movement, you must type or select your Operator ID to continue. For more information on Remote ID, see "Using Remote ID" on page 341.
- If you have payload control, you can use any of the payload functions, including setting camera targets, taking pictures, recording videos, or switching cameras. For more information on the capabilities of your payload, visit the Customer Self-Service Portal at https://selfservice.teledyneflir.com to read the Operating Manual for your payload.
- If you use a payload that supports independent camera payload and aircraft yaw, and you take payload control and unlock the yaw of the payload from the yaw of the aircraft, the operator in control of the aircraft's movement cannot yaw the aircraft using the front EO/IR camera.

Give control to another operator

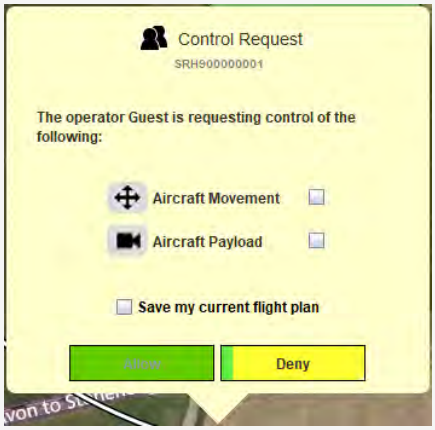
Another operator can request control of the aircraft, the payload, or both the aircraft and payload. When the operator requests control, the **Control Request** dialog box appears on your screen. This dialog box shows the serial number of the aircraft and whether the operator is requesting aircraft control, payload control, or both. It also shows the name of the operator that is requesting control. If the operator does not specify a name when submitting the request, the dialog box indicates that a guest operator is requesting control.

You can allow or deny the request. If you approve a request for payload control, you remain in control of the movement of the aircraft but can no longer yaw the aircraft. If you approve a request for aircraft control, you can no longer control the aircraft's movement. To regain control of the aircraft, you must request control from the other operator. For more information, see "Request control of the aircraft or payload" on the previous page.

If the operator is requesting both aircraft and payload control, you can allow both, deny both, or allow one and deny one.

In the **Control Request** dialog box, perform one of the following actions:

- If the operator requested only aircraft control or only payload control, tap **Allow** or **Deny**.
- If the operator requested both aircraft and payload control, to allow control, select one or both check boxes. Tap **Allow**. If you selected only one check box, the other option is denied.

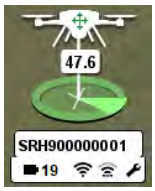


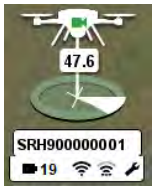
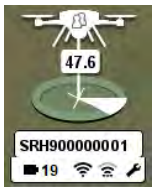
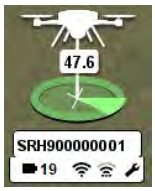
- If the operator requested aircraft control and both operators have flight plan sharing enabled, to avoid losing your flight plan, select the **Save my current flight plan** check box. Navigate to the location where you want to save your flight plan. Type a name. Tap **Save**. In the **Control Request** dialog box, tap **Allow**.
- If the operator requested both aircraft and payload control, to deny control, click **Deny**.

In the dialog box, a progress bar appears on **Deny**. If you do not tap **Allow** or **Deny**, when the progress bar completes (after approximately one minute), the aircraft automatically denies the request.

About icons for dual operator mode

If you request control of the aircraft or payload, the aircraft icon changes on your device and the other operator's device, depending on what you are controlling:

Aircraft icon	Your device	Other operator's device
	This icon appears on your device when you are controlling only the aircraft.	This icon appears on the other operator's device when you are controlling only the payload.

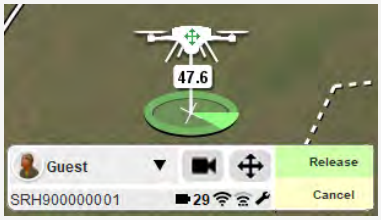
Aircraft icon	Your device	Other operator's device
	This icon appears on your device when you are controlling only the payload.	This icon appears on the other operator's device when you are controlling only the aircraft.
	This icon appears on your device when you connect to the aircraft but have not requested control yet.	This icon appears on the other operator's device when you are controlling both the aircraft and the payload.
	This icon appears on your device when you have control of both the aircraft and the payload.	This icon appears on the other operator's device when the other operator has control of both the aircraft and the payload.

Return control of the aircraft or payload

If you request control from another operator, you can return it at any time.

You cannot return control to the other operator if you are in control of both the aircraft and the payload. If you are in control of both the aircraft and the payload, the other operator must request control.

1. Tap the body of the aircraft icon.
2. Perform one of the following actions:
   - To return control of the payload, tap so the icon changes to .
   - To return control of the aircraft, tap so the icon changes to .
3. Tap **Release**.



Take control of the payload

If you have control of the aircraft's movement and another operator has control of the payload, you can take control of the payload at any time. Control is given immediately. You do not need to wait for the other operator to approve the request.

Perform one of the following actions:

- Tap the body of the aircraft icon. Tap so the icon changes to . Tap **Request**.
- In the toolbar of the primary video panel, tap **Take Control of Aircraft Payload**.

If the payload operator unlocked the payload yaw from the aircraft yaw, when you take control of the payload, the yaw remains unlocked. For more information on independent camera payload and aircraft yaw, the target tracking features for your payload, visit the Customer Self-Service Portal at https://selfservice.teledyneflir.com to read the Operating Manual for your payload.

Take over aircraft control

If you are controlling the payload only, you can take control of the aircraft quickly in the following situations:

- There is a low battery on the aircraft operator's tablet and the tablet turns off.
- The aircraft operator closes MCS.
- The aircraft operator's tablet disconnects from the base station.

If any of the above situations occur, a warning appears, and the aircraft starts performing its **Non-Fatal Condition Response**.

On the map, tap **Take Control**.

Fly multiple aircraft

If you fly multiple aircraft, you must be aware of the position of all aircraft during the flight.

⚠

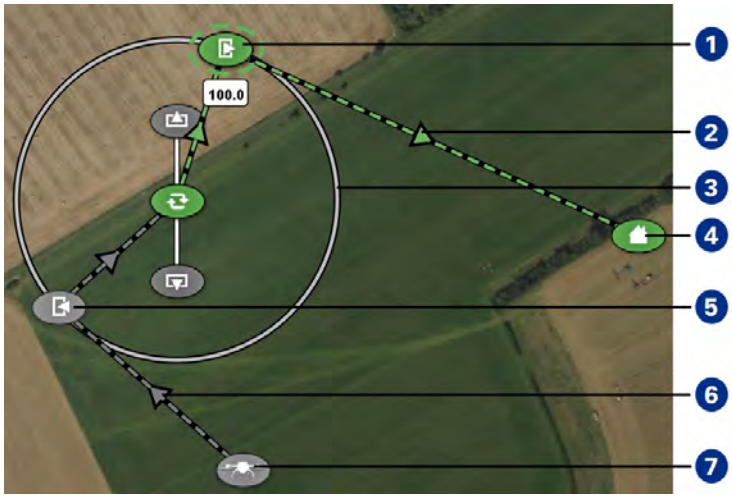
> If you fly with multiple aircraft, know and follow the local regulations for aircraft-to-operator ratios. If you connect multiple aircraft to the same base station, do not turn on the second aircraft until it is needed. Set up the second aircraft a minimum of 10 m / 33 ft from the base station. Keep a minimum of 10 m / 33 ft between the two aircraft.

MCS detects when multiple aircraft are connected and enables features that are available when flying more than one aircraft, such as Automatic In-air Replacement (AIR).

About AIR

You can use AIR to replace an aircraft without interrupting the flight. You might want to do this if the primary aircraft's battery is running low, but you want to keep eyes on a target.

When you start AIR, the **In-Air Replacement** dialog box allows you to configure the replacement settings. On the map, a circle representing the replacement aircraft appears and a dashed line with arrows shows the path that it takes. As you adjust the settings, the map updates the flight path.



In-air replacement

1. Exit point for primary aircraft
2. Exit path for primary aircraft
3. Replacement circle
4. Home position of the primary aircraft
5. Entry point for replacement aircraft
6. Entry path for replacement aircraft
7. Home position of the replacement aircraft

Replacements must occur above MSH, within a radius greater than 10 m / 33 ft. The home positions for each aircraft should also be placed greater than 10 m / 33 ft apart.

> When you are configuring the entry point for the replacement aircraft and the exit point for the primary aircraft, always ensure that their flight paths do not cross, especially as the aircraft travel to or from their home positions. To avoid collisions, keep the entry and exit points as far away from each other as possible. The points should also be at least 20° off the direct path to home. If you are unsure about the configuration of your in-air replacement, practice the replacement using the simulator first. For more information, see "Simulating a flight" on page 316.

You can configure staging points which allow you to set the percentage of distance that the replacement aircraft travels at a specified staging height before it changes to the primary aircraft's height. You can also configure the percentage of distance that the primary aircraft travels at its current height after it is replaced, before it descends to the specified staging height. You can only configure staging points when the replacement aircraft is on the ground.

Complete an in-air replacement

You can use AIR to replace an aircraft without interrupting a flight.

> To complete an in-air replacement, you must connect to two aircraft.

1. Perform one of the following actions:
   - Tap the primary aircraft. In the lower-right corner of the screen, tap . Tap . Tap .
   - Right-tap the primary aircraft. In the **Actions** menu, tap .

2. On the map, perform one of the following actions:

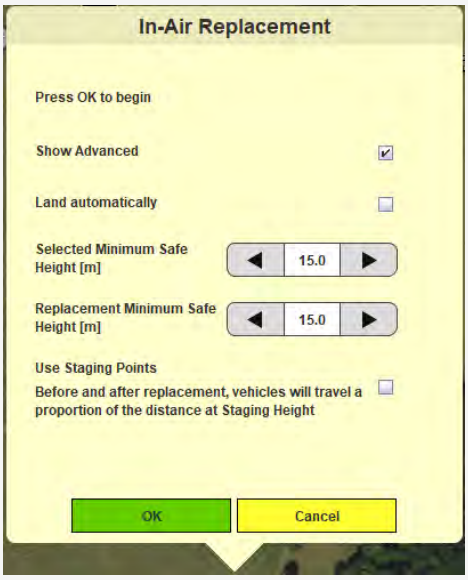
    - To replace the aircraft from the side, use the left and right arrow controls. To select where the replacement aircraft enters the replacement circle, tap and hold while you drag . To select where the primary aircraft exits the replacement circle, tap and hold while you drag .

    - To replace the aircraft from above or below, use the up and down arrow controls. To increase the height that the primary aircraft flies to before the replacement aircraft enters the replacement circle, tap and drag . To lower the height that the primary aircraft flies to before the replacement aircraft enters the replacement circle, tap and drag .

3. In the **In-Air Replacement** dialog box, perform one or more of the following actions:

    - If there are more than two aircraft connected to the base station, set the **Replacement** drop-down list to the name of the replacement aircraft.

    - To set advanced settings, such as staging points and specific MSH values for the primary and the replacement aircraft, select the **Show Advanced** check box.



4. If you enabled the advanced settings, perform one or more of the following actions:

    - If you want the primary aircraft to land automatically, select the **Land automatically** check box.
    - In the **Selected Minimum Safe Height** field, set the MSH for the primary aircraft.
    - In the **Replacement Minimum Safe Height** field, set the MSH for the replacement aircraft.
    - To configure staging points, select the **Use Staging Points** check box. If necessary, adjust the **Staging Height**. Adjust the **Entry %** slider to set the percentage of distance that the replacement aircraft flies at the staging height before changing to the primary aircraft's height. Adjust the **Exit %** slider to set the percentage of distance that the primary aircraft flies at its staging height as it flies to the home position. The percentage on the slider that remains represents the distance that the aircraft flies at its current height before descending to the staging height.

5. If warnings appear at the top of the **In-Air Replacement** dialog box, perform one of the following actions:

    - Adjust the replacement path or the MSH until the warnings disappear.
    - To proceed with the warnings, select the **Acknowledge Warnings** check box.

6. Tap **OK**.
7. If you are connected to ELB, in the **Select Pilot** dialog box, set the **Pilot** and **Mission** drop-down lists to the appropriate values for the flight.
8. Tap **Continue**. The **Height Settings** dialog box appears. If you have not configured an outgoing SafeRoute for the replacement aircraft, MCS confirms the height settings automatically and proceeds to the **Preflight Checks** dialog box.
9. If you configured an outgoing SafeRoute for the replacement aircraft, in the **Height Settings** dialog box, to configure auto ascend, perform the following actions:

    a. If necessary, select the **Auto Ascend after Takeoff** check box.

    b. If you selected the **Auto Ascend after Takeoff** check box, set an auto ascend height.

    c. Tap **Continue**.

10. If warnings appear at the top of the **Preflight Checks** dialog box, perform one of the following actions:

- Make the necessary adjustments until the warnings disappear.
- To proceed with the warnings, select the **Acknowledge Above Warnings** check box.

11. Tap **Spin Up**. The motors on the replacement aircraft begin spinning.
12. Tap **Take Off**.

After the aircraft takes off, allow the in-air replacement to complete. If you change a flight plan, tap the aircraft shadow, change the aircraft height, or adjust the aircraft's speed, MCS cancels the in-air replacement.

Until the replacement is made, appears above the primary aircraft. After the replacement, appears above the replacement aircraft. When the primary aircraft has returned home, no longer appears.

If you do not select the **Land automatically** dialog box, after the replacement, land the primary aircraft as you would normally.

Notes about AIR

- During AIR, any camera targets and zoom levels on the primary and replacement aircraft match.
- When the replacement happens, the video stream switches from the primary aircraft to the replacement aircraft automatically.
- The replacement aircraft automatically sets its speed to match the speed of the primary aircraft.
- You cannot complete an in-air replacement if Follow-Me is enabled.
- If you configure an outgoing or incoming SafeRoute and use in-air replacement, you cannot configure staging points for the replacement.
- AIR is canceled if, on the primary aircraft, you enable, update, or turn off the incoming SafeRoute. AIR is also canceled if, on the replacement aircraft, you enable, update, or turn off the outgoing SafeRoute.
- If you configure the replacement aircraft to ascend automatically after taking off, the auto ascend does not complete unless you also configured an outgoing SafeRoute for the replacement aircraft.

- When configuring AIR, consider the position and height of your incoming and outgoing SafeRoutes or your staging points. If the points are not placed correctly or the height of the points is too low, communications issues can result.

Fly multiple aircraft at the same time

You can connect a maximum of 16 aircraft to MCS. When an aircraft is flying, it appears with its aircraft icon on the map. You can review the status of each aircraft by reviewing its aircraft status label.

⚠ Flying multiple aircraft can be dangerous. Operators and observers must monitor the position, speed, and status of all aircraft carefully during the flight. Injury or damages can result if the aircraft fly too close to each other. Before flying multiple aircraft, you should always check the local aviation regulations to confirm the required operator-to-aircraft ratio. You (and any flight observers) should also practice first in a controlled environment with repeated successful results.

While you can connect a maximum of 16 aircraft, that many aircraft on one base station can affect the quality of the video and pictures that you take from each aircraft. You should not connect more than two aircraft to one base station.

Setting up your system with multiple base stations requires a specialized configuration of the base station. For more information, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for "multiple base stations."

When you fly multiple aircraft, only one aircraft is the active aircraft. Any action that you complete, such as flying a flight plan, recording video, or changing the aircraft's speed, applies to the active aircraft only. Always verify which aircraft is active before initiating any actions.

⚠ When flying multiple aircraft, if an error or warning appears on the screen, ensure that you select the correct aircraft before taking action. If an aircraft that is not the active aircraft loses its GPS connection, MCS centers the map on the aircraft and its aircraft shadow turns red. Select the aircraft and, if possible, visually guide it to a safe location to land. For more information, see "Fly in recovery mode" on page 306.

If you are using multiple video panels when flying more than one aircraft, MCS keeps the multiple video panels open as you switch between the aircraft. If the aircraft are using different payloads, MCS shows the video feed from the payload that is available. If a payload is not available, it shows the video stream from the front EO/IR camera or the navigation cameras.

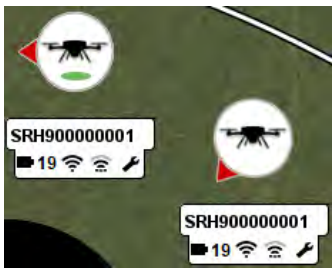
1. Connect all aircraft to the base station’s network.
2. Position the first aircraft at a safe height.
3. Fly the first aircraft to its location.

4. Position the second aircraft at a safe height.
5. Fly the second aircraft to its location.
6. Repeat steps 4 and 5 for any additional aircraft.
7. To make a specific aircraft the active aircraft, tap its aircraft icon.

✓ If you are using the joystick when flying multiple aircraft, use waypoints to fly to a destination. Use MCS to change the aircraft's height or land the aircraft, instead of using the joysticks to change the height manually.

About icons for multiple aircraft

If you are flying multiple aircraft, the following icons can appear on the map:

Icon	Description
	If multiple aircraft are off the current view of the map, multiple off-map aircraft icons appear, each pointing in the direction of an aircraft. The green shadow below the aircraft icon indicates the active aircraft. You can center the map on an off-map aircraft by tapping the off-map aircraft icon.
	If multiple aircraft are off the current view of the map, but are in the same direction, one off-map aircraft icon appears for each group of four aircraft. The aircraft names appear below the off-map aircraft icon. The green shadow below the aircraft icon appears if the active aircraft is among the listed aircraft. You can center the map on a group of aircraft by tapping the grouped off-map aircraft icon.
	If there are multiple aircraft on the current view of the map and the **Aircraft Going Home** or **Land** dialog box appears for one of them, this icon appears with the dialog box when the aircraft

Icon	Description
	approaches the other aircraft on the map. The orange arrow points toward the aircraft associated with the dialog box. The green shadow appears if the aircraft is the active aircraft.

Move the home position

If you want the aircraft to land at a different location than the takeoff location, you can move the home position during a flight.

You cannot set a new home position that is outside the radius of the aircraft's Maximum Range, as configured in your aircraft flight settings.

You can also update the home position while landing. For more information, see "Land the aircraft" on page 75.

1. In the lower-right corner of the screen, tap .
2. Tap and hold until the icon changes to .
3. Tap the new home position.

On the map, appears at the new home position.

You can also use the map to move the home position. On the map, tap and hold until the icon changes to , and drag to the new home position. When you move the home position using this method, the circle that shows the aircraft's Maximum Range also moves. While you move the Maximum Range, the circle turns blue. If you move the home position to a location that is outside of the aircraft's current Maximum Range, the circle turns red to indicate that you cannot move the home position to that location.

Set the base station / network node as home

Before taking off or during a flight, you can set the base station / network node as the aircraft's home position. When you do, the aircraft uses the GPS position of the base station / network node as its home position.

If you enable this feature before taking off, you must acknowledge that the base station / network node is set as the home position during the takeoff process.

1. If you are setting the base station / network node as home before takeoff, take control of the aircraft.
2. In the status label below the base station / network node icon, tap .

If the aircraft and base station / network node can establish a GPS connection, the icon in the status label changes to .

The icon on the map also changes:

Icon on map	Description
	This icon appears on the map if you set the base station as home. In the lower-right corner of the screen, when you tap , changes to .
	This icon appears on the map if you set a network node as home. In the lower-right corner of the screen, when you tap , changes to .

 appears at the previous home position to indicate that it is a possible land location.

If you enable this feature, when you land the aircraft, it will land at the location of the base station / network node.

Configure the default base station / network node as home preference

If you set the base station / network node as home, it remains on after you land the aircraft. You can set a preference so that the base station / network node is always the default home position whenever you restart the aircraft.

1. In the lower-left corner of the screen, tap .
2. Tap .
3. Tap .
4. On the **Preferences** tab, ensure that the **General** tab is selected.
5. Select the **Set Base Station / Node as Home** check box.

Notes about setting the base station / network node as home

- If you use Follow-Me, you should also set the base station / network node as home. For more information, see "Use Follow-Me" on the next page.
- When you are ready to land the aircraft, position the base station / network node or external GPS antenna as close to the landing location as possible, especially if you are landing on a target.
- If you are using a base station and a mesh network with multiple nodes, you can perform different actions for the base station and the network nodes. For example, you can set the base station as home and point the camera target at a network node.
- If you set the base station / network node as home, and you want to land at a land location, you cannot set the land location as the home position.
- If you are flying to a waypoint or POI, completing a waypoint list, AutoGrid, or circular flight plan, flying to a location on the map, or loitering the aircraft quickly, and then you set the base station / network node as home, the aircraft updates the home position but continues flying the flight plan. Similarly, if you set the base station / network node as home and then start flying the flight plan, the home position changes, and the aircraft starts the flight plan.
- If you lose communications during a flight, the aircraft uses the last known position of the base station / network node as home.
- If the quality of the GPS connection of the base station / network node is poor, the icon in the status label flashes orange. When the icon flashes, setting the base station / network node as home is suspended temporarily. If the quality of the GPS connection improves, it is enabled again. If you set the base station / network node as home before the quality of the GPS connection degraded, the home position continues to update as it can, but it might be less accurate.
- After the aircraft arrives at the home position, if you move the base station, an external GPS antenna attached to the base station, or the network node, the aircraft moves to the new location of the base station / network node.
- If you are using an incoming SafeRoute, have the base station / network node set as home, and the base station / network node is moving, the aircraft continues to update the home position as the base station / network node moves. If the last point in your incoming SafeRoute is a long distance from the home position, a low battery warning might appear earlier than anticipated. If you expect the home position of the base station / network node to move significantly, do not use an incoming SafeRoute.

- If you are flying multiple aircraft, and you set the same base station / network node as home for all aircraft, change your **Non-Fatal Condition Response** to **Home and Hover**. Set different heights for the aircraft to avoid collisions. Set a higher height for the aircraft that has more battery power remaining.
- After you set the base station / network node as home, you can change the home position during landing. If you do, a notification appears, and the base station / network node is no longer set as home. You cannot enable it again during the landing process. If you want to continue using the base station / network node as home, do not change the home position during landing.
- If you land the aircraft when the base station / network node is set as the home position, it remains enabled for your next flight, even if you restart MCS or restart the base station / network node. It does not remain enabled if you restart the aircraft. If you enable the preference to set the base station / network node as home by default, the base station / network node is set as home automatically when you restart the aircraft. For more information, see "Configure the default base station / network node as home preference" on page 214.

Turn off base station / network node as home

In the status label below the base station / network node icon, tap .

The last location of the base station / network node becomes the home position.

Use Follow-Me

Before taking off or during a flight, you can use the Follow-Me feature with the base station / any network nodes that you add. When you enable this feature, the aircraft follows the movements of the base station / network node. You might want to use Follow-Me if one of these objects is in a moving vehicle, such as a truck or a boat.

Follow-Me is not available when the aircraft is in visual navigation mode, if the aircraft loses its GPS connection, or if the aircraft loses its communications link with the base station / network node.

If communications between the base station / network node and the tablet become limited or lost, the Follow-Me behavior can change, depending on your settings. For more information, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for "Using Follow-Me with limited communications."

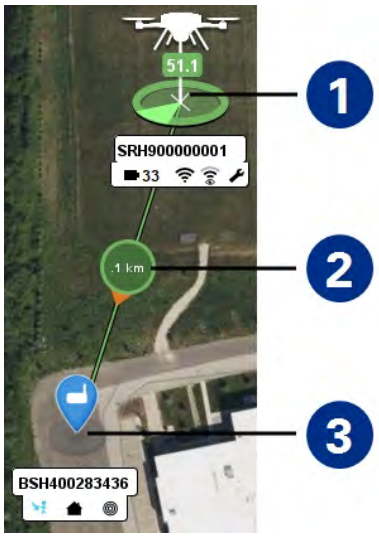
Enable Follow-Me

If you enable Follow-Me before taking off, you must acknowledge that it is enabled during the takeoff process.

1. Perform one of the following actions:
    - If you are enabling Follow-Me before takeoff, take control of the aircraft.
    - If you are enabling Follow-Me during a flight, position the aircraft at a safe height.
2. In the status label below the base station icon or the network node icon, tap .

If the aircraft and base station / network node can establish a GPS connection, the icon changes to .

A line appears between the aircraft and the object it is following to indicate that the aircraft is following the object's movements. On the line, the offset distance between the aircraft and the object appears as a green circle. An orange arrow appears on the circle to indicate the direction that the aircraft is following.



1. Aircraft icon
2. Offset distance between the aircraft and base station
3. Base station icon

1. Aircraft icon
2. Offset distance between the aircraft and the network node
3. Network node icon

If the current airspeed is greater than 45 km/h / 28 mph, after takeoff, the aircraft can't keep up with the movements of the base station / network node during flight optimization. As a result, a **Position Control Problem [W20]** error appears.

About the Follow-Me offset

In Follow-Me, when the base station / network node moves, the aircraft moves with it, maintaining its current relative offset distance. The Follow-Me offset is absolute and doesn't change when the base station / network node moves around corners.

Follow-Me does not adjust the height of the aircraft. Because Follow-Me always maintains the offset between the base station / network node and the aircraft, you must set the aircraft's MSH appropriately to avoid crashes. If the aircraft is following the base station / network node along a road that increases in height, you must adjust the aircraft's height manually.

For example, if you enable Follow-Me on the base station and the aircraft is 100 m / 330 ft north of the base station, if the base station moves 40 m / 130 ft west, the aircraft would also move 40 m / 130 ft west. When the base station stops, the aircraft stops, 100 m / 330 ft north of the base station. If the base station moved 10 m / 33 ft west and 20 m / 66 ft south, the aircraft flies on the diagonal to maintain its offset.

If the base station / network node goes outside the aircraft's Maximum Range during the flight, the aircraft flies to its Maximum Range and stops. Follow-Me remains enabled. If you adjust your flight settings to increase the Maximum Range, the aircraft continues following the base station / network node and attempts to maintain the previous offset. The aircraft's speed increases until it can catch up to the base station / network node.

In Follow-Me mode, by default, the aircraft’s speed is relative to the speed of the base station / network node that it is following. When you drag the stylus to move the aircraft to a location on the map or move the aircraft with the joystick, the aircraft adjusts its speed to maintain the changed offset. In some cases, the speed that the aircraft flies at can be greater than the speed that you set in MCS. For example, if the aircraft is traveling at 10 km/h and is following a base station that is moving at 20 km/h, when you move the aircraft in the same direction that the base station is traveling, the aircraft flies at 30 km/h to maintain the offset. For the aircraft to apply a relative speed, you must ensure that the map is centered on the aircraft. For more information on centering the map, see "Center the map on the aircraft" on page 41.

Adjust the offset

During a flight, you can adjust the amount of offset between the base station / network node and the aircraft.

Perform one of the following actions:

- Adjust the aircraft’s height.

- Adjust the aircraft's position.

Notes about Follow-Me

- When you enable Follow-Me, you should also set the base station / network node that you are following as the home position so that the aircraft does not have to return to the takeoff position to land. You can also update the home position during landing. If you do, the base station / network node no longer acts as the home position. For more information, see "Set the base station / network node as home" on page 213.

- If you enable Follow-Me and set the base station / network node as home, keep the base station / network node as close to the takeoff location as possible. When you are ready to land the aircraft, position the base station / network node as close to the landing location as possible, especially if you are landing on a target.

- If you are using a base station and a mesh network with multiple nodes, you can perform different actions for the base station and the network nodes. For example, you can follow the base station and point the camera target at a network node.

- If you are flying to a waypoint or POI, completing a waypoint list, AutoGrid, or circular flight plan, flying to a location on the map, or loitering the aircraft quickly, and then you enable Follow-Me, the aircraft stops flying the flight plan and begins following the movements of the base station / network node. If you enable Follow-Me first and then start flying a flight plan, MCS turns off Follow-Me.

- When you enable Follow-Me, the aircraft automatically centers the map on the aircraft. For more information, see "Center the map on the aircraft" on page 41.

- If you are flying an outgoing SafeRoute, the aircraft uses the last waypoint in the waypoint list to determine its offset distance from the base station / network node.

- If the quality of the GPS connection of the base station / network node is poor, the offset distance between the aircraft and the base station / network node animates. The  icon in the status label also flashes orange. When the icon flashes, Follow-Me is suspended temporarily. If the quality of the GPS connection improves, Follow-Me is enabled again, with an updated offset.

- If you did not set the base station / network node as home or the base station / network node is moving quickly, the base station / network node can go outside the aircraft's Maximum Range during the flight. If this occurs, the aircraft flies to its Maximum Range and stops. You must adjust your flight settings to increase the Maximum Range so that you can continue following the base station / network node. For more information, see "Check flight settings and behaviors" on page 54.

- If you are flying multiple aircraft and they are following the same base station / network node, change your **Non-Fatal Condition Response** to **Home and Hover**. Set different heights for the aircraft to avoid collisions. Set a higher height for the aircraft that has more battery power remaining.
- You can land on a target while using Follow-Me. For more information on landing on a target, see "Using target landing" on page 223.
- You cannot complete an in-air replacement while using Follow-Me.
- If you land the aircraft with Follow-Me enabled, and the base station / network node that you are following is set as home, Follow-Me remains enabled for your next flight. It remains enabled even if you restart MCS or restart the base station / network node. It does not remain enabled if you restart the aircraft.
- If you return home with Follow-Me enabled, and the base station / network node that you are following is not set as home, Follow-Me is turned off automatically.
- If you are using Follow-Me, it turns off automatically when you return home using an incoming SafeRoute.

Turn off Follow-Me

You should turn off Follow-Me before landing the aircraft unless you are landing on a target.

Perform one of the following actions:

- Hover the stylus over the green circle that indicates the distance between the aircraft and the base station or network node. Tap  .
- In the status label below the base station icon / network node icon, tap  .

If you set the base station / network node as home after you enabled Follow-Me, when you turn off Follow-Me, MCS uses the last location of the base station / network node as home.

Point the camera target at the base station / network node

Before taking off or during a flight, you can point the camera target at the base station / network node. You might want to enable this feature when you are using Follow-Me if you want to view the base station / network node while you are following it. For more information on Follow-Me, see "Use Follow-Me" on page 216.

You might want to enable this feature before takeoff so that you can view the base station / network node position in the primary video panel at the beginning of a flight.

If you enable this feature before taking off, during the takeoff process, you must acknowledge that the camera target is pointed at the base station / network node.

1. If you are pointing the camera target at the base station / network node before takeoff, take control of the aircraft.
2. In the status label below the base station / network node icon, tap .

If the aircraft and base station / network node can establish a GPS connection, the icon changes to .

When you point a camera target at the base station / network node, the aircraft yaws to point the camera payload at the base station / network node.

If you use a camera payload that can unlock its yaw from the aircraft yaw, when you unlock the payload yaw, only the camera payload yaws to point at the base station / network node. The aircraft does not yaw.

When you enable this feature, the icon on the map changes:

Icon on map	Description
	This icon appears if you point the camera target at the base station.
	This icon appears if you point the camera target at a network node.

When you enable this feature,  is replaced with one of the icons described above because you can only point the camera target at one object at a time.

Notes about pointing the camera target at the base station / network node

- If you are using a base station and a mesh network with multiple nodes, you can perform different actions for the base station and the network nodes. For example, you can point the camera target at the base station and follow a network node.

- If you are flying to a waypoint or POI, completing a waypoint list or circular flight plan, flying to a location on the map, or loitering the aircraft quickly, and then you point the camera target at the base station / network node, the aircraft points the camera, but continues flying the flight plan. Similarly, if you point the camera target at the base station / network node and then start flying the flight plan, the camera target continues to point the camera, and the aircraft starts the flight plan.
- If you are flying an AutoGrid, and then you point the camera target at the base station / network node, the aircraft stops flying the AutoGrid. Similarly, if you point the camera target at the base station / network node and then start flying an AutoGrid, when you tap **Continue** to proceed with the AutoGrid, the aircraft proceeds with the AutoGrid and no longer points the camera target at the base station / network node.
- If the quality of the GPS connection of the base station / network node is poor, the  icon in the status label flashes orange. When the icon flashes, pointing the camera target at the base station / network node is suspended temporarily. If the quality of the GPS connection improves, it is enabled again.
- If you point the camera target at the base station / network node, it is turned off automatically when you start landing the aircraft. After the aircraft lands, however, it is turned on again.
- When you turn off pointing the camera target at the base station / network node, MCS enables the default camera target automatically.

Stop pointing the camera target at the base station / network node

In the status label below the base station icon or network node icon, tap  .

When you turn off this feature,  appears at the last location of the base station / network node.

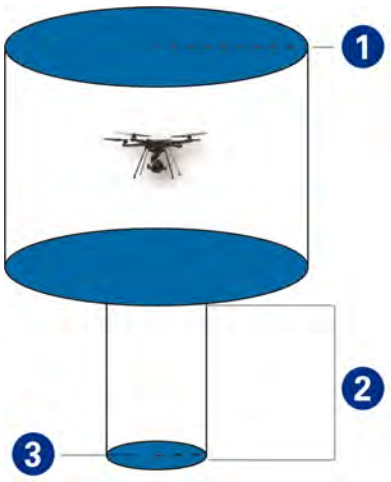
USING TARGET LANDING

After you configure target landing, the aircraft uses its navigation cameras during the landing process to lock onto the tags that appear on a landing target. When it acquires a target lock, it lands on the target.

You must use a Teledyne FLIR landing target with this feature. To purchase a landing target, contact your Teledyne FLIR representative.

Landing on a target might not be possible in poor conditions (such as foggy or snowy weather, high winds, or low light).

When the aircraft lands on a target, the required landing zone narrows as the aircraft descends. When you initiate target landing, there must be a clear landing zone from the aircraft's current height to the ground with a 5-m / 16-foot radius around the aircraft. When the aircraft reaches approximately 3 m / 10 ft above the ground, the aircraft requires a clear landing zone with a 2.5-m / 8-foot radius.



1. 5-m / 16-foot radius around aircraft
2. Approximately 3 m / 10 ft above ground
3. 2.5-m / 8-foot radius around aircraft

If you attach an Osprey payload with cargo to the aircraft or a large payload developed using the PDK, the ability to land on a target is severely compromised. The cargo or payload can obstruct the navigation cameras so the aircraft might not be able to position itself close enough to the target to land accurately. If you are flying with cargo, to ensure that the aircraft can land on the target, drop the cargo before starting the landing process.

Notes about placing the landing target

- You can place the target in the aircraft's landing zone at a stationary location or on a moving vehicle.
- If the target is on a moving vehicle, such as a boat, the vehicle must remain at a constant speed during the landing process. Landing on a moving target is available for speeds up to 20 km/h / 12 mph. For more information, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for "Landing on a target at speeds greater than 10 km/h / 6 mph." You should also enable the Follow-Me feature when landing on a moving target. For more information, see "Use Follow-Me" on page 216.
- You can also place the target at the GPS coordinates of a land location that is part of your flight plan. For more information on land locations, see "Land the aircraft at a land location" on page 142.

Configure target landing

Before landing on a target, in the flight behaviors, you must configure the settings that you want to use.

1. In the aircraft status label, tap . A dialog box with the aircraft settings appears on the right side of the screen.
2. Tap **Behaviors**.
3. On the tab, in the **Target Landing Mode** drop-down list, perform one of the following actions:
    - If you want the aircraft to search for a target and land if one is available, select **Optional**. With this setting, during the landing process, if a target is not available, the aircraft lands at its current location.
    - If you want the aircraft to continue searching until it finds a target to land on, select **Required**. With this setting, the aircraft does not land until it acquires a lock on a target.
4. In the **Target Landing Mat** drop-down list, select the type of landing target that you are using.

For more information on target landing, see "Land on a target" on the next page.

Turn off reverse motor spin up after landing on target

By default, when the aircraft touches the ground on a target, the motors spin up in the reverse direction to stabilize the aircraft on the landing surface. You can turn off this feature for quieter landings.

> ⚠ If you turn off this feature, the aircraft might not be as stable if you land on a target on an angled surface.

1. In the aircraft status label, tap . A dialog box with the aircraft settings appears on the right side of the screen.
2. Ensure that the **Target Landing Mode** field is set to **Optional** or **Required**.
3. Clear the **Reverse Thrust on Target Land** check box.

When you turn off this feature, it stays off until you enable it again.

Land on a target

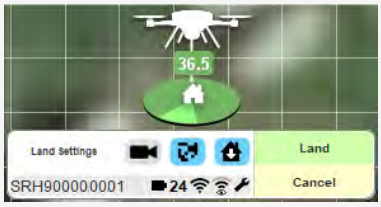
Before landing on a target, you must configure target landing in the flight behaviors, including setting the **Target Landing Mode** drop-down list. For more information, see "Configure target landing" on the previous page.

Landing on a target uses different cameras than monitoring moving targets. When you land on a target, the aircraft uses its navigation cameras to lock onto the tags that appear on a landing target. When you monitor moving targets, the aircraft uses the camera payload to monitor what is moving in the video stream. When you start landing on a target, the target tracking features no longer function.

1. Position the aircraft as close as possible above the target.
2. Perform one of the following actions:
   - In the upper-right corner of the screen, right-tap .
   - Tap and hold the aircraft icon. In the height slider, drag the stylus to the icon.
3. In the **Land Settings** dialog box, ensure that is selected.
4. If you want to set the aircraft's landing location or the target as the home position, in the **Land Settings** dialog box, tap so that the icon changes to .
5. To land with video assistance while landing on a target, tap so that the icon changes to

.

6. Tap **Land**.



The aircraft starts descending and searches for the target. A magnifying glass appears in the aircraft shadow.

When the aircraft reaches MSH, it starts yawing from side to side in the landing zone. The aircraft's four navigation cameras operate in pairs to search for the target. If you are viewing the navigation cameras in the video panel, the contrast between the two left navigation cameras and the two right navigation cameras alternates between light and dark during the search.

When searching for a target, the aircraft's behavior changes, depending on what you set as your target landing mode:

Target landing mode	Aircraft behavior
Optional	• When the aircraft reaches the target search zone (approximately 5 m / 16 ft), it stops descending and continues searching for the target. • If it cannot find the target within 30 seconds, a warning appears and the aircraft resumes descending until it lands. • If a target is found after that initial 30 seconds, the aircraft continues to land in place and does not land on the target.
Required	• When the aircraft reaches the target search zone, it stops descending until it can lock on the target. • The aircraft continues to search until it can lock on the target, or the battery power level is too low to continue flying.

When the aircraft does lock on the target, the following changes occur:

- The aircraft shadow turns blue, a sound plays, and a notification appears.
- An arrow appears in the aircraft shadow, indicating that the aircraft is landing on the acquired target.

- If you are using the joystick, the joystick vibrates.
- If you are viewing the navigation cameras, an arrow appears in the video panel.
- If you are using the height slider when the aircraft acquires a target, the aircraft's current height turns blue.
- If you are landing with video assistance or using full-screen navigation controls, the current height turns blue.

If the aircraft loses its target lock, the following changes occur:

- The aircraft shadow turns green again.
- If the aircraft was in the target search zone when it lost the target, it ascends to 5 m / 16 ft to search for the target again.
- If the aircraft was above the target search zone when it lost the target, it continues descending until it reaches the target search zone.

By default, when the aircraft touches the ground, the motors spin up in the reverse direction for approximately 2 seconds to stabilize the aircraft on the landing surface. You can turn off this feature for quieter landings. For more information, see "Turn off reverse motor spin up after landing on target" on page 225.

Notes about landing on a target

- If you selected the option to update home while landing, when the aircraft acquires a target lock, it updates the home position from the location where you started landing to the target's location. If the target is moving, the aircraft follows the target and updates the home position as the target moves. If you cancel the landing after it starts, the home position updates, even though you canceled the landing.

- If you do not select the option to update the home position while landing, the aircraft flies to its previous home position if it cannot find a target and a non-fatal warning occurs (when the **Non-Fatal Condition Response** is set to **Home and Land** or **Home and Hover**). Confirm that the previous home position is a safe place to land. If you set your **Target Landing Mode** to **Required**, ensure that a target is available. If the aircraft found a target before the non-fatal warning occurred, it continues landing on the target.
- If the aircraft cannot find the target after 30 seconds, cancel the landing and bring the aircraft closer to the landing zone. Decrease the aircraft's height below 5 m / 16 ft and try landing on the target again.
- After the aircraft acquires a lock on the target, you can change its direction. If the aircraft maintains the target lock after you move it, the landing continues.
- If you are landing the aircraft on a target, you cannot point the camera target at the base station / network node after the aircraft is below MSH or the aircraft acquires a lock on the target.
- If you are using Follow-Me and landing on a target, place the base station / network node or the external GPS antenna close to the target, opposite to the direction that the aircraft is approaching from. Place the base station / network node or external GPS antenna as close to the target as possible, without obstructing it.
- If the aircraft enters visual navigation mode during a target landing, the aircraft might not be able to continue with the landing. If the aircraft already acquired a target, it might lose the target lock if it enters visual navigation mode.
- The aircraft only actively searches for a target after you start the landing process. You can tell that the aircraft is searching because the aircraft shadow turns green, and a magnifying glass appears in the aircraft shadow. The aircraft also yaws from side to side in the landing zone, and the contrast of the navigation cameras changes in the video panel. The aircraft might indicate that it can see a target before you start the landing, but its detection is not accurate until the landing starts.
- If you enable target landing and a fatal error occurs, the aircraft immediately begins landing in place. It tries to detect the landing target as it descends but does not stop descending to search for the target. If it can acquire the target lock during the descent, it lands on the target. If the aircraft acquired a target lock before the fatal error occurred, it tries to maintain that lock to land on the target. If there is a fatal landing and the aircraft lands on the target, the motors do not spin up in the reverse direction.
- After you land on the target, before taking off again from the target, ensure that the aircraft is centered on the target.

Tips for improving the aircraft's ability to detect the target

- Before a flight that includes landing on a target, clean the lenses on the navigation cameras. For more information, see "Clean the camera lenses" on page 336.
- Keep the landing target clean. Wash it with mild soap and water.
- Lay out the landing target as flat as possible. Waves or wrinkles in the target can cause problems during detection.
- Before landing, ensure that there are no shadows on the target, including any shadows cast by the aircraft. If a shadow can be seen, the target can be difficult to detect.
- Give the aircraft enough time to find the target. It can take more than 10 seconds to detect the target, especially if it is dirty or if the environmental conditions make finding the target difficult.
- If you are flying at night, set a visible LED mode (**Red**, **Nav**, or **Green**) for the propulsion arms to illuminate the target during landings. In the aircraft status label, tap . In the aircraft flight settings, set a visible LED Mode or set the **LED Mode for Vision Operations** drop-down list. During target landings, the LED lights turn on but flash off once per second while the aircraft searches for the target. After the aircraft acquires the target, the LEDs remain on until the aircraft lands.
- If you are flying at night, do not set the **LED Mode for Vision Operations** drop-down list to **IR**. This mode does not provide enough illumination for the target.
- After your flight, roll the landing target as tightly as possible before storing it. Do not fold it, since that can add waves and wrinkles to the target.

USING CURSOR ON TARGET

Cursor on Target (CoT) allows compatible devices to share position information and status updates.

With CoT, you can receive incoming messages so that nodes, points of interest (POIs), waypoints, or waypoint lists appear in MCS. You can also add nodes, POIs, waypoints, or waypoint lists to MCS and share them with other users that are connected to the same CoT server.

You can send and receive CoT messages over UDP or TCP.

Some CoT applications can create numerous waypoints in MCS. These additional waypoints can cause performance issues for MCS.

Configure CoT

You can configure the server settings and icon type for the CoT messages that you receive.

You can also configure the server settings for CoT messages that you send. After you configure these server settings, you can also set what flight planning elements you share with other users.

Outgoing CoT messages are not sent unless you are connected to a real aircraft. If you add a simulated aircraft, MCS does not send outgoing CoT messages.

Set the icon type for CoT nodes

You can set the icon type that should be used for any CoT nodes that you receive.

Setting the icon type only changes the icon for CoT nodes. The icons for any flight planning elements do not change from the standard ones used in MCS.

1. In the lower-left corner of the screen, tap .
2. Tap .
3. Tap .
4. On the **General** tab, in the **Icon Style** drop-down list, set the type of icons that you want to use for CoT nodes.

Configure what CoT flight planning elements to share

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **General** tab, in the **Share Flight Plan Elements** drop-down list, set whether you want to share all waypoints and POIs, only selected waypoints and POIs, or no waypoints and POIs.

If you change your settings from sharing all waypoints or POIs to sharing only selected waypoints or POIs, any waypoints or POIs that were previously created remain shared. The change applies only to new flight planning elements that you create. If you are sharing all waypoints or POIs or sharing only selected ones, and then change to sharing none, all flight planning elements are no longer shared.

Configure how long CoT messages are valid

You can configure how much time should pass after receiving a CoT message before the message is marked as invalid. You can customize the settings that you want to use, or you can use the default settings.

If you use the default settings, waypoint lists are marked as invalid after one month and a single waypoint or point of interest is marked as invalid after one year.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **General** tab, perform one of the following actions:
   - To customize the settings, in the **Select Stale Interval** drop-down list, select **Manual**. In the **Stale Interval** drop-down list, set the amount of time before a message is marked as invalid.
   - To use the default settings, in the **Select Stale Interval** drop-down list, select **Use Defaults**.

Configure settings for CoT messages over TCP

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. Tap the **TCP Settings** tab.
5. If necessary, change the **Server IP Address** and **Port** fields to point to the CoT server that you are receiving messages from.
6. Select the **Enable** check box.
7. To send aircraft telemetry over TCP, select the **Send Aircraft Telemetry** check box.

When you select the **Enable** check box, MCS attempts to establish a connection with the server until it is successful, or you clear the **Enable** check box. On the **TCP Settings** tab, the **Status** field shows the current state of the connection.

Configure settings for CoT messages over UDP

To send and receive CoT messages over UDP, you must configure settings for MCS and for the aircraft.

Configure MCS settings for CoT messages over UDP

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. Tap the **UDP Settings** tab.
5. To receive messages over UDP, perform the following actions:
    a. If necessary, change the **Server IP Address** and **Port** fields to point to the CoT server that you are receiving messages from.
    b. Select the **Enable Incoming Messages** check box.
6. To send messages over UDP, perform the following actions:

a. If necessary, change the **Server IP Address** and **Port** fields to point to the CoT server that you are sending messages to.

b. Select the **Enable Outgoing Messages** check box.

Configure aircraft settings for CoT messages over UDP

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. On the **Connection** tab, select the aircraft that you are configuring CoT messages for.
4. Tap  . The **Cursor on Target Configuration** dialog box appears.
5. If necessary, change the **Server Address** and **Port** fields to point to the CoT server that you are using to send CoT messages.
6. To send aircraft telemetry over UDP, select the **Publish Telemetry** check box.
7. Tap **Done**.

Use CoT

After configuring the settings for CoT, you are notified of any CoT nodes or flight planning elements that you receive. You can interact with these nodes and flight planning elements on the map.

In the CoT settings, you configure how long CoT messages remain valid. If the sender stops sharing CoT nodes and flight planning elements, any nodes and flight planning elements might remain on the map until that configured time interval passes.

If you are sharing only selected CoT flight planning elements, you can select which ones to broadcast.

Review CoT messages

When new nodes or flight planning elements are broadcast, they appear in MCS automatically. When messages are available,  appears at the bottom of the screen. If you have not read the messages, the icon is blue. When you open the **Messages** dialog box, the icon turns white.

If the number of CoT messages is less than ten, the number appears beside  . If there are more than ten unread messages, **10+** appears with the icon.

At the bottom of the screen, tap  .

In the **Messages** list, a message appears for every node or flight planning element received. Each message includes an icon that represents the CoT message type, an information label, and the date and time that the message was created.

✓ If you connect MCS to ELB and are broadcasting your flight, you are also notified of any viewer-designated markers (VDMs) that are added during the flight. They appear in the **Messages** list.

Show or hide CoT flight planning elements and nodes

By default, all flight planning elements and nodes appear in the **Messages** list and on the map. You can select the ones that you want to show.

1. At the bottom of the screen, tap  .
2. In the **Messages** list, perform one or more of the following actions:
   - To hide a flight planning element or node, beside the element or node, tap  .
   - To show a flight planning element or node, beside the element or node, tap  .
   - To hide all flight planning elements and nodes, at the bottom of the **Messages** list, tap  .
   - To show all flight planning elements and nodes, at the bottom of the **Messages** list, tap  .

✓ If you connect MCS to ELB and are broadcasting your flight, you can also show or hide any VDMs that appear in the **Messages** list.

Change the label of a CoT flight planning element or node

You can change the label for a CoT flight planning element or node. When you change the label, the change appears in the **Messages** list as well as on the map.

1. At the bottom of the screen, tap  .
2. In the **Messages** list, beside the flight planning element or node that you want to change, tap  .
3. In the **Edit** dialog box, type the new text for the label.

4. Tap **OK**.

After you change the label, in the **Messages** list, the original label appears on a second line below the first.

Move the map to the location of a flight planning element or node

1. At the bottom of the screen, tap .
2. In the **Messages** list, tap a notification.

The map centers on the flight planning element or node associated with the notification.

Share flight planning elements

If you configured CoT to share only selected waypoints or POIs, you select which ones you want to broadcast to other users.

If you change the location or height of one of the waypoints or POIs that you shared or configure a waypoint list as continuous, those changes are then shared. However, if you configure a waypoint or POI with loiter settings, set an action for a waypoint, or configure a waypoint with Autonomous Waypoint Mode, those features are not shared. If you configure a waypoint list with heights, the height information is not shared.

Share flight planning elements using the flight planning menu

1. In the lower-right corner of the screen, tap .
2. Tap .
3. Add a waypoint, waypoint list, or POI.
4. Select the waypoint or POI that you want to share.
5. Beside the waypoint or POI, tap .
6. On the **Edit** tab, select the **Share With COT** check box.

After you share the flight planning element with CoT, if the sharing is successful, a blue arrow appears in the lower-right corner of the icon:

Stop sharing flight planning elements using the flight planning menu

1. In the lower-right corner of the screen, tap .
2. Tap .
3. Select the waypoint or POI that you want to stop sharing.
4. Beside the waypoint or POI, tap .
5. On the **Edit** tab, clear the **Share With COT** check box.

Share flight planning elements quickly

1. In MCS, right-tap a waypoint or POI.
2. Tap .

After you share the flight planning element with CoT, if the sharing is successful, a blue arrow appears in the lower-right corner of the icon:

✓ To stop sharing the flight planning element, right-tap the waypoint or POI. Tap .

COMPLETING POSTFLIGHT PROCEDURES

After you land the aircraft, you must complete important postflight procedures, such as downloading flight logs, downloading pictures and videos, disassembling the system, charging the batteries, and performing scheduled maintenance.

If you are using ELB, upload your flight logs to your account after the flight. If you associated your flight with ELB during the takeoff process, when you connect to the internet, the software uploads the logs automatically. See "Connect the tablet to the internet" on page 45.

Download flight logs

By default, the system downloads flight logs to the tablet automatically after the aircraft lands. You must keep MCS open and the system turned on until downloading finishes.

When logs are available to download, 

appears at the bottom of the screen in place of the **Notifications** icon. The number in this indicator changes depending on how many logs are available to download.

While the system downloads the flight logs, the video stream is suspended temporarily to increase the download speed. After the system downloads the logs, the video stream resumes.

Although it doesn't take long to download a flight log for a flight, you can cancel this process at any time. The next time that the aircraft lands, the tablet attempts to download all available flight logs. Depending on the space available on the aircraft, if you do not download the flight logs, for each new flight, the aircraft deletes the oldest record permanently.

About notifications

After you install MCS, a notification icon appears in the Windows notification area. You can tap this icon to access status information about flight logs and configure how they are shared with Teledyne FLIR. If you use ELB, you can tap this icon to configure how logs are uploaded to ELB.

If you connect the tablet to the internet, this icon also provides information about software updates. For more information, see "About software update notifications" on page 337.

Icon	Description
	Notification icon
	Uploading logs

Icon	Description
	Waiting to upload logs
	Error uploading logs
	Not uploading logs. For more information on configuring this option, see "Configure how flight logs are sent to ELB" on page 349 or "Configure how flight logs are sent to Teledyne FLIR" on the next page.

Monitor the progress of log downloads

1. At the bottom of the screen, tap  .
2. In the **Notifications** dialog box, view the progress bar.

Cancel log downloads

1. At the bottom of the screen, tap  .
2. Beside the progress bar, tap  .

Turn off automatic downloading of flight logs

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. Tap the **Log Download** tab.
5. Clear the **Automatically download flight logs to MCS tablet after landing** check box.

Download flight logs manually

If you turn off automatic downloading of flight logs, you can download flight logs manually.

Perform one of the following actions:

- In the lower-left corner of the screen, tap  . Tap  . Tap  . If necessary, tap the

Log Download tab. Tap **Download now**.

- At the bottom of the screen, tap  . Tap  **Download Logs**.

If you have not taken off and you click **Download now** on the **Cloud Services** tab, the tablet downloads logs used for troubleshooting even though there are no flight logs.

Configure how flight logs are sent to Teledyne FLIR

When you installed MCS, if you agreed to share log information with Teledyne FLIR, logs are uploaded even if you do not use ELB. You can configure how the flight logs are sent.

If you choose to send flight logs to Teledyne FLIR, you must connect the tablet to the internet. For more information, see "Connect the tablet to the internet" on page 45.

1. In the Windows notification area, tap  .
2. Perform one or more of the following actions:
   - To send flight logs from the aircraft to Teledyne FLIR automatically (after the tablet is connected to the internet and after you open MCS), ensure that **Send Logs To FLIR** is selected.
   - To start the upload process when you turn on the tablet (after the tablet is connected to the internet but before you open MCS), ensure that **Open on Start-Up** is selected.

If you use ELB, you should upload your logs to ELB so that flights and equipment are tracked. For more information, see "Configure how flight logs are sent to ELB" on page 349.

Transfer flight logs to Teledyne FLIR manually

If you do not use ELB, you configured MCS to send flight logs to Teledyne FLIR, and you connected the tablet to the internet, the system should transfer flight logs automatically. If the flight logs are not transferred automatically, you can transfer them manually.

1. In the Windows notification area, tap  .
2. Tap **Send Logs Now**.

If the log upload is not successful, in the Windows notification area, tap  . Tap **Retry Log Upload**.

Download pictures and videos

During a flight, the aircraft captures pictures and videos and saves them to a memory card. See "Data locations" on page 377.

1. After a flight, remove the memory cards from the aircraft and, if applicable, the payload.
2. Insert the memory cards into a computer to access the pictures and videos.
3. Download the pictures and videos.

✓ If you download any pictures or videos during a flight, the tablet saves them in the default pictures and videos folder.

Charge the base station

After a flight, you should charge the base station battery. You do not need to turn on the base station to charge its battery.

1. Plug the base station power cord into the charger port on the end of the base station.

1. Base station
2. Charger port

2. To secure the connector in place, turn the silver connector on the cord clockwise.
3. Plug the power cord into a power outlet.

The base station's battery level appears on its LCD screen. The LCD screen also indicates that the battery is charging.

Charge the base station using the battery diverter

If necessary, you can use an aircraft battery and the battery diverter to charge the base station's battery.

A fully charged standard aircraft battery can charge the base station battery from empty to approximately 60%. To charge the base station fully from empty, use two standard aircraft batteries. You can also use one fully charged XL battery to charge the base station battery from empty.

1. Insert one end of the battery diverter cord into the charger port on the end of the base station.

2. Insert an aircraft battery into the battery diverter.
3. Twist the gray battery latch counterclockwise to lock the battery in place.
4. Insert the other end of the battery diverter cord into the port on the side of the battery diverter.

When the battery diverter is charging the base station, the LED on the battery diverter turns blue. The base station’s battery level appears on the base station's LCD screen. The LCD screen also indicates that the battery is charging.

While the diverter uses an aircraft battery to charge the base station, it also drains the battery to approximately 30%.

Charge the tablet

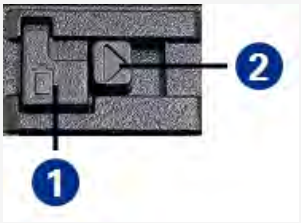
After a flight, you should charge the tablet to 100% if you are going to use it again soon.

1. Plug the tablet power cord into the charging port on the side of the tablet.
2. Plug the power cord into a power outlet.

Remove the tablet battery

Before storing the tablet for more than a week, remove the battery.

1. On the back of the tablet, beside the battery lock switch, push the battery lock up.



1 Battery lock

2 Battery lock switch

2. While sliding the battery lock switch to the right, pull the battery latch down to remove the battery.

Turn off the aircraft

On the aircraft, press and hold  until the progress bar appears. After the progress bar completes, the aircraft turns off.

Turn off the aircraft from MCS

You can use MCS to turn off the aircraft when the aircraft is on the ground.

You cannot use MCS to turn off the aircraft during a flight.

1. In the aircraft status label, tap .
2. In the **Vehicle Power** field, tap **Power Off**.
3. Tap **Yes**.

Disassemble the system

When you disassemble the system, remove the propulsion arms, payload, and legs from the aircraft and pack them into the mission case. You can leave the batteries in the aircraft, but do not leave them in the aircraft for an extended period of time.

If you do leave the batteries in the aircraft, do not lock them into place until you are going to fly.

Remove the propulsion arms

1. On the top of the propulsion arm, turn the lock counterclockwise.
2. Gently lift the propeller end of the propulsion arm and turn the latch counterclockwise.
3. Pull the arm down and out.

4. Repeat steps 1 to 3 for the other three propulsion arms.

Store the propulsion arms with the latch and the lock in the open position so that you can attach the arms quickly the next time that you fly the aircraft.

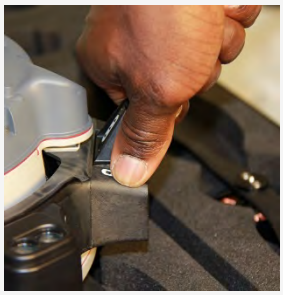
Remove the payload

1. Rest the aircraft body upside down (so that the batteries face down) on the top layer of the mission case.
2. Rotate the payload latches.

3. Remove the payload from the payload compartment.
4. If necessary, put the lens cap on the payload.
5. Insert the protector plate into the payload compartment.

Remove the legs

1. Firmly grasp the leg where it connects to the aircraft body, ensuring that the leg is on the opposite side of your arm and is facing away from you.
2. Position your thumb on the dots beside the leg receptacle.
3. Using your thumb as a lever, push down while pushing the leg away from you. You should feel the side of the leg closest to your thumb pop out.



4. Gently rock the leg side to side until it comes out of the leg receptacle.
5. If the leg is too difficult to remove, do not continue to exert more force. Perform the following actions:
    a. Reposition your thumb further out to gain more leverage.
    b. Repeat steps 1 to 4.
6. Repeat these steps for the other three legs.

Turn off the base station

1. On the base station, press  until the progress bar appears. After the progress bar

completes, the base station turns off.

2. Perform one of the following actions:

   - Fold down the antennas.

   - Remove the antennas from the base station.

Pack the system

1. Pack the propulsion arms and legs into the top layer of the mission case.
2. Remove the top layer of the mission case so that you can access the bottom layer.
3. On the tablet, perform the following actions:

   a. To close MCS, in the upper-right corner, tap **X**. Tap **OK**.

   b. To turn off the tablet, shut down Windows.

4. Store the tablet in the mission case.
5. Lifting the aircraft by the propulsion arm receptacles, pack the aircraft body into the mission case.

6. If you removed the base station antennas from the base station, pack the antennas in the mission case.
7. Pack the base station and payload in the mission case.

Perform maintenance

After a flight, review the maintenance checklist to determine what maintenance you should perform on the system. See "Scheduled maintenance checklist" on page 383.

UNDERSTANDING ERRORS AND WARNING MESSAGES

If the system encounters a problem, a sound plays, and an error or warning message appears on the tablet. If you are using a joystick, the joystick can vibrate when an error or warning occurs. Each error or warning has a unique identifier. Use this identifier when reporting any issues to Support.

There are six types of errors and warning messages:

Error types	Description	Identifier includes
Takeoff error	The aircraft detects these errors on takeoff.	T
Warning	These messages might appear during flight.	W
Non-fatal warning during flight	Non-fatal warnings are conditions that can pose danger to the aircraft. You should land the aircraft as soon as possible.	N
Fatal error during flight	Fatal errors during flight pose immediate danger to the aircraft. The aircraft starts an immediate emergency landing automatically.	F
Fatal error with recovery option	With these errors, you can cancel the emergency landing and fly the aircraft to a safe location to land.	R
Hardware error	The aircraft detects a problem with the hardware.	H

All errors or warnings also appear in the **Notifications** dialog box. See "Review notifications" on page 355.

✓ You can use the simulator to practice responding to the errors and warnings that appear in MCS. For more information, see "Simulate errors and warning messages" on page 319.

Detect warnings early

The system includes an early warning detection system that is always monitoring the aircraft. It warns you when situations arise, such as when a magnetic field compromises the compass, if the temperature of the batteries or payload rises to unsafe levels, or the communication link is weak.

If the system detects any issues, early warning detection indicators appear beside the compass rose. If the issue prompts any warnings or errors to appear, a notification also appears in the **Notifications** dialog box.

There are two types of warnings: early warnings and critical warnings.

- Early warnings appear in yellow and include ⚠. These warnings notify you when an issue first appears. If the issue persists, the indicator fills up. If the indicator gets close to filling up completely, appears in the indicator and a non-fatal warning appears on the screen. The aircraft performs the action that is set in the **Non-Fatal Condition Response** drop-down list in the aircraft flight settings.

- Critical indicators appear in red and include . If the issue persists, the indicator fills up. If the indicator gets close to filling up completely, a fatal error appears on the screen and the aircraft begins an emergency landing.

1. Early warning indicator (battery temperature)
2. Critical warning indicator (compass error)

The icon that appears in the indicator indicates the type of warning:

Icon	Description
	Compass error or magnetic interference
	Battery temperature
	Payload temperature high for advanced functions, such as target tracking
	Weak communications link or weak GPS connection
	Motor temperature

⚠

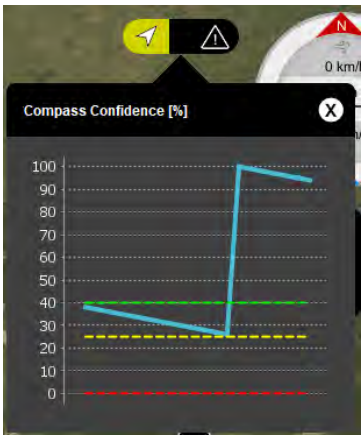
Stay aware of your surroundings at all times. Do not ignore the early warnings since they can lead to critical warnings and fatal errors. Ignoring the warnings increases the potential for an emergency landing in an unsuitable location, a sudden loss of control, a crash landing, personal injury, or damage to property.

View graphs for warnings and errors

If early or critical warnings appear, you can view graphs for them.

In the upper-right corner of the screen, beside the compass rose, tap the early or critical warning.

A graph for the warning appears.



Notes about warning graphs

- The title of the graph shows the units measured by the y-axis.
- The x-axis represents time.
- The thick, light blue line shows the current value.
- The green dashed line shows the acceptable value for the graph.
- The yellow dashed line shows the value where a non-fatal warning appears.
- The red dashed line shows the value where a fatal error appears.

Takeoff errors

When you attempt to take off, the system checks for any errors that can prevent takeoff. If the system finds a problem, an error message appears in the **Takeoff Not Possible** dialog box.

Message	Identifier	Possible cause	Possible solution
System initializing Wait while the system completes initialization.	T0	The aircraft is not ready for takeoff because the sensors are still initializing.	Wait for the system to finish initializing and try to take off again. If the problem persists, disassemble the aircraft, and clean all electrical contact points. Reassemble the aircraft and try to take off again.
Aircraft not level The aircraft is not sufficiently level for takeoff. Move the aircraft to a flat surface.	T1	The aircraft is not on a level surface.	Move the aircraft to a firm and level surface and try to take off again.
Height sensor warning Put the aircraft on a solid surface. If you are using GPS, ensure that the aircraft is in an area where it can receive a GPS signal. If the problem persists, contact Support.	T2	The sonar sensors are not detecting a ground surface. The error might appear if the aircraft is in long grass, on soft snow, or on other unstable surfaces.	Ensure that the sonar sensors are clear of any debris. Make sure that the aircraft is sitting on a firm and level surface. If the problem persists, contact Support.
Acquiring GPS lock Make sure the aircraft is in an area where it can receive GPS signal or configure GPS Denied Mode.	T3	The aircraft is not ready for takeoff because it is still acquiring a GPS lock.	Ensure that the aircraft has a clear view of the sky. Wait for it to acquire a GPS lock and try to take off again. If a GPS signal is not available, configure GPS Denied Mode. For more information, see "Fly in GPS-Denied environments" on page 300.
Battery low Replace with a	T4	The battery power level of one or more batteries in the	Remove the batteries from the aircraft and replace with fully

Message	Identifier	Possible cause	Possible solution
charged battery.		aircraft is low.	charged batteries.
Aircraft control off Take control of the aircraft before attempting to take off.	T5	You can't take off because there is a communications problem.	Ensure that you have reliable, clear communications and try to take off again.
Compass error Check that the aircraft compass calibration is acceptable or move the aircraft away from metal objects.	T6	If you are in automatic initialization mode, this message appears if a local magnetic field is interfering with the aircraft's compass or the compass needs recalibration.	If you are using automatic initialization mode, enable manual takeoff initialization mode and try to take off again. If the error still appears, if possible, move the aircraft away from any metal objects and try to take off again. If the problem persists, verify or recalibrate the compass. See "Calibrate the compass manually" on page 360.
Compass error Move the aircraft away from metal objects and ensure aircraft heading is constant during initialization.	T6	If you are in manual initialization mode, this message appears if a local magnetic field is interfering with the aircraft's compass or the compass needs recalibration.	If possible, move the aircraft away from metal objects and try to take off again. If the problem persists, recalibrate the compass. See "Calibrate the compass manually" on page 360.
Compass error Horizontal component of magnetic field strength is too weak to calculate heading. Compass reading can be degraded when operating near the	T6	If you are using the aircraft near the magnetic North or South pole, the aircraft cannot calculate an accurate heading.	If this error appears when you are using the aircraft near the magnetic North or South pole, takeoff is not possible.

Message	Identifier	Possible cause	Possible solution
magnetic North and South poles.			
Not ready for spin-up Try to spin up again. If the problem persists, restart the aircraft.	T7	The aircraft's propulsion arms are not able to spin up.	Attempt to spin up again. If the problem persists, turn off the aircraft. Remove and reattach the propulsion arms and restart the aircraft. If the problem continues after restarting, contact Support.
Invalid flight settings Ensure valid flight settings and behaviors are set. If the problem persists, contact Support.	T8	One or more flight settings or behaviors are invalid for takeoff.	Check your flight settings and behaviors. If the problem persists, contact Support.
Aircraft calibration error The aircraft appears to be calibrated incorrectly. Contact Support.	T9	The aircraft is not calibrated correctly.	Contact Support.
Battery performance error Switch batteries and contact Support.	T10	The aircraft detected a performance problem in one of the batteries currently installed in the aircraft.	Remove the batteries from the aircraft and replace them with fully charged batteries. Try to take off again. For assistance with the problem battery, contact Support.
Flight time estimate error The aircraft cannot estimate flight time accurately. Contact	T11	The aircraft cannot estimate the flight time accurately.	Contact Support.

Message	Identifier	Possible cause	Possible solution
Support.			
Battery too cold for flight One or more batteries are too cold for flight. Warm up the batteries.	T12	The battery temperature is too low for takeoff and flight.	Always store batteries at room temperature and install them when they are at room temperature.
Battery too warm for flight One or more batteries are too warm for flight. Cool the batteries.	T13	The battery temperature is too high for takeoff and flight.	Cool down the batteries and try to take off again.
Aircraft core too cold for flight Warm up the aircraft before takeoff.	T14	The aircraft's core temperature is too low for takeoff and flight.	Take the aircraft to a warmer environment to warm it up slowly. Then, try to take off again. If the warning reappears, continue to warm the aircraft.
Aircraft core too warm for flight Cool down the aircraft before takeoff.	T15	The aircraft's core temperature is too high for takeoff and flight.	Take the aircraft to a cooler environment to cool it down slowly. Then, try to take off again. If the warning reappears, continue to cool the aircraft.
Motor spin-up fault A motor spin-up fault has been detected. Check arms and restart the aircraft.	T17	The aircraft detected an error when spinning up the motors.	Cancel the spin-up and restart the aircraft. Try to take off again.
Peripheral firmware Invalid firmware. Update the aircraft's software. If the problem persists, contact	T19	The firmware on the aircraft might be out of date. Sometimes, this error appears if you move through the preflight checks too quickly.	Try to take off again, allowing more time for the aircraft to initialize all arms, legs, and batteries. If the error appears again, update the aircraft software. See "Update the

Message	Identifier	Possible cause	Possible solution
Support.			system" on page 338. Ensure that all arms, legs, and batteries have the latest software. See "Update the components individually" on page 339. To ensure that each component updates correctly, try reattaching the arms and legs and reinserting the batteries. If the problem persists, contact Support.
Peripheral missing Check that all aircraft parts are installed correctly. If the problem persists, contact Support.	T20	The aircraft can't take off because a part is missing or installed incorrectly. Sometimes, this error appears if you move through the preflight checks too quickly.	Check that all parts are installed correctly and try to take off again, allowing more time for the aircraft to initialize all arms, legs, and batteries. If the problem persists, contact Support.
Peripheral configuration Restart the aircraft and try to spin up again. If the problem persists, contact Support.	T21	The aircraft can detect that a part is connected, but the aircraft can't configure or prepare the part for flight. Sometimes, this error appears if you move through the preflight checks too quickly. The error might also appear if a new hardware configuration is connected to an aircraft with older software.	Try to take off again, allowing more time for the aircraft to initialize all arms, legs, and batteries. If the error appears again, restart the aircraft, and attempt to spin up again. If you attached a new hardware configuration, update the software on the aircraft. If the problem persists, contact Support.
Battery: Fault No power from one	T22	One or more of the batteries is not providing	Check the battery level for each battery. Replace any batteries

Message	Identifier	Possible cause	Possible solution
or more batteries. Replace the affected battery.		power.	that are low on power. When you fly the aircraft, all batteries should be at an equal level.
Wiring fault Internal wiring fault detected. Do not continue with flight. Contact Support.	T23	There is a problem with the internal wiring on the aircraft.	Contact Support.
Arm missing Missing arm detected. Ensure that the arms are connected, latched, and locked.	T25	The aircraft cannot detect that all propulsion arms are connected.	Make sure that you have closed both the latch and the lock on each propulsion arm. See "Attach the propulsion arms" on page 26.
Leg missing Missing leg detected. Ensure that the legs are connected.	T26	The aircraft cannot detect that all legs are connected.	Make sure that you have fully inserted each leg into its receptacle. See "Attach the legs" on page 26.
Battery: Missing Missing battery detected. Ensure that all batteries are inserted correctly.	T27	The aircraft cannot detect all the batteries.	Make sure that you have properly inserted the batteries into the aircraft. See "Change the aircraft batteries" on page 79.
Battery: Charge imbalance The voltage difference between the batteries is too large. Charge or replace the batteries.	T28	The batteries in the aircraft do not have the same power charge level.	Remove the batteries from the aircraft. Insert new batteries or charge the batteries before flying the aircraft. See "Change the aircraft batteries" on page 79.
Battery: Charge imbalance The battery voltage is not enough to	T28	The batteries are not providing enough power to turn on tether power safely.	Remove the batteries from the aircraft. Insert new batteries or charge the batteries before flying the aircraft. See "Change

Message	Identifier	Possible cause	Possible solution
turn on tether power safely. Charge or replace the batteries.			the aircraft batteries" on page 79.
Tether power failure Tether power not detected. Check the tether connections and power source.	T29	The micro-tether is not providing power to the aircraft.	Turn off the power for the tether ground station. Check that all connections are secure and verify that the power source for the tether ground station is turned on. Turn on the power for the tether ground station and try to take off again. If the problem persists, contact Support.
Peripheral mismatch The combination of peripherals is not allowed.	T30	The aircraft cannot fly with the current configuration.	Ensure that all parts are compatible and that the current configuration is not too heavy. Try to take off again. If the problem persists, contact Support.

Message	Identifier	Possible cause	Possible solution
Remote ID failure Remote ID is not available.	T31	Remote ID is required, but not available, for the aircraft.	Ensure that you have configured your Remote ID settings correctly. For more information, see "Configure Remote ID settings before takeoff" on page 343. Restart the aircraft. If the problem persists, contact Support.
Invalid arms for SafeRoutes Incoming and outgoing SafeRoutes cannot be used with the attached arms.	T32	You cannot use incoming and outgoing SafeRoutes with the arms that are currently attached to the aircraft.	If you want to use an outgoing or incoming SafeRoute, attach HL-LE arms to the aircraft. If you do not have HL-LE arms, turn off the outgoing and incoming SafeRoutes.

Warnings during flight

If a warning appears, a dialog box appears below the aircraft icon. The dialog box disappears after 10 seconds unless it indicates a permanent state. If the aircraft is returning home or landing when a warning appears, the warning also appears in the **Aircraft Going Home** or **Land** dialog box.

In many cases, you can continue flying if a warning appears.

To clear the warning quickly, tap the warning dialog box. The warning is cleared and the **Notifications** dialog box appears.

Message	Identifier	Possible cause	Possible solution
Excessive vibration detected Abort mission and land as soon as possible. Contact Support.	W1	The aircraft detected excessive vibration during flight.	Land the aircraft. Contact Support.
Battery: Excessive power draw Abort mission and land as soon as possible. Contact Support.	W2	The battery is drawing more power than expected. The warning can occur if you are flying the aircraft at a high speed in high winds.	To view more information about the batteries, in the warning dialog box, tap . If you are flying in high winds, reduce the aircraft's speed. If you are flying into the wind, do not increase the aircraft's height while the aircraft is moving. Land the aircraft. Contact Support.
Yaw control: Arm alignment error Abort mission and land as soon as possible. Inspect arms and propellers.	W3	There is an issue with the arm alignment.	Land the aircraft. Contact Support.
High core body temperature Land when practical. Allow the aircraft to cool before next flight.	W4	The aircraft detected a high core temperature.	Allow the aircraft to cool before flying it again.
Temporary loss of yaw control Cannot hold yaw temporarily. Consider reducing speed.	W7	The aircraft cannot hold yaw temporarily.	If possible, reduce your maximum speed.

Message	Identifier	Possible cause	Possible solution
Spun too many times with tether The aircraft cannot spin anymore in this direction. Unwind to release the twist on the tether.	W11	The aircraft cannot spin in this direction any longer.	Unwind the micro-tether. For more information, see the *Tether Kit Operating Manual*. To view the tether ground station information, in the warning dialog box, tap .
Spinning the aircraft to unwind tether The aircraft is spinning automatically to unwind the tether completely before landing.	W12	Before the aircraft lands, it is spinning to unwind the micro-tether completely.	Wait for the micro-tether to unwind before landing the aircraft. To view the tether ground station information, in the warning dialog box, tap .
Tether might be stuck Tether might be stuck. Inspect the tether cables.	W13	The micro-tether might be stuck in the tether ground station.	Reduce the aircraft's height. If you are using the Tether Kit with a Block 2 aircraft, turn the tether ground station Power switch to off (O). Check the tether ground station and, if necessary, free the micro-tether. When the cable is free, set the Power switch to on (—). To view the tether ground station information, in the warning dialog box, tap .
Ground sensor fault Ground sensors are off for the remainder of the flight. Use caution when landing.	W14	The laser altimeter or sonar module is not reading the ground correctly.	Use caution when landing the aircraft. If the problem persists during subsequent flights, contact Support.

Message	Identifier	Possible cause	Possible solution
Tether has reached maximum power limit Tether power limit reached. Descend to lower altitude or the system might eventually land.	W15	Although the micro-tether has reached its maximum power limit, it is not enough for what the aircraft currently needs.	Descend and continue to fly. To view the tether ground station information, in the warning dialog box, tap .
Tether failed to reconnect Power failure between aircraft and tether ground station. Inspect tether components and connections.	W16	Power from the tether ground station was lost then returned, but the power could not be reconnected to the aircraft.	Land the aircraft. Turn off the power for the tether ground station. Examine the batteries and all connections. Before takeoff, check the battery power levels and ensure that at least four LED lights appear. If not, replace the batteries. To view the tether ground station information, in the warning dialog box, tap .
Network timeout A network issue resulted in a communication timeout. Reposition the antennas or increase the aircraft's height.	W17	There is a communications problem between the aircraft and the base station.	Try to improve the connection between the aircraft and base station by repositioning the base station's antennas or increasing the aircraft's height. If the wireless signal strength does not improve, a communications warning appears, and the aircraft performs the action set in the **Non-Fatal Condition Response** drop-down list in the aircraft flight settings.

Message	Identifier	Possible cause	Possible solution
Network/control error Navigation control was released. Take control of the aircraft.	W17	The aircraft cannot be detected so MCS does not currently have control of the aircraft.	To take control of the aircraft, tap the aircraft icon.
Network delay Network is causing delays to aircraft commands. Use waypoints to ensure reliable movement.	W18	Due to network issues, there are delays with the commands sent from MCS to the aircraft.	To fly to a location, use waypoints instead of controlling the aircraft's speed and direction manually.
Poor landing target tracking Ensure that the landing target is visible, unobstructed, or consider reducing speed.	W19	The aircraft has detected the target, but the landing is delayed.	Ensure that the target is not obstructed. If the target is moving, reduce the speed of the target. If you are flying in windy conditions, try landing when the winds are lower.
Position control problem The aircraft is having difficulty maintaining position. Reduce the aircraft's speed or height or increase the distance to any nearby obstacles.	W20	The aircraft is having difficulty maintaining its current position.	If you are flying the aircraft when the warning appears, reduce the aircraft’s speed. If the problem persists, return home, and land the aircraft.
Tether power imbalance Tether is supplying imbalanced power to the aircraft. The aircraft will land	W21	More power is being supplied by one of the batteries compared to the others.	This warning appears when the imbalance is above 40%. It is still safe to fly as is. If the imbalance increases to an unsafe level, an error message

Message	Identifier	Possible cause	Possible solution
automatically if this imbalance worsens.			appears. If this problem persists on subsequent flights, contact Support. To view the tether ground station information, in the warning dialog box, tap .
Redundant GPS sources unavailable Only one GPS source is functional or able to provide a good lock for position control.	W22	If the system needs to switch GPS sources, no sources are available.	Monitor the system's GPS connection closely during the flight. In the warning dialog box, tap . If this problem persists on subsequent flights, contact Support.
Target landing visibility is poor The aircraft cannot locate the landing target. Move the aircraft closer to the landing target and try again.	W23	The landing target is not visible to the aircraft so it cannot acquire the target.	Reduce the aircraft's height to bring it closer to the target. Try landing again.
Landing target too tilted The landing target is too tilted to land safely. Cancel landing and resume after the tilt angle is reduced.	W24	The target is placed on an angle that is greater than the maximum allowed.	Cancel the landing and reposition the target to reduce its angle. Try landing again.
Motor temperature is high One of the motors is getting hot. For continued flight,	W28	The motors are getting too hot when flying with the tether.	Reduce the aircraft's height.

Message	Identifier	Possible cause	Possible solution
reduce the aircraft's height.			
Tether power failure The aircraft is not receiving tether power. Attempt to reconnect power to the tether ground station.	W29	The micro-tether is not providing power to the aircraft.	This warning appears when you are using auto-height management to control the aircraft's height and the aircraft detects that power is not available from the micro-tether. Ensure that the micro-tether power source is providing power and that the connectors are secure. To view the tether ground station information, in the warning dialog box, tap .
Obstacle detected Take proper action to avoid a collision.	W30	With collision avoidance on, the aircraft detected an obstacle. (You must have a specific hardware configuration to use the collision avoidance feature.)	Fly the aircraft away from the obstacle.
Waypoint skipped Aircraft skipped a waypoint that is beyond its Maximum Range or Maximum Height.	W31	A waypoint in the current waypoint list is beyond the aircraft's Maximum Range or has a height beyond the aircraft's Maximum Height. The aircraft does not fly to that waypoint.	Change the location or height of the waypoint.
Destination is beyond Maximum Range Incoming or outgoing SafeRoute	W32	A waypoint in the incoming or outgoing SafeRoute is beyond the aircraft's Maximum Range. The aircraft does not fly the	Change the location of the waypoint in the incoming or outgoing SafeRoute.

Message	Identifier	Possible cause	Possible solution
is beyond Maximum Range.		incoming or outgoing SafeRoute.	
Destination is beyond Maximum Height Incoming or outgoing SafeRoute is beyond Maximum Height.	W33	A waypoint in the incoming or outgoing SafeRoute is beyond the aircraft's Maximum Height. The aircraft does not fly the incoming or outgoing SafeRoute.	Change the height for the waypoint in the incoming or outgoing SafeRoute.
Auxiliary power output problem Auxiliary power overcurrent occurred. The aircraft is trying again.	W34	An attached accessory is drawing too much power from the aircraft. This warning can appear if a temporary surge in power draw exceeds the limit.	The aircraft tries to resolve the power problem so that it can continue to use the attached accessory.
Auxiliary power output failed Auxiliary power overcurrent occurred and could not be recovered. Auxiliary power off.	W35	An attached accessory is drawing too much power and the aircraft cannot recover from that state. Auxiliary power remains off.	The aircraft cannot continue to use the attached accessory. When practical, land the aircraft. Remove the accessory and restart the aircraft.

Non-fatal warnings during flight

If a non-fatal warning appears during a flight, the problem can pose danger to the aircraft. You should land the aircraft as soon as possible.

When a non-fatal warning appears, the aircraft shadow turns yellow, and a dialog box appears below the aircraft icon. On the left side of the dialog box, the warning appears:

Non-fatal warning

On the right side of the dialog box, a progress bar appears. If you do not select an option within 10 seconds, the aircraft automatically performs the action that you configured in the **Non-Fatal Condition Response** drop-down list in the aircraft flight settings. For more information on changing this option, see "Check flight settings and behaviors" on page 54.

If your **Non-Fatal Condition Response** is set to **Home and Land** or **Home and Hover**, the aircraft starts to return to its home position automatically. When the aircraft is returning home, you cannot control its direction. To control the aircraft's direction again, cancel the return to home action first.

If you are landing the aircraft when a non-fatal warning occurs, the aircraft cancels the landing if your **Non-Fatal Condition Response** is set to **Home and Hover** or **Hover in Place**. If you are landing on a target, the aircraft does not cancel the landing if it acquired the target before the non-fatal warning occurred. For more information, see "Using target landing" on page 223.

Up to three non-fatal warnings can appear at once.

Multiple non-fatal warnings

If the aircraft is returning home or landing when a non-fatal warning appears, the non-fatal warning also appears in the **Aircraft Going Home** or **Land** dialog box. In these dialog boxes, the non-fatal warning has a yellow background.

If you ignore a non-fatal warning, it does not appear on the screen again. So, if you decide to continue flying, monitor the problem closely and take the appropriate action before the warning progresses to a fatal warning. Most warnings should not be ignored. You should land the aircraft as soon as possible.

Message	Identifier	Possible cause	Possible solution
Low battery Return home now to land with the configured battery margin.	N0	The charge level in a battery is too low to continue the flight. This error appears when the battery level approaches the amount needed to return home and land under the current flight conditions.	Return home immediately to land the aircraft with the user-configured battery margin.
Poor GPS signal GPS signal might not be strong enough to hold position. Ensure visual navigation is available or use GPS Denied Mode.	N1	The GPS signal is not strong enough for the flight. If you fly with a poor GPS signal, you can compromise the aircraft's position and flight behavior.	Use visual navigation mode or GPS Denied Mode. For more information, see "Flying under special circumstances" on page 294.
Battery: Cell imbalance Abort mission and land as soon as possible. Replace the battery.	N3	One of the batteries has an internal resistance problem and the flight time estimate might be inaccurate.	Return home and land the aircraft as soon as possible. If the problem persists during subsequent flights, contact Support.
Flight time estimation error Abort mission and land as soon as possible. The aircraft cannot estimate flight time accurately. Replace faulty batteries.	N4	The aircraft can't estimate the flight time accurately. This error might also appear when the aircraft is drawing a large amount of power from the batteries, such as when flying in high winds.	Return home and land the aircraft as soon as possible. Replace the battery. If flying in windy conditions, return home, land the aircraft, and wait for the winds to lower. For more information, see "Flying in windy conditions" on page 10.
Motor performance problem Abort mission and land as soon as	N5	The aircraft detected a motor performance problem.	Return home and land the aircraft as soon as possible. Isolate the arms used in this flight and do not fly with them

Message	Identifier	Possible cause	Possible solution
possible. Do not continue flying with these arms. Contact Support.			again. Contact Support as soon as possible.
Unable to estimate altitude accurately Altitude control might not be accurate due to turbulence. Reset the aircraft when practical.	N7	There is a problem with the pressure sensor. Due to turbulence, the aircraft might not be able to control its height.	Return home and land the aircraft when practical. Restart the aircraft. If the problem persists, contact Support.
Unable to estimate altitude accurately Altitude control might not be accurate due to turbulence. Reset the aircraft when practical.	N8	Due to turbulence, the aircraft might not be able to control its height.	Return home and land the aircraft when practical. Restart the aircraft. If the problem persists, contact Support.
Battery: High temperature Abort mission and land as soon as possible. Batteries are too warm for prolonged mission. Replace batteries.	N9	A battery is too warm to continue flying.	Return home and land the aircraft as soon as possible. Remove the batteries from the aircraft.
Strong winds Winds are approaching limit for safe flight. Monitor and reduce height if safe to do so.	N10	The winds are too strong to fly safely. Typically, this error appears when the aircraft experiences winds at or above 40 km/h / 25 mph.	If it is safe to do so, reduce the aircraft's height. If the problem persists or you cannot reduce the height, return home and land the aircraft.
Compass bias	N11	There is an error with the flight control optimization.	During flight, initiate flight

Message	Identifier	Possible cause	Possible solution
problem Move takeoff location away from magnetic objects or optimize flight control manually.		This error can be caused by magnetic interference.	control optimization manually. For more information, see "Initiate flight control optimization manually" on page 306.
Poor heading The aircraft is having difficulty maintaining its heading. If using GPS, accelerate the aircraft until the warning clears.	N12	The aircraft is having difficulty maintaining its current heading.	If it is safe to do so, increase the aircraft's speed until the warning clears. If the problem persists, return home, and land the aircraft. Contact Support.
Very low battery Abort mission and land as soon as possible.	N13	The battery level in one or more of the batteries is too low to continue flying. There is only enough time left to return home and land the aircraft. It does not include the battery margin defined in the aircraft flight settings.	Return home and land the aircraft as soon as possible. Replace the batteries.
Compass sensor fault Abort mission and land as soon as possible. Contact Support.	N14	There is a problem with a compass sensor.	Return home and land the aircraft as soon as possible. Contact Support.
Battery: Fault Abort mission and land as soon as possible. One or more batteries has stopped providing power. Replace batteries.	N15	One of the batteries does not have power.	Return home and land the aircraft as soon as possible. Check the battery level for each battery. Replace the battery that is low on power. When you fly the aircraft, all batteries should be at an equal level.

Message	Identifier	Possible cause	Possible solution
Wiring fault Abort mission and land as soon as possible. Do not continue to fly. Contact Support.	N16	There is a problem with the internal wiring on the aircraft.	Return home and land the aircraft as soon as possible. Do not continue to fly. Contact Support as soon as possible.
Peripheral reset Abort mission and land as soon as possible. Unexpected peripheral reset detected. Contact Support.	N17	A part (such as a propulsion arm, leg, or payload) reset during the flight.	Return home and land the aircraft as soon as possible. Contact Support.
System is too heavy Land when practical. Attach Heavy Lift - Long Endurance arms or reduce the system's weight.	N18	There is too much weight for the aircraft to fly safely.	Return home and land the aircraft when practical. Reduce the weight that the aircraft is carrying. If possible, use propulsion arms that support more weight, such as the HL-LE V2 arms.
Peripheral missing Abort mission and land as soon as possible. An aircraft component has stopped responding. Contact Support.	N19	The aircraft can no longer detect a part.	Return home and land the aircraft as soon as possible. Check that all parts are installed correctly. If the problem persists during subsequent flights, contact Support.
Battery: Charge imbalance Abort mission and land as soon as possible. The voltage difference between batteries	N20	The batteries in the aircraft do not have the same power charge level.	Return home and land the aircraft as soon as possible. Remove the batteries from the aircraft. Insert different batteries or charge the batteries. See "Change the aircraft batteries"

Message	Identifier	Possible cause	Possible solution
is too large or voltage is not enough to continue safely with tether power. Replace batteries with fully charged ones.			on page 79 or "Charge the aircraft batteries" on page 23.
Motors too warm for flight Abort mission and land as soon as possible. Wait for the motors to cool.	N21	The motors are too warm to continue flying.	Return home and land the aircraft as soon as possible. Allow the aircraft to cool before flying it again.
Arm reset Abort mission and land as soon as possible. Contact Support.	N22	A propulsion arm has reset during the flight.	Return home and land the aircraft as soon as possible. Remove the propulsion arms and attach them again. If the problem persists during subsequent flights, contact Support.
Arm not responding Abort mission and land as soon as possible. Contact Support.	N23	A propulsion arm has stopped responding.	Return home and land the aircraft as soon as possible. Remove the propulsion arms and attach them again. If the problem persists during subsequent flights, contact Support.
Battery: Reset Abort mission and land as soon as possible. Remove and reinsert the batteries. If the problem persists, contact Support.	N24	A battery has reset during the flight.	Return home and land the aircraft as soon as possible. Remove the batteries and insert them again. If the problem persists during subsequent flights, contact Support.

Message	Identifier	Possible cause	Possible solution
Battery: Not responding Abort mission and land as soon as possible. Remove and reinsert the batteries. If the problem persists, contact Support.	N25	A battery has stopped responding or the aircraft is not detecting it.	Return home and land the aircraft as soon as possible. Remove the batteries and insert them again. If the problem persists during subsequent flights, contact Support.
Leg not responding Abort mission and land as soon as possible. Remove the legs and reattach them.	N27	A leg has stopped responding during the flight.	Return home and land the aircraft as soon as possible. Remove the legs and attach them again. If the problem persists during subsequent flights, contact Support.
Tether power failure The tether is not providing power. Check tether ground station connections or land when practical.	N28	The micro-tether is not providing power to the aircraft. If power is restored before the aircraft uses all the battery power, the aircraft resumes the flight. If power is not restored before the aircraft uses all the battery power, the aircraft lands.	Ensure that the micro-tether power source is providing power and that the connectors are secure. Before takeoff, check the battery power levels and ensure that four lights appear. If not, replace the batteries. If necessary, contact Support.
Flight control optimization canceled Flight control optimization canceled. Land and allow it to complete on the next flight.	N29	There was a system fault, or the aircraft did not have enough time to complete the flight control optimization.	Initiate flight control optimization manually. For more information, see "Initiate flight control optimization manually" on page 306. If the problem persists during the flight, land the aircraft as soon as possible. At the start of

Message	Identifier	Possible cause	Possible solution
			the next flight, allow the flight control optimization to complete fully. If the problem persists during subsequent flights, contact Support.
Bad GPS source GPS not available. Ensure visual navigation mode is available or use GPS Denied Mode.	N30	The aircraft's primary GPS navigation source has malfunctioned, and the aircraft switched to a secondary source.	Use visual navigation or GPS Denied Mode. For more information, see "Flying under special circumstances" on page 294. If the problem persists, contact Support.
Arm voltage drop Abort mission and land as soon as possible. Arm voltage drop has been detected. Contact Support.	N31	The voltage level for one of the arms unexpectedly dropped below the acceptable limits.	Return home and land the aircraft as soon as possible. Contact Support.

Fatal errors during flight

If the aircraft encounters a fatal error, a red warning message appears, and the aircraft automatically starts an immediate emergency landing.

During an emergency landing, the aircraft lands immediately. The location might not be suitable, and injury, a crash, or damages can occur. During the emergency landing, point the camera payload straight down or, if you are using a non-camera payload, such as the Osprey payload, switch to the navigation cameras. Guide the aircraft to a safe location to land the aircraft. Given the serious nature of a fatal error, however, you should limit the amount of horizontal movement as much as possible. The aircraft does not pause, but continues to descend, even if you do move it horizontally.

Message	Identifier	Possible cause	Result
Cannot maintain position Emergency landing in progress. Guide the aircraft to a safe landing location and contact Support.	F1	The aircraft cannot control its position, possibly because of a sensor failure.	The aircraft lands immediately.
Battery is too low to continue flying Emergency landing in progress. Guide the aircraft to a safe landing location.	F2	The aircraft only has enough battery to return to its takeoff height, with zero battery margin.	The aircraft lands immediately.
Cannot maintain orientation Emergency landing in progress. Guide the aircraft to a safe landing location and contact Support.	F3	The aircraft can't maintain the correct orientation during flight.	The aircraft lands immediately. Contact Support.
Battery overheating Emergency landing in progress. Guide the aircraft to a safe landing location. Cool or replace the battery before the next flight.	F4	The battery temperature is not within a safe range for flight.	The aircraft lands immediately. Replace the battery and start your flight again.
Cannot estimate altitude Emergency landing in progress. Guide the aircraft to a safe landing location and contact	F6	The aircraft can't estimate its altitude accurately.	The aircraft lands immediately. Contact Support.

Message	Identifier	Possible cause	Result
Support.			
Motor performance problem Emergency landing in progress. Guide the aircraft to a safe landing location and contact Support.	F7	One or more motors failed.	The aircraft lands immediately. Contact Support.
Flight control optimization failed Emergency landing in progress. Guide the aircraft to a safe landing location and contact Support.	F9	The aircraft can't optimize flight control.	The aircraft lands immediately. After the aircraft lands, calibrate the compass. See "Calibrate the compass manually" on page 360. Then, attempt to take off again. During the takeoff process, increase the **Takeoff Height**. If the problem persists, contact Support.
Heading failure Emergency landing in progress. Guide the aircraft to a safe landing location and contact Support.	F11	The aircraft is having difficulty maintaining its heading.	The aircraft lands immediately. Contact Support.
Battery: Fault Multiple batteries have stopped providing power. Emergency landing in progress. Guide the aircraft to a safe landing location and replace batteries.	F12	Multiple batteries do not have power.	The aircraft lands immediately. Check the battery level for each battery. Replace any batteries that are low on power. When you fly the aircraft, all batteries should be at an equal level.

Message	Identifier	Possible cause	Result
Motors overheated Emergency landing in progress. Guide the aircraft to a safe landing location. Allow motors to cool before next flight.	F13	The motors are too warm to continue with the flight.	The aircraft lands immediately. Allow it to cool before flying again.
Battery: Too cold Battery temperature is too cold for safe flight. Raise battery temperature and resume flight.	F14	The battery is too cold to continue with the flight.	The aircraft lands immediately. Allow the battery to warm up to above -10°C / 14°F before flying again.
Ground sensor fault during takeoff Ground sensor fault detected during takeoff. Guide the aircraft to a safe landing location and contact Support.	F15	There was a problem with the ground sensors during takeoff.	The aircraft lands immediately. Contact Support.
GPS lock lost Emergency landing in progress. Do not cancel landing unless trained to fly without GPS navigation.	R0	The aircraft lost its GPS lock.	The aircraft lands immediately. If you were trained by Teledyne FLIR or an authorized training partner on flying without GPS navigation, you can cancel the emergency landing and fly the aircraft to a safe landing location. For more information, see "Fly in recovery mode" on page 306.

Hardware errors

If the aircraft detects any type of hardware error, it does not take off or fly. Hardware errors are rare but can include issues with the hardware for the accelerometer, sensors, GPS, or memory.

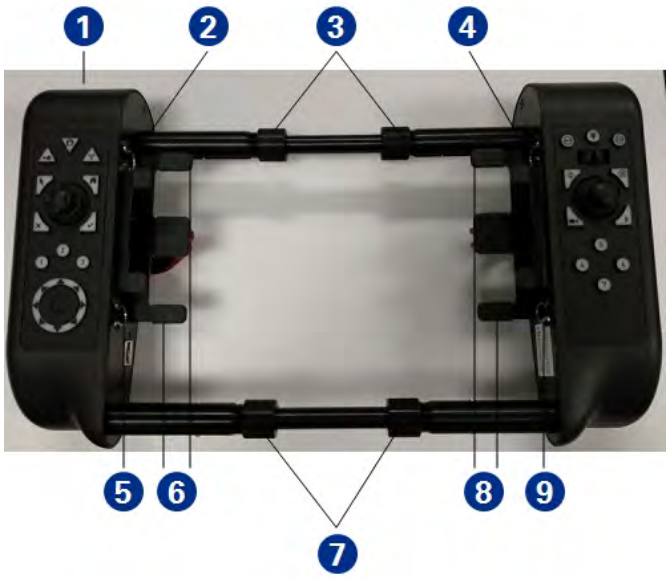
If you encounter any hardware errors, contact Support.

USING THE JOYSTICK

The joystick is an add-on accessory that attaches securely to your tablet and gives you more precise control when flying manually. Designed to be all-weather and rugged, the joystick matches the weather handling of the tablet and can be used in almost all conditions. It supports multiple control modes, including First Person View, RCMode 1, and RCMode 2.

By default, the joystick vibrates when any errors or warnings appear in MCS, even if you turned off sound.

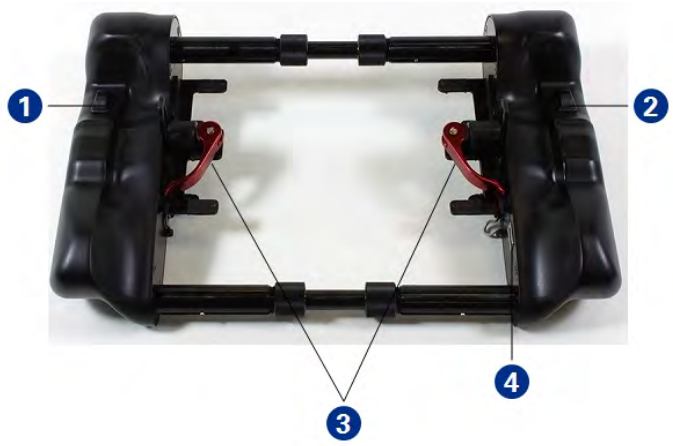
Flying the aircraft with the joystick can be dangerous if you are not familiar with its use. You should review all available documentation from Teledyne FLIR. Practice any non-standard procedures in a controlled environment first.



1. External USB port
2. D-ring
3. Twist locks
4. D-rings
5. D-rings
6. Mounting brackets
7. Twist locks
8. Mounting brackets
9. D-ring

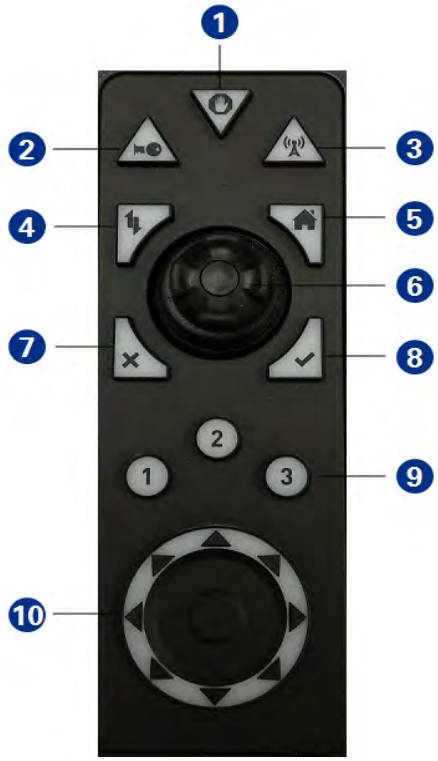
Front of the joystick

Use the D-rings to attach a harness to the joystick.



1. Right trigger
2. Left trigger
3. Mounting bracket clamps
4. USB port

Back of the joystick

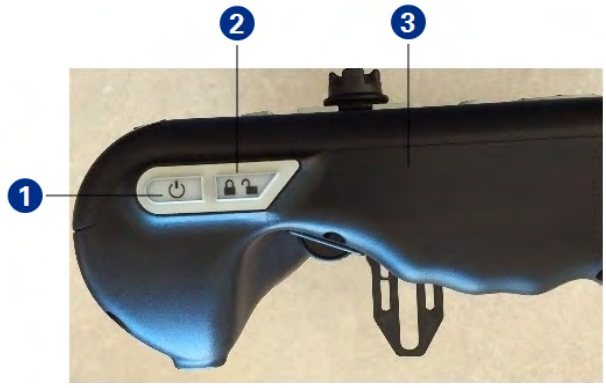


1. Stop the motors
2. Take control
3. GPS Assist
4. Take off and land
5. Return home
6. Joystick
7. Cancel
8. Accept
9. Customizable buttons
10. Navigation pad

Buttons on left joystick handle

1. Swap video stream (depending on payload)
2. Turn on joystick backlight
3. Swap video or picture mode (depending on payload)
4. Adjust aircraft's speed
5. Enable full-screen video
6. Lock default camera target
7. Joystick
8. Take a picture or record video
9. Customizable buttons
10. Customizable buttons

Buttons on right joystick handle



1. Power
2. Lock
3. Joystick handle

Buttons on the side of the left joystick handle

Buttons on the side of the right joystick handle

1. Joystick handle
2. Customizable buttons

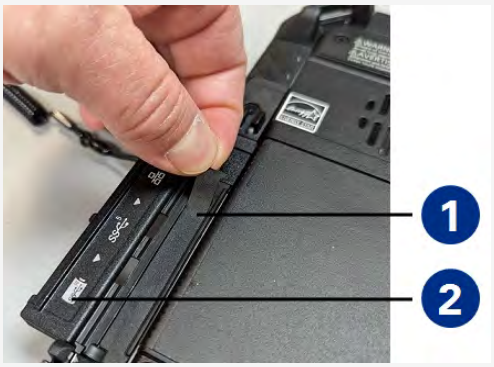
Prepare the tablet

The first time that you insert the tablet into the joystick, you must remove the cover over the ports on the lower-right side of the tablet. For the FZ-G1 tablet, this cover protects the tablet's USB and HDMI ports. For the FZ-G2 tablet, this cover protects the tablet's USB and Ethernet ports.

After you remove the cover, you can connect the joystick to the tablet using USB and the tablet can fit into the joystick's mounting brackets.

When you receive your system, the tablet might be inserted into the joystick already, but the cover remains attached. You must remove the tablet from the joystick to remove the cover. For more information, see "Remove the tablet from the joystick" on page 293.

1. Open the cover on the lower-right side of the tablet.
2. If you are using an FZ-G2 tablet, carefully remove the sticker that covers the screws for the cover.



1. Sticker covering the cover screws
2. USB and Ethernet port cover

3. Using a Phillips #1 screwdriver, unscrew the two screws.

4. Remove the cover.

✓ After removing the cover, put the screws back into the tablet so that you don't lose them.

Insert tablet spacers into the joystick

If you are using the FZ-G2 tablet, you must use tablet spacers with the joystick to ensure that the tablet fits properly inside the joystick. If your joystick does not already include these spacers, you must insert them.

If you are using the FZ-G1 tablet, you can use a 3-D printer to create tablet spacers so you can charge the tablet when it is inserted into the joystick. For more information, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for "tablet spacers."

1. Identify the left and right joystick spacers. An L or R is printed on the inside of the joystick spacer, near the top.
2. Align the left joystick spacer with the mounting brackets on the left side of the joystick.

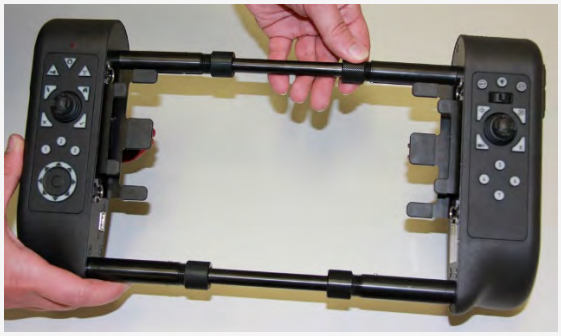
3. Slide the joystick spacer towards the left joystick handle, until it is flush with the joystick.
4. Repeat steps 2 and 3 with the right joystick spacer.

Insert the tablet

You can insert either the FZ-G1 or FZ-G2 tablet into the joystick. If you are using the FZ-G2 tablet, you must insert tablet spacers into the joystick first. For more information, see "Insert tablet spacers into the joystick" on the previous page.

> If you are using the FZ-G1 tablet, and are not using tablet spacers with the joystick, you must remove the tablet from the joystick to charge it. You must use tablet spacers with the FZ-G2 tablet, so the tablet is already raised to allow you to charge it while it is in the joystick.

1. Remove the stylus from the side of the tablet so that you can continue to use it while the tablet is in the joystick.
2. Loosen the four twist locks.
3. Extend the joystick as wide as possible.



4. On the bottom of the joystick, loosen the mounting bracket clamps so that the mounting brackets move up and down easily.
5. On the inside of the joystick, fold the D-rings up so that you can access them after you install the tablet.
6. Insert the included USB connector into the tablet.
7. While lifting the mounting brackets, slide the tablet into the joystick from the top until the bottom of the tablet rests on the bottom of the joystick.

8. Check that the USB cable is underneath the tablet.

9. Slide the joystick closed until the tablet is firmly in place.
10. Tighten the four twist locks.
11. Push the mounting brackets down until they are tight against the top of the tablet.
12. On the back of the joystick, tighten the mounting bracket clamps.
13. Close the mounting bracket clamps.

14. On the bottom of the joystick, insert the USB cable into the USB port.

After installing the tablet into the joystick, you can use the external USB port on the front of the joystick. The tablet recognizes any USB memory key or other USB 2.0 device that you insert.

Turn the joystick on and off

The joystick uses power from the tablet. When flying using the joystick, monitor the tablet's battery level closely. See "Check the status of the tablet" on page 62.

On the side of the left joystick, press  .

If the joystick is connected properly, in MCS,  appears in lower-left corner of the screen. In the toolbar of the primary video panel,  appears. On the left joystick handle, the keys related to takeoff start flashing.

To turn off the joystick, press  again.

✓ You can also turn the joystick on and off using the Power button on the tablet. If the tablet is turned on, when you insert the tablet into the joystick, the joystick turns on automatically.

Configure the joystick

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Basic Settings** tab, perform one or more of the following actions:
    - Set the **Joystick Mode** drop-down list to the control mode that you want to use. The control mode that you select appears in the preflight check results that appear during takeoff.
    - To adjust the angle that the aircraft uses to compensate for the wind when GPS is lost, set the **Max Orientation** field. If the winds are high, increase the value in this field.
    - If you do not want the joystick to vibrate when any errors or warnings appear in MCS, clear the **Enable Haptic Feedback** check box.
    - To turn off the backlights for the joystick keys, clear the **Enable LED Feedback** check box.

If you turn off GPS manually (and fly in GPS Denied Mode) or the aircraft loses its GPS connection during a flight, you can use the compass rose to adjust the **Max Orientation**.

Control modes

You can use one of the following control modes:

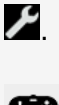
Control mode	Description	Controls
First Person View Mode	This mode is like first person video games. The controls are camera relative. The controls move the way that the camera is facing.	Left joystick: Moves the aircraft forward, backward, left, or right. Left trigger: Changes the height of the aircraft. Right joystick: Changes the pitch of the camera payload and the yaw of the aircraft. Right trigger: Changes the zoom of the camera.
First Person View Mode (Camera Inverted)	This mode is like first person video games. The controls are camera relative. The camera controls for pitch move opposite to the way that the camera is facing.	Left joystick: Moves the aircraft forward, backward, left, or right. Left trigger: Changes the height of the aircraft. Right joystick: Changes the pitch of the camera and the yaw of the aircraft. Right trigger: Changes the zoom of the camera.
RC Mode 1	This mode is like remote control aircraft. The controls are camera relative. The controls move the way that the camera is facing.	Left joystick: Moves the aircraft forward or backward and changes the yaw of the aircraft. Left trigger: Changes the pitch of the camera. Right joystick: Moves the aircraft left or right and changes the aircraft's height. Right trigger: Changes the zoom of the camera.

Control mode	Description	Controls
RC Mode 2	This mode is like remote control aircraft. The controls are camera relative. The controls move opposite to the way that the camera is facing.	Left joystick: Changes the aircraft's height and changes the yaw of the aircraft. Left trigger: Changes the pitch of the camera. Right joystick: Moves the aircraft forward, backward, left, or right. Right trigger: Changes the zoom of the camera.

Customize joystick response to input

You can customize how the joystick responds to movements. You can set the dead zone for an action, which represents how far you must move the joystick for it to register an action. You can also set the sensitivity, which represents how quickly the aircraft responds.

When you customize these settings, you should test them, so that you understand how the joystick responds.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. Tap the **Left Stick** tab.
5. In the **Axis Calibration** section, perform one or more of the following actions:
    - To set the **Sensitivity** field, use the slider.
    - To set the **Deadzone** field, use the slider.
    - To reset the settings to the default values, tap **Reset**.
6. To test the settings, perform the following actions:
    a. Move the joystick on the left joystick handle up and down and side to side.

b. While moving the joystick, in the **Axis Input** section, observe the sensitivity and dead zone levels.

c. If necessary, adjust the settings.

7. Tap the **Right Stick** tab.
8. Repeat steps 5 and 6 for the joystick on the right joystick handle.

If you set a small dead zone, the wind can affect the controls.

Customize the buttons

You can customize the actions for the numbered (1 to 8) buttons and the R1 and R2 buttons. For more information on the options for customization, see "Joystick button customizations" below.

1. In the lower-left corner of the screen, tap .
2. Tap .
3. Tap .
4. Tap the **Button Mapping** tab.
5. In the drop-down list for each button, set the action for that button.

By default, a dialog box appears after you press a button on the joystick to inform you of the action taken. If you do not want these dialog boxes to appear, on the **Joystick** tab, clear the **Show Indication on Action** check box.

Joystick button customizations

When customizing the joystick buttons, you can select from the following options:

Option	Action
None	No customized action.
Take Control of Aircraft Payload	Take control of the payload.
Toggle Focus Mode / Refocus	Turn focus mode and refocus on and off.

Option	Action
Toggle UDOT	Turn UDOT on and off.
Toggle MTI	Turn MTI on and off.
Toggle People Detection	Turn people detection on and off.
Toggle Vehicle Detection	Turn vehicle detection on and off.
Toggle Center on Aircraft	Turn center on aircraft on and off.
Toggle Collision Avoidance	Turn collision avoidance on and off (requires specific aircraft hardware to enable).
Toggle Follow-Me	Turn Follow-Me on and off.
Toggle Base Station / Node Is Home	Turn on and off setting the base station / network node as home.
Toggle Base Station / Node Is Target	Turn on and off pointing the camera target at the base station / network node.
Toggle IR Polarity	Turn IR polarity on and off.
Toggle IR Spot Meter	Turn the IR spot meter on and off.
Toggle Isotherms	Turn isotherms on and off.
Toggle In-Air Replacement	Turn in-air replacement on and off.
Toggle Ground Sensor	Turn ground sensors on and off.
Toggle LED	Turn the LEDs on and off.
Toggle Unlock Yaw	Turn on and off separating the camera payload yaw from the aircraft yaw.
Toggle Local Zoom	Turn local zoom on and off.
Toggle Aircraft Focus	Turn aircraft focus on and off.
Toggle Adjust Target Height	Turn adjust target height on and off.
Toggle Open/Close Payload Latch	Open or close the payload latch.
Pause/Resume Action	When flying to a flight planning element or location on the map, pause the flight. If you are flying between waypoints in a waypoint list,

Option	Action
	you can also resume the flight.
Take Snapshot	Take a picture.
Toggle Video Recording	Turn video recording on and off.
Toggle AutoSnaps	Turn AutoSnaps on and off.
Toggle Adjust Map Rotation	Adjust the map rotation.
Toggle Adjust Map Zoom	Adjust the map zoom.
Land	Land the aircraft.
Toggle GPS Denied Mode	Turn GPS Denied Mode on and off.
Toggle Auto Height Management	Turn Auto Height Management on and off for tethered operations.
Toggle Aircraft Speed / Orientation	Move between the preset aircraft speeds or change aircraft pitch in orientation control mode.
Optimize Flight Control	Optimize flight control manually.

Take off using the joystick

You can use the joystick to take off.

If the regulatory region for your flight requires Remote ID, you must enable it for your flight. Depending on the region, you might also need to lock it. For more information, see "Using Remote ID" on page 341.

1. On the joystick, press  .
2. If you are connected to ELB, perform the following actions:
    a. In the **Select Pilot** dialog box, set the **Pilot** and **Mission** drop-down lists to the appropriate values for the flight.
    b. Press  . The **Height Settings** dialog box appears.
3. Confirm the height settings.
4. Press  . The next dialog box that appears shows the aircraft's status and whether it is ready to take off.

5. In the dialog box, ensure that there is sufficient space available on the aircraft's memory card. If you are using a camera payload with a memory card, ensure that there is sufficient space on the payload's memory card.
6. If the aircraft is not ready to take off, in the dialog box, review the results of the preflight checks and then perform one of the following actions:
    - To resolve the warnings, press . Adjust the aircraft or your settings as necessary. Start the takeoff process again.
    - If you want to proceed with any minor warnings or acknowledge special circumstances for the flight, press to select the **Acknowledge Above Warnings** check box.
7. When the aircraft is ready to take off, confirm that the correct control mode is set for the joystick. To change the current control mode, use the stylus to tap the arrows on the right side of the dialog box.
8. Press .
9. To take off, press again.

✓ You can also press to acknowledge the prompts during the takeoff process.

Lock the joystick

When you are working with the tablet, you can lock the buttons to prevent moving the aircraft accidentally.

On the side of the left joystick, press . The button on the joystick turns green to indicate that the buttons are locked.

To unlock the buttons, press again. The button on the joystick turns orange to indicate that the buttons are unlocked.

Land the aircraft using the joystick

You can land the aircraft using the joystick.

You can use the joystick to bring the aircraft to the ground. However, if you release the joystick, the aircraft takes off again. To land the aircraft, you must complete the landing process. If you are using the joystick on the left joystick handle, you can't access the Land button easily. Before your flight, configure one of the customizable buttons on the right joystick handle to land the aircraft. To land, hold the joystick on the left joystick handle until the aircraft reaches the ground. Press the customized button twice. Do not release the joystick until the propellers have stopped spinning completely.

Perform one of the following actions:

- On the joystick, press . Press .
- Press twice.

The aircraft starts the landing process. During the landing, you can use the joystick to position the aircraft. If you do, the aircraft does not stop descending and it moves horizontally in the direction that you indicate. When it moves, it moves at the speed that you have currently configured for the aircraft. You should reduce your speed when landing with joysticks.

To cancel the landing after it is in progress, press .

If you are using the joystick when landing on a target, you cannot use the joystick controls to change the aircraft's height.

Pause an autonomous flight

When the aircraft is flying an autonomous flight, you can pause it using the Cancel button on the joystick or a customized joystick button.

Examples of autonomous flights include the following:

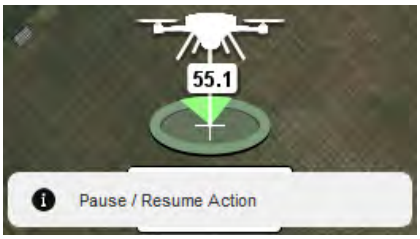
- Flying to a flight planning element.
- Flying a flight plan such as a waypoint list, an AutoGrid, or a circular flight plan.
- Flying to a location on the map.

If you want to use a customized joystick button, configure the button with **Pause/Resume Action**. For more information, see "Customize the buttons" on page 287.

While flying an autonomous flight, perform one of the following actions: Press .Press the customized joystick button.

When you pause the flight, the line on the map between the aircraft and the flight planning element or the location on the map no longer appears.

If you used the customized joystick button, **Pause/Resume Action** appears below the aircraft icon.



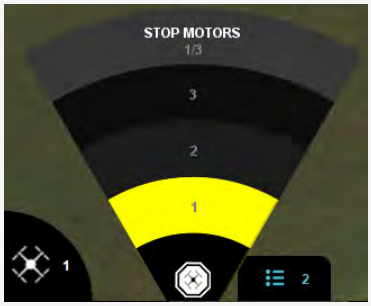
✓ If you are flying between waypoints in a waypoint list and use a customized joystick button to pause the flight, you can press the button again to resume flying the waypoint list.

Stop the motors using the joystick

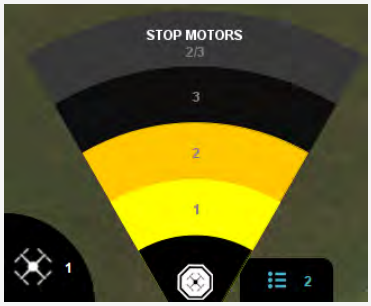
If there is an emergency when you are flying the aircraft with the joystick, you can stop the aircraft's motors immediately. This action shuts down the propellers on the arms and the aircraft falls from its current height to the ground.

⚠
- Use this feature in emergencies only.
- All motors stop and, if the aircraft is in the air, it falls to the ground.
- If you begin to stop the motors when the aircraft is landing, but do not complete the procedure before it times out, the aircraft continues to land.
- After you complete the process to stop the motors, you cannot cancel, stop, or undo the command.
- Depending on the height of the aircraft, damage to the propulsion arms, legs, payload, or aircraft body can result. Injury or damages to property can also occur.

1. On the left joystick handle, press  . The **Stop Motors** indicator appears on the screen:



2. Press again. The **Stop Motors** indicator changes to show you moved to the second step of the process:



3. Press and hold . The **Stop Motors** indicator changes to show that you moved to the third step of the process:

The aircraft falls from its current height to the ground.

Remove the tablet from the joystick

1. On the bottom of the joystick, remove the USB cable from the USB port.
2. Loosen the four twist locks.
3. Extend the joystick as wide as possible.
4. On the bottom of the joystick, loosen the mounting bracket clamps so that the mounting brackets move up and down easily.
5. While lifting the mounting brackets, slide the tablet out of the joystick.

FLYING UNDER SPECIAL CIRCUMSTANCES

Some less-common situations or conditions, such as taking off from or landing on a building or bridge, can present additional challenges when flying the aircraft. There is an increased risk of radio interference, GPS degradation, GPS loss, magnetic fields that can affect the aircraft's compass, or additional obstacles to navigate when the aircraft flies home. You must set aside extra time for landing when flying in these advanced scenarios.

Before flying under these circumstances, you (and any flight observers) should review all available documentation from Teledyne FLIR. Practice any non-standard procedures in a controlled environment first.

Fly without relative ground sensors

If you are flying the aircraft from a moving vessel, movement from the deck can cause movement of the aircraft as its ground sensors come into range. Before landing the aircraft, you can turn off the relative ground sensors (sonar and the built-in laser altimeter).

Flying without relative ground sensors is dangerous. Operators and observers must monitor the aircraft's position and speed carefully during landing. Without relative ground sensors, the aircraft does not slow down automatically when it descends and can ascend again quickly after initially touching down. Injury or damages can result if the aircraft has a hard landing. Before flying without relative ground sensors, you (and any flight observers) should practice any non-standard procedures in a controlled environment with repeated successful results and follow all manufacturer's instructions carefully. Failure to do so will void the warranty, and can potentially damage the aircraft, or property. Injury can also result.

Show the ground sensor button

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Preferences** tab, tap the **Advanced** tab.
5. Select the **Show Ground Sensor Button** check box.

To prevent accidentally disabling relative ground sensors, you should only show the ground sensor button when you need to fly without them. Don't leave this option enabled in MCS when flying under regular circumstances.

Fly without ground sensors

You can only turn off ground sensors when the aircraft is in the air.

If you fly without ground sensors, at lower heights, the aircraft's speed is not limited to 4 km/h / 2 mph.

1. In the lower-right corner of the screen, tap .
2. Tap .
3. Ensure that appears.
4. Position the aircraft at a safe height.
5. Before landing, to turn off ground sensors, tap so the icon changes to . The icon animates as the change is applied.
6. Land the aircraft. Make small, lateral adjustments to help the aircraft reach the landing position or land with video assistance to guide the aircraft to a precise position. For more information, "Land the aircraft with video assistance" on page 77.

When you are not landing on a target, without ground sensors, the aircraft lands and can pop back up to ensure that it detected the ground accurately. During this type of landing, the propellers slow down but do not stop until aircraft knows it has landed.

Instead of flying without relative ground sensors when the aircraft has difficulty identifying a landing position, you can land the aircraft on a target or at a land location that you specify. For more information, see "Using target landing" on page 223 or "Land the aircraft at a land location" on page 142.

After the aircraft lands, ground sensors are enabled again automatically.

Fly without maps

Maps are a visual aid that help you navigate when flying. The software does not require them. Although they help you judge distances and keep your orientation when flying, it is common to fly without their aid. For example, if you are flying in a remote location, you might have a low-quality map or no map at all.

You should practice flying without maps to understand how to perform tasks without using map-based navigation. See "Simulating a flight" on page 316.

Judge distance

When flying without maps, use the following tips to help you judge distance:

- Show a grid on the map. See "Show a grid on the map" on page 322.
- Use the aircraft's **Maximum Range** field to set the distance from the base station that the aircraft can fly. See "Check flight settings and behaviors" on page 54.

Maintain orientation

When flying without maps, use the following tips to help you maintain orientation:

- Before flying, orient the aircraft in the same way that you would orient the map. See "Establish orientation" on page 53.
- Rotate the map so that the top of the map points in the direction that you plan to fly.
- Add points of interest or markers as you fly so that you can map where you have been.
- Place your base station directly behind your home position or at a right angle to your planned flight direction.
- If there is a ground feature (such as a road, river, or object) that can help orient you, use LiveMaps. For more information on LiveMaps, visit the Customer Self-Service Portal at https://selfservice.teledyneflir.com to read the Operating Manual for your payload.

Fly by camera

When flying without maps, use the following tips to help you fly by camera:

- As soon as you take off, identify a distinctive local feature against the sky. Keep this object centered in the camera.
- Fly to the local feature's location. Rotate the camera to search for your destination.
- Try to locate your destination quickly and keep it in your camera view.
- If there is a ground feature (such as a road, river, or object) that can help you fly, use LiveMaps. For more information on LiveMaps, visit the Customer Self-Service Portal at https://selfservice.teledyneflir.com to read the Operating Manual for your payload.

Fly in environments with magnetic interference or a weak magnetic field

Flying in environments with magnetic interference or a weak magnetic field can be challenging. The interference or weak field can cause issues with the aircraft's ability to maintain its compass orientation. If the aircraft loses its compass orientation, during a flight, the aircraft completes a full yaw rotation to recalibrate.

If you are using a joystick to move the aircraft horizontally, the aircraft does not complete this yaw rotation. As a result, the early warning detection indicator or a non-fatal warning can appear. Stop moving the aircraft so it can complete the yaw rotation to improve its compass orientation.

⚠ If you are flying in an environment where the Earth's horizontal magnetic field strength is lower than 8,000 nanotesla (nT), do not use XL batteries. Consult a map of the Earth's magnetic field to verify that the area that you are flying in has a strong enough magnetic field for XL batteries.

About visual navigation mode

Visual navigation mode uses the aircraft’s navigation cameras to identify features on the ground, such as buildings or roads, to determine its position and speed. Under optimal conditions, the maximum height for visual navigation mode is 60 m / 195 ft.

⚠ If the aircraft loses its GPS connection, it attempts to determine its position and speed automatically by switching to visual navigation mode. If GPS and visual navigation mode are not available, the system switches to recovery mode and starts an emergency landing. For more information on recovery mode, see "Fly in recovery mode" on page 306.

Before flying into an area where there could be a problem with the GPS connection, check the estimated quality of visual navigation lock. See "Check the quality of the aircraft's visual navigation lock" on page 71.

⚠ If you attach an Osprey payload to the aircraft, visual navigation is not available until you open the latch. Opening the latch ensures that any cargo does not obstruct the field of view. If you have not opened the latch on the Osprey payload during the current flight, open the latch before flying into an area where the aircraft might lose its GPS connection so that the aircraft can enter visual navigation mode automatically. If there is cargo attached to the payload, it drops when you open the latch.

Visual navigation mode might not be possible in poor conditions (such as foggy or snowy weather), if the aircraft is over a snowy field or water, if the aircraft is flying in low light or flying too high, or if the ground features are too small.

Since visual navigation does not use GPS coordinates to determine the aircraft's position and movement, the location of the aircraft in MCS can be inaccurate. The accuracy also degrades over time.

If the aircraft is in visual navigation mode and you return home using an incoming SafeRoute, the aircraft still attempts to follow the path, but without GPS coordinates, the actual distance of the aircraft is offset from what appears in MCS. If the incoming SafeRoute has multiple waypoints or has multiple directional changes, the offset could be large. The illustration below shows the incoming SafeRoute that appears in MCS and an estimated path that the aircraft follows:

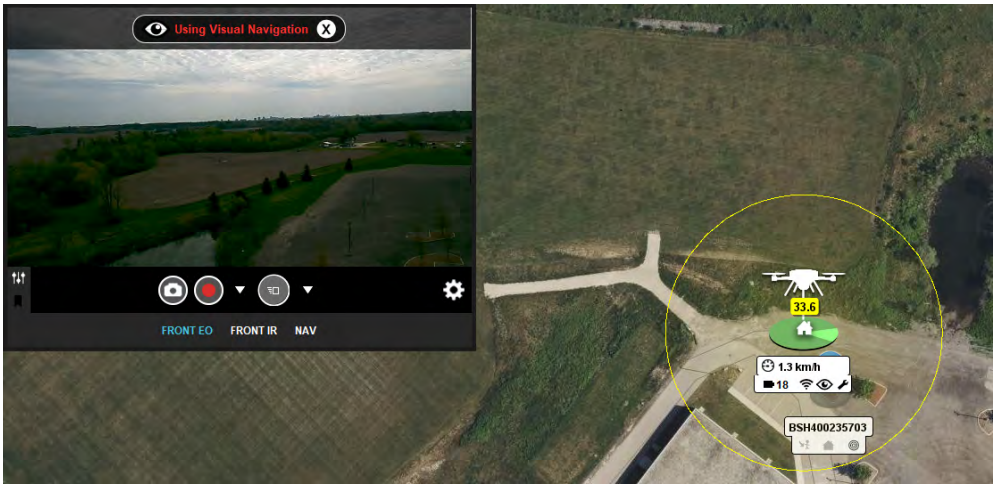
1. Incoming SafeRoute shown in MCS
2. Estimated path that the aircraft follows

Changes in MCS when flying in visual navigation mode

When the aircraft is in visual navigation mode, the following changes appear in MCS:

- Depending on the quality of the visual navigation lock, (good lock), (poor lock), or (bad lock) appears in the aircraft status label.

- and **Using Visual Navigation** appear as a message at the top of the primary video panel.



- On the map, a yellow circle appears around the aircraft shadow, indicating that MCS is approximating the aircraft's location. The smaller the circle, the higher the confidence in the accuracy of the aircraft's position. You might need to adjust the zoom level of the map to see the yellow circle.
- Within the circle, the area behind the aircraft flashes yellow to indicate that the aircraft is using visual navigation mode.
- Flight planning mode is not available. You can continue to right-tap the default camera target and add a marker, but you cannot interact with other flight planning elements.
- You cannot use the Follow-Me or AIR features.
- You cannot use to bring the aircraft to a point on the map.
- You can land the aircraft on a target.
- If you set a visible LED Mode for the arms or set the **LED Mode for Vision Operations** drop-down list in the aircraft flight settings, the LED lights remain on while the aircraft is in visual navigation mode.

⚠ If you set the **Non-Fatal Condition Response** drop-down list in the aircraft flight settings to **Home and Land**, when the aircraft enters visual navigation mode, the system automatically changes this setting to **Home and Hover**. If a non-fatal warning occurs, the aircraft flies to the approximate home position so that you can land it safely. After the aircraft exits visual navigation mode, the system changes the **Non-Fatal Condition Response** back to **Home and Land**.

Fly in GPS-Denied environments

In certain locations, such as downtown urban areas or areas with an obstructed view of the sky, a GPS connection might be limited or might not be available. You might encounter this situation before you take off or during a flight. If this occurs, you can use GPS Denied Mode to continue flying the aircraft.

You can configure your **GPS Denied Mode** preference to set how you want to fly in GPS-Denied environments. The aircraft uses this preference if you take off when a GPS connection is not available or when you enable GPS Denied Mode manually.

If you enable GPS Denied Mode manually, it remains enabled after you land the aircraft. It remains enabled until you turn it off manually or you restart the aircraft.

Set your GPS Denied Mode

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Preferences** tab, tap the **Advanced** tab.
5. Set the **GPS Denied Mode** drop-down list.

If GPS Denied Mode is already enabled, you cannot change your GPS Denied Mode preference. You must turn off GPS Denied Mode first.

GPS Denied Mode options

Setting	Description
None	GPS Denied Mode is not available. You cannot put the system into this mode.
Orientation Control	In this mode, using the stylus to control the aircraft's direction behaves differently than it does during normal flight. When you change the aircraft's direction in orientation control mode, the aircraft continues flying in that direction if you release the stylus. This option is the default.
Vision / Orientation	The aircraft uses visual navigation first. If visual navigation cannot be used, the aircraft uses orientation control mode.

Setting	Description
Vision / GPS	The aircraft uses visual navigation first. If visual navigation cannot be used, the aircraft uses GPS. If the aircraft does not have a GPS signal, it enters recovery mode and starts an emergency landing. For more information, see "Fly in recovery mode" on page 306.

Notes about Orientation Control mode

- When you use the stylus to change the aircraft's direction in Orientation Control mode, both the direction and length of the line that you draw on the map affect how the aircraft moves. When you draw a line in a different direction, the aircraft moves in that direction. The length of the line that you draw on the map determines how quickly the aircraft moves in that direction. The longer the line that you draw, the faster the aircraft flies.
- When flying in Orientation Control mode, to prevent drifting, you must counter the wind by changing the aircraft's direction and speed.
- You cannot use the compass rose to adjust the speed of the aircraft. Instead, the compass rose shows the aircraft's pitch. You can use the slider in the bottom half of the compass rose to adjust the pitch.
- As you move the aircraft, the aircraft information label changes. If a GPS connection is limited, the aircraft information label shows the aircraft's current speed, as well as the pitch and roll angle that the aircraft is using. If no GPS connection is available, the aircraft information label shows the pitch and roll angle only.

- You cannot land on a target when the aircraft is in Orientation Control mode.
- Since the aircraft cannot determine an accurate position with no GPS connection, if a non-fatal warning appears, you can only acknowledge or ignore the warning. These two options appear regardless of what you set in the **Non-Fatal Condition Response** drop-down list in the aircraft flight settings.

Notes about visual navigation and GPS Denied Mode

- If you set your GPS Denied Mode to **Vision / Orientation** or **Vision / GPS**, when you take off, visual navigation might be limited if the ground features are too small. At low heights, visual navigation can be compromised, especially in foggy or snowy weather or if the

aircraft is over a snowy field or water. To improve visual navigation, increase your takeoff height and ascend automatically after taking off.

- If you are recording video from the front EO/IR camera, and you use **Vision / Orientation** or **Vision / GPS**, when you use GPS Denied Mode, the aircraft pauses recording video from the front EO/IR camera. Recording video resumes again when you are no longer using GPS Denied Mode.

Take off when GPS is not available

If a GPS connection is not available in your takeoff location, you can adjust MCS to continue with the takeoff process.

✓ If you connect to an aircraft and a GPS connection is not available for that aircraft, the aircraft icon appears in the center of the map. To change the aircraft's location on the map, tap  . Tap and hold  until the icon changes to  . Tap a new location for the aircraft.

1. Take control of the aircraft.
2. If you are connected to ELB, perform the following actions:
    a. In the **Select Pilot** dialog box, set the **Pilot** and **Mission** drop-down lists to the appropriate values for the flight.
    b. Tap **Continue**. The **Height Settings** dialog box appears.
3. In the **Height Settings** dialog box, confirm the height settings.
4. Tap **Continue**. The next dialog box that appears indicates that the aircraft is not ready to take off. The **[H3] GPS Hardware Error** and the **[T3] Acquiring GPS Lock** error messages appear.
5. Beside the error messages, tap  . The **No GPS Takeoff** dialog box appears.
6. If necessary, in the **GPS Denied Mode** drop-down list, change your GPS Denied Mode setting. By default, MCS uses the option that you set on the **Preferences** tab of the **System Configuration** dialog box. For more information, see "Set your GPS Denied Mode" on page 300.
7. If you set the **GPS Denied Mode** drop-down list to **Orientation Control**, position the aircraft so the front EO/IR camera faces north.
8. To update the aircraft's approximate location, perform one of the following actions:
    - In the **Position** field, type the approximate latitude and longitude coordinates of the

aircraft's location. Tap **Set**.

- Copy the approximate latitude and longitude coordinates of the aircraft's location from another source. In the **Position** field, tap **Paste**. Tap **Set**.
- Tap **Center on Map**.

9. At the bottom of the dialog box, drag 

to the right. When 

appears, lift the stylus. The **Preflight Checks** dialog box appears, and the aircraft is ready to take off.
10. Continue with the takeoff process.

If you want to change the GPS Denied Mode that the aircraft uses before taking off, you must turn off GPS Denied Mode first. In the **No GPS Takeoff** dialog box, drag 

to the left. When 

appears, lift the stylus. Change the **GPS Denied Mode** drop-down list and then enable GPS Denied Mode again.

If you set your **GPS Denied Mode** to **Orientation Control**, during takeoff, the aircraft does not complete its normal flight control optimization process. This process establishes the aircraft's compass directions, and, without it, the aircraft cannot establish an accurate heading. After taking off, you should initiate flight control optimization manually. For more information, see "Initiate flight control optimization manually" on page 306.

If you do not initiate flight control optimization and you are using a stylus to change the aircraft's direction (instead of the joystick), the aircraft does not move in the direction that you command. For more information, see "Notes about Orientation Control mode" on page 308.

Enable GPS Denied Mode manually

When flying in areas where the GPS connection might be compromised, you can enable GPS Denied Mode manually. You can enable GPS Denied Mode before you take off or during your flight. If you enable GPS Denied Mode before takeoff, you must take control of the aircraft first.

To enable GPS Denied Mode, you can use the **GPS Information** dialog box or the joystick.

If you enable GPS Denied Mode manually, the GPS Denied Mode setting is applied to the aircraft. Therefore, in dual operator mode, the GPS Denied Mode transfers with aircraft control. If you enable GPS Denied Mode manually, ensure all operators are aware that this setting is applied.

Enable GPS Denied Mode from the GPS Information dialog box

You can enable GPS Denied Mode from the **GPS Information** dialog box.

The current GPS Denied Mode that you set appears above the slider in the **GPS Denied Mode** section of the **GPS Information** dialog box. For more information on changing this option, see "Set your GPS Denied Mode" on page 300.

1. In the aircraft status label, tap  or  .
2. At the bottom of the **GPS Information** dialog box, in the **GPS Denied Mode** section, drag 

to the right. When 

appears, lift the stylus.

If the aircraft still has a GPS signal, MCS continues to update the map on the tablet to reflect the aircraft's position. If the aircraft does not have a GPS signal, or the signal is weak, the map does not update.

If the aircraft does not have a GPS signal, it enters recovery mode and starts an emergency landing. You can cancel the landing and move the aircraft to a safe location to land. See "Fly in recovery mode" on page 306.

Enable GPS Denied Mode using the joystick

You can use the joystick to enable GPS Denied Mode manually.

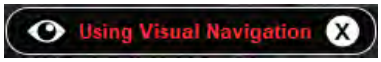
On the left joystick handle, press and hold  .

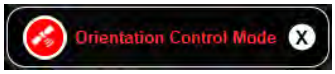
When you enable this option, the  button on the joystick turns green.

If the aircraft still has a GPS signal, MCS continues to update the map on the tablet to reflect the aircraft's position. If the aircraft does not have a GPS signal, or the signal is weak, the map does not update.

Notes about the primary video panel and GPS Denied Mode

If you are using GPS Denied Mode, a message appears at the top of the primary video panel. Different messages appear for the different GPS Denied Mode options:

Message	Conditions
No message	No message appears if your GPS Denied Mode is set to **Vision/GPS** and visual navigation is not available, but GPS is still available. In this case, the aircraft starts using GPS.
	This message appears if your GPS Denied Mode is set to **Vision/Orientation** or **Vision/GPS** and visual navigation is available.

Message	Conditions
	This message appears if your GPS Denied Mode is set to **Orientation Control**. It also appears if your GPS Denied Mode is set to **Vision/Orientation** and visual navigation is not available.
	This message appears if your GPS Denied Mode is set to **Vision/GPS** and visual navigation and GPS are not available. It also appears if your GPS Denied Mode is set to **Orientation Control** and GPS is not available.

Turn off GPS Denied Mode manually

To turn off GPS Denied Mode manually, you can use the **GPS Information** dialog box or the joystick.

If you set your **GPS Denied Mode** to **Orientation Control**, you must optimize flight control after turning off GPS Denied Mode. For more information, see "Initiate flight control optimization manually" on the next page.

Turn off GPS Denied Mode from the GPS Information dialog box

1. In the aircraft status label, tap  or  .
2. At the bottom of the **GPS Information** dialog box, in the **GPS Denied Mode** section, drag  to the left. When  appears, lift the stylus.
3. If you used **Orientation Control** as your **GPS Denied Mode**, when it is safe to do so, in the **Optimize Flight Control** dialog box, tap **Begin**.

Turn off GPS Denied Mode using the joystick

1. On the left joystick handle, press and hold  .
2. If you used **Orientation Control** as your **GPS Denied Mode**, when it is safe to do so, in the **Optimize Flight Control** dialog box, tap **Begin**.

Initiate flight control optimization manually

If you set your **GPS Denied Mode** to **Orientation Control**, after exiting GPS Denied Mode, you must initiate flight control optimization so the aircraft can determine its heading. You do not fully exit Orientation Control mode until the aircraft completes this process.

The aircraft prompts you automatically to optimize flight control when you exit GPS Denied Mode. You can also initiate it manually to avoid any delays when exiting GPS Denied Mode.

If the aircraft needs to optimize flight control,  flashes in the aircraft status label.

Before initiating flight control optimization manually, ensure that you are in an area without magnetic interference, away from any large metal structures or power lines.

1. Position the aircraft at a safe height away from any obstacles and clear of any magnetic interference.
2. Perform one of the following actions:
   - In the aircraft status label, tap  .
   - In the aircraft status label, tap  . On the **Flight Settings** tab, tap **Optimize Flight Control**.
   - If you are using the joystick, and you customized a joystick button to initiate flight control optimization, press the customized joystick button.
3. In the **Optimize Flight Control** dialog box, tap **Begin**.

Fly in recovery mode

The aircraft has multiple sources that it can use for its GPS connection. If the primary source fails, the aircraft attempts to reconnect using a secondary source.

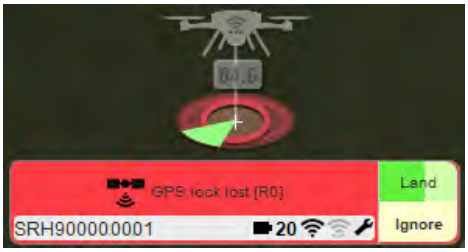
If the aircraft cannot maintain a GPS connection at all, it loses its GPS lock. Several reasons can cause the loss of GPS, including solar flare activity, GPS sensor failures, or objects blocking or reflecting the GPS signal. The aircraft uses its other sensors to attempt to maintain its height and the direction it is facing, but it can drift without a GPS lock.

If the aircraft loses its GPS lock, it attempts to determine its position and speed automatically by switching to visual navigation mode. See "About visual navigation mode" on page 297. If GPS and visual navigation mode are not available, the system switches to recovery mode.

When the aircraft enters recovery mode, the following changes appear in MCS:

- Messages at the top of the primary video panel and the top of the screen show that you are flying in recovery mode and GPS is not available:

- A fatal error message appears on the screen.



- The aircraft shadow turns red and the map darkens.

The map does not update since the GPS location of the aircraft is unknown.

✓ Since the map does not update, identify a distinctive object in the camera's field of view. Keep this object centered in the video panel to orient you as you land the aircraft.

You can use the tablet or joystick to fly the aircraft in orientation control mode. In this mode, the commands are different.

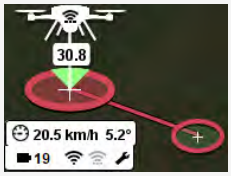
Normal mode	Orientation control mode
To fly in one direction, tap and hold the aircraft shadow and drag it to a location on the map or use the joystick to move the aircraft.	To fly in one direction, draw a line in the direction that you want to travel. If you release the stylus, the aircraft continues to travel in that direction. If you release the joystick, the aircraft stops traveling.
To stop flying in that direction, release the stylus or joystick.	To stop flying in that direction, if you are using the stylus, tap and hold the aircraft shadow and slowly drag it in the opposite direction until you regain control of the aircraft. If you are using a joystick, release the joystick.

⚠ Allow the aircraft to land automatically. The aircraft drifts downwind while it does so. If necessary, you can cancel the automatic landing and land the aircraft manually. Only attempt this type of landing if you were trained by Teledyne FLIR or an authorized training partner on how to fly without GPS navigation.

1. If you want to cancel the automatic landing and land the aircraft manually, perform one of the following actions:

- In the **GPS Lock Lost** dialog box, tap **Ignore**.
- If the aircraft already started an emergency landing, slide **Cancel land** to the right.

2. To bring the aircraft to a safe location to land, drag the aircraft shadow to a new location on the map. The line indicates the direction that the aircraft travels.



3. Continue to move the aircraft toward that location, making small, lateral adjustments in alternating directions. Keep the adjustments small and deliberate. As you make adjustments, the aircraft continues descending.
4. When you reach your landing location, if you are using a camera payload, point it downward.
5. Land the aircraft.

After the aircraft lands, contact Support to determine the cause of the GPS lock loss.

Notes about Orientation Control mode

- When you use the stylus to change the aircraft's direction in Orientation Control mode, both the direction and length of the line that you draw on the map affect how the aircraft moves. When you draw a line in a different direction, the aircraft moves in that direction. The length of the line that you draw on the map determines how quickly the aircraft moves in that direction. The longer the line that you draw, the faster the aircraft flies.
- When flying in Orientation Control mode, to prevent drifting, you must counter the wind by changing the aircraft's direction and speed.
- You cannot use the compass rose to adjust the speed of the aircraft. Instead, the compass rose shows the aircraft's pitch. You can use the slider in the bottom half of the compass rose to adjust the pitch.
- As you move the aircraft, the aircraft information label changes. If a GPS connection is limited, the aircraft information label shows the aircraft's current speed, as well as the pitch and roll angle that the aircraft is using. If no GPS connection is available, the aircraft information label shows the pitch and roll angle only.

- You cannot land on a target when the aircraft is in Orientation Control mode.
- Since the aircraft cannot determine an accurate position with no GPS connection, if a non-fatal warning appears, you can only acknowledge or ignore the warning. These two options appear regardless of what you set in the **Non-Fatal Condition Response** drop-down list in the aircraft flight settings.

CUSTOMIZING MAPS

After you download base maps, you can add new layers on top to increase the level of detail. You can also customize map elevation settings, change the order of the layers, or import and export maps.

Add map layers

You can add map layers in any of the following formats:

- mbtiles (raster formats only)
- .tiff with geotiff georeferencing tags
- .tiff or .tif with world file .tfw or .wld
- .jpg or .jpeg with world file .jgw or .wld
- .png with world file .pgw or .wld
- .jp2 with georeferencing file
- CADRG
- DTED

When adding map layers, note the following items:

- If you add a file type that has an accompanying georeferencing or world file, you might need to add both files to create the map layer. The system uses these files to raster the map images.
- If you are using an .mbtiles file to add a map layer, it must be in raster format. You cannot add layers using .mbtiles files that are in vector format.
- If you are using a .tif file to add a map layer, the layer might not appear if the file uses an unsupported coordinate reference system. For more information, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for "Unable to add map layers using .tif files."

1. In the lower-left corner of the screen, tap  .
2. Tap  .

3. Tap  .
4. On the **Maps** tab, tap  .
5. Perform one of the following actions:
    - To add a single image file on top of the base maps, tap **New Image Layer**.
    - To add multiple image files (such as a .tif with geotiff georeferencing tags), tap **New Image Folder**.
    - To add map tiles to the base maps, tap **New MBTiles Layer**.
    - To add a terrain and elevation data layer to the base maps, tap **New Elevation Layer**.
6. Navigate to the folder that contains the map file or folder that you want to add.
7. Tap the file or folder.
8. Tap **OK**.
9. If you added an elevation layer, customize the settings.

The new map layer appears in the center of the screen.

After adding an elevation map layer, verify that the imported data (including any terrain features) appears correctly in MCS. To check the elevation map data, open MCS and connect to an aircraft or add a simulator.

Customize the elevation layer settings

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Maps** tab, tap the elevation data layer.
5. Customize the settings for the layer.

When you add a terrain and elevation data layer to the map, the aircraft compares the **Minimum Safe Height** set in the aircraft flight settings against the highest point in the area. If the MSH is not sufficient to clear the highest terrain, a warning appears. MCS also uses the elevation data to approximate the location of the default camera target more accurately.

Terrain and data elevation layer settings

You can set the following terrain and data elevation layer settings:

Setting	Description
Hillshading	
Draw Hillshade	Select this check box to show hillshade. The software adds shadows to the map to simulate the appearance of the sun's rays on the terrain.
Elevation-Emphasis	Set the contour lines that you want to appear on the map. For example, if you set this drop-down list to 10 m / 33 ft, contour lines appear at 10 m / 33 ft intervals.
Terrain Risk	
Draw Terrain Risk	Select this check box to show the terrain risk. The software adds areas that can present obstacles to the aircraft at its current height. The areas at the aircraft's height, or higher, appear in red.
Ground Feature Height	Set the height of the highest known obstacle in the map region.
Contour Lines	
Draw Contour Lines	Select this check box to show contour lines. The software adds white-colored isolines to join equal elevation points above sea level. A map with isolines shows the elevation and depth of features of the terrain, such as any valleys or hills.
Major Isoline Interval	Set the amount of space between major isolines on the map.
Minor Isoline Interval	Set the amount of space between minor isolines on the map.

Notes about elevation and terrain data

- After you add a map layer with elevation and terrain data, the terrain data appears on the map within the aircraft's Maximum Range. Terrain height risks appear in red.
- Before takeoff, the aircraft checks the terrain data from the map layer to determine if MSH is sufficient to clear the highest terrain in the area. If MSH is not sufficient, a warning appears during the takeoff process.
- When you change the height of the aircraft, the current terrain height appears in the height slider as a white line with notches in it.

1. Height slider
2. Terrain height

- The terrain height is also visible in the height slider that appears when you land the aircraft with video assistance.
- During a flight, the aircraft uses the terrain data to calculate the target's position in the video panel. If you are using a camera payload that supports user-defined object tracking (UDOT), the aircraft also uses terrain data to update the target's position.
- The aircraft does not use terrain data to calculate the video panel's slant range value or the target's location on the map.

Change the order of map layers

You can change the order of any map layers, but the bottom layer is always the base map.

1. In the lower-left corner of the screen, tap .
2. Tap .

3. Tap  .
4. On the **Maps** tab, tap and drag a layer to a different position in the order.

Remove map layers or folders

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Maps** tab, tap the layer or folder.
5. Tap .

Export maps

You can export the map cache from the tablet. You might want to export the map cache from one tablet and import it to another.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Maps** tab, tap the map layer.
5. Tap  .
6. If necessary, navigate to the folder where you want to save the export.
7. Type a name for the export.
8. Tap **OK**.

Import maps

You can import maps to MCS.

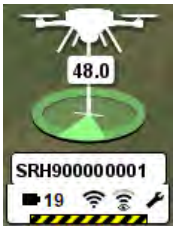
1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Maps** tab, tap  .
5. If necessary, navigate to the folder with the file that you want to import.
6. Tap the file.
7. Tap **OK**.

SIMULATING A FLIGHT

You can use the simulator to simulate flight behavior without physically flying the aircraft. When you use the simulator, you use the software in the same way that you would when flying the aircraft, making it useful for training, planning, and practice. You can practice flying in difficult situations, such as flying in high winds or extreme temperatures.

You can connect to an aircraft to simulate a flight or use the tablet alone. If you use the tablet alone, you cannot simulate payload activity. If you connect to an aircraft, it does not take off or fly if the software is in simulator mode.

When using the software in simulator mode, on the map, a black and yellow line appears below the aircraft icon.



Aircraft icon in simulator mode

⚠ Before putting the aircraft in simulator mode, remove the propulsion arms from the aircraft. If the aircraft is not in simulator mode properly, the aircraft could take off and fly. Removing the propulsion arms can prevent accidental takeoff, injury, or damages to people, property, or the aircraft.

Put the aircraft into simulator mode

If you want to connect to an aircraft to simulate flights, you must put the aircraft into simulator mode.

1. In the status label for the aircraft that you want to put into simulator mode, tap . A dialog box with the aircraft settings appears on the right side of the screen.
2. Tap the **Simulator** tab.
3. Select the **Simulator Mode** check box.
4. To close the dialog box, in the upper-right corner of the dialog box, tap .

Add a simulator

You can add up to 16 simulated aircraft to MCS.

1. In the lower-left corner of the screen, tap .
2. Tap .
3. At the bottom of the **Connection** tab, tap **Add Simulators**.
4. Set the **Number** drop-down list to the number of aircraft that you want to add.
5. Tap **OK**.
6. If necessary, to connect a simulated aircraft to the Wi-Fi network and add it to the map, on the **Connection** tab, select the **Connect** check box.

The simulator attempts to estimate wind. As a result, the wind icon in the compass rose moves around.

Set the location for a simulated flight

You can set the location for flights flown in the simulator.

1. In the status label for the simulated aircraft, tap . A dialog box with the aircraft settings appears on the right side of the screen.
2. Tap the **Simulator** tab.
3. In the **Position** field, type the GPS coordinates for the location that you want to use.
4. Tap **Set**.

The aircraft icon moves to that location on the map.

To move the map to center on the aircraft, tap **Center on Map**.

Configure the simulation

1. In the status label for the simulated aircraft, tap . A dialog box with the aircraft settings appears on the right side of the screen.
2. Tap the **Simulator** tab.

3. Set any of simulated parameters for the flight, such as the wind speed, battery temperature, or ground height.

4. To close the dialog box, in the upper-right corner of the dialog box, tap ✖.

Simulator settings

You can configure the following settings for each simulation. Changing these settings can help you practice how to adjust your flight in different situations.

Option	Description
Wind North	This field sets the simulated wind coming from the north or south. A positive number simulates the wind coming from the north. A negative number simulates the wind coming from the south.
Wind East	This field sets the simulated wind coming from the east or west. A positive number simulates the wind coming from the east. A negative number simulates the wind coming from the west.
Wind Gust	This field sets the speed for simulated wind gusts.
Compass Error	This field simulates an error in the compass. The compass reading is incorrect by the specified number of degrees.
Ground Height	This field sets the simulated ground height. You can change this value during a simulated flight to practice landing in a valley or on a roof.
GPS Assist Enabled	Clear this check box if you want to simulate flying the aircraft without GPS assistance.
Position Accuracy	This field simulates an error in the GPS position. The GPS is inaccurate by the specified amount.
GPS Velocity Accuracy	This field simulates an error in the accuracy of the GPS velocity. The GPS velocity is inaccurate by the specified amount.
Battery Temp	This field simulates a specific battery temperature.
Use Aircraft Battery Level	Clear this check box if you are connecting to an aircraft and don't want to use the aircraft's actual battery level.
Warnings	Select the warnings that you want to simulate with the aircraft.
Hardware Errors	Select the hardware errors that you want to simulate with the aircraft.

Option	Description
Takeoff Errors	Select the takeoff errors that you want to simulate with the aircraft.
Non-Fatal Warnings	Select the non-fatal warnings that you want to simulate with the aircraft.
Recovery Errors	Select the fatal errors that you want to simulate with the aircraft. It is possible to recover from these errors.
Fatal Errors	Select the fatal errors that you want to simulate with the aircraft.

Simulate errors and warning messages

You can use the simulator to practice responding to the errors and warning messages that might appear in MCS before or during a flight.

This feature simulates the errors and warning messages only. It does not simulate the conditions that cause the error or warning message to appear.

All errors and warning messages clear when you land the simulated aircraft. You can clear errors and warning messages from MCS during a flight, but non-fatal warnings only reset after you land.

To simulate takeoff errors or hardware errors, the simulated aircraft must be on the ground. To simulate non-fatal warnings or fatal errors, the simulated aircraft must be in the air.

For some of the errors and warnings that you simulate, a change might not appear in MCS. For more information on each error or warning message, see "Understanding errors and warning messages" on page 247.

1. In the status label for the simulated aircraft, tap  . A dialog box with the aircraft settings appears on the right side of the screen.
2. Tap the **Simulator** tab.
3. Beside the category of error or warning that you want to simulate, perform one of the following actions:
   - Select the check box.
   - Tap  .
4. In the list of errors or warnings, select the check boxes for the messages that you want to simulate.

5. If necessary, repeat steps 3 and 4 for any additional categories or messages.

Clear simulated errors and warning messages

All errors and warning messages clear when you land the simulated aircraft, but you can clear them individually.

If you simulate non-fatal warnings, the warnings only reset after you land the simulated aircraft.

1. In the status label for the simulated aircraft, tap . A dialog box with the aircraft settings appears on the right side of the screen.
2. Tap the **Simulator** tab.
3. Beside the category of error or warning that you are simulating, perform one of the following actions:
   - If you want to stop simulating all errors or warnings for that category, clear the check box.
   - If you want to stop simulating a particular error or warning, tap . Clear the check box beside the message that you want to stop simulating.

CUSTOMIZING MCS

You can customize MCS to suit your needs.

Set your language

You can set the language for the system.

If you set the **Language** field to **System Default**, the system uses the Windows display language, if MCS is available in that language. If MCS is not available in that language, English is used.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Preferences** tab, ensure that the **General** tab is selected.
5. Set the **Language** drop-down list to your desired language.

After setting your language, you must restart MCS.

Change the default coordinate unit

By default, the system uses degrees to measure GPS coordinates. You can change this to another measurement, such as UTM or MGRS.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Preferences** tab, ensure that the **General** tab is selected.
5. Set the **Default Coordinate Unit** drop-down list to **DEG**, **DM**, **DMS**, **UTM**, or **MGRS**.

Change the default position of the primary video panel or map

By default, the primary video panel appears on the left side of the screen. You can change its position, so that it appears on the right side of the screen. When you change the position of the primary video panel, the compass rose, the height adjustment arrows, and the flight planning menu also move to the left side of the map.

✓ If you are left-handed, you might want to switch the default location of the primary video panel to make it easier to use the stylus with the tablet.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Preferences** tab, ensure that the **General** tab is selected.
5. Select the **Swap Default Video Panel Position** check box.

Change the graphics quality setting

By default, the system uses anti-aliasing for map elements and other graphics in MCS. You can change the graphics quality setting to turn off anti-aliasing, which can help to improve the performance of MCS.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Preferences** tab, tap the **Advanced** tab.
5. Set the **Graphics Quality** drop-down list to **Medium**.

Show a grid on the map

For easier navigation, you can add a grid to the map. Each square in the grid matches the zoom scale shown in the compass rose.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Preferences** tab, ensure that the **General** tab is selected.
5. Select the **Show Grid on Map** check box.

Turn off sound effects

If you are flying the aircraft for clandestine operations, you can turn off the sound effects in MCS.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Preferences** tab, tap the **Advanced** tab.
5. Select the **No Sound Effects** check box.

MCS turns off all sounds, including any warning or landing sounds.

Remove airspace information

If you need to clear memory on your tablet, you can remove the airspace information for countries that you are not flying in.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Preferences** tab, ensure that the **General** tab is selected.
5. Set the **Airspace Region** field to **None**.

Before flying your next flight, to see airspace information again, reset this field to the country that you are flying in.

Configure the server for log uploads

If you are not using ELB, you can configure the server that MCS should use to upload flight logs so that the logs are accessible to Support.

You should only change the server for log uploads if you are instructed to do so by Support.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. If necessary, at the top of the **Cloud Services** tab, set the drop-down list to **None**.
5. Tap the **Configure Upload Server URL** tab.
6. To unlock the **Current Server** field, tap **Change Server**.
7. Complete the fields in the dialog box using the information provided to you by Support.
8. Tap **Save Changes**.

To return to the default values, tap **Reset**.

CUSTOMIZING THE BASE STATION

If necessary, you can customize the base station by changing the network settings on the **Base Configuration** web page.

When you customize the base station, follow the instructions carefully. If an error occurs, you might not be able to connect to your aircraft or your base station. For more information, contact Support.

Open the Base Configuration web page

1. Turn on the base station.
2. Verify that the base station and tablet are connected.
3. Perform one of the following actions:
    - In a browser, open http://192.168.3.1/config.
    - Open MCS. In the lower-left corner of the screen, tap  . Tap  . On the **Connection** tab, select the base station that you want to configure. Tap **Network**.

The **Base Configuration** web page appears. If multiple aircraft are connected to the base station, the name and IP address of each aircraft appear at the top of this page.

You can also access the **Base Configuration** web page if the base station and tablet are connected using an Ethernet connection.

Copy the password for the base station’s Wi-Fi network

1. Open the **Base Configuration** web page.
2. In the **Wi-Fi Command Network** section, copy the value that appears in the **Passkey** field.

After you copy the password, you can paste it when you need to connect to the base station’s Wi-Fi network through Windows network settings.

Change the password for the base station's Wi-Fi network

1. Open the **Base Configuration** web page.

2. In the **Wi-Fi Command Network** section, perform one of the following actions:
    - To generate a random 64-character password, beside the **Passkey** field, tap  .
    - To set a custom password, in the **Passkey** field, type a password. The password must have a minimum of 8 characters.
3. Copy the new password.
4. Tap **Update Configuration**.
5. Use the password that you copied in step 3 to reconnect the tablet to the base station's Wi-Fi network. See "Reconnect the tablet to the base station's Wi-Fi network" on page 356.

Change the network settings

If necessary, you can change the network settings for the base station.

In the **Wi-Fi Command Network** section, the default for the **Channel** field is 1 (2.4GHz). You should only change the **Channel** field if there is environmental interference in the connection between the tablet and the base station or the aircraft and the base station. In some regions, certain 5GHz channels are meant for indoor use only. Consult your local regulations before changing the **Channel** field.

1. Open the **Base Configuration** web page.
2. To change the base station network name, in the **Wi-Fi Command Network** section, change the **SSID** field.
3. Update any of the other network settings.
4. Tap **Update Configuration**.
5. After the web page refreshes, confirm that the changes were made.
6. Perform one or more of the following actions:
    - If you changed the **Channel** field only, restart the aircraft.
    - If you changed any other fields, pair the aircraft with the base station again. See "Pair an aircraft with a base station" on page 356.
7. Reconnect the tablet to the base station's Wi-Fi network. For more information, see "Reconnect the tablet to the base station's Wi-Fi network" on page 356.

Network settings

You can configure the following network settings:

Setting	Description
Regional Power Level Setting	This field shows the region and the associated power output for the base station's modem.
Wired (Base)	
IP	This field shows the IP address of the base station.
Wi-Fi Command Network (Tablet to Base)	
SSID	This field shows the base station network name.
Passkey	This field shows the password used to connect the tablet to the base station network. The password must be between 8 and 64 characters.
Channel	This field shows the communication channel and frequency for the wireless network.
Air Network Base (Base to Aircraft)	
Model	This field shows the modem type.
Channel	This field shows the communication channel and frequency for the aircraft to base station wireless network.

The additional fields on this web page are used for advanced configuration of the base station, including enabling multiple base stations. For more information, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for "multiple base stations." Do not change these fields unless you understand networking configuration environments. If you do change the IP address of the base station in this section, do not set the IP address to anything in the 192.168.100.xxx or 192.168.200.xxx ranges.

Customers with compatible radio configurations can use the **Region** setting on the **Base Configuration** web page to appropriately configure the RF outputs of their systems for the region they are operating in. For more information, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for "regional settings."

Configure remote power for the base station

You can configure the base station so that it turns on or turns off automatically when you connect or disconnect the power cord.

If you enable remote power on, you cannot use to turn the base station on. If you enable remote power on and off, you cannot use to turn the base station on or off.

1. Ensure that the base station is connected to a power source.
2. Open the **Base Configuration** web page.
3. In the **Remote Power** section, perform one of the following actions:
    - To turn on the base station when the power cord is connected, set the **Remote Power Mode** drop-down list to **Remote Power On Enabled**.
    - To turn the base station on and off when the power cord is connected or disconnected, set the **Remote Power Mode** drop-down list to **Remote Power On and Off Enabled**.
    - To turn off remote power, set the **Remote Power Mode** drop-down list to **Remote Power Disabled**.
4. Tap **Save Remote Power Settings**. The base station restarts.

Turn off the base station's pressure sensor

The base station includes an internal pressure sensor or you can attach an external pressure sensor. This sensor helps improve height estimates by correcting for ambient pressure changes that occur after takeoff. If your base station is situated in a different pressure environment than the aircraft (such as indoors), you can turn off the pressure sensor so that these corrections are not made.

If you are flying the aircraft with the tether, do not turn off the base station's pressure sensor.

1. In the aircraft status label, tap . A dialog box with the aircraft settings appears on the right side of the screen.
2. On the **Flight Settings** tab, clear the **Base Station Pressure Correction** check box.

Restart the base station remotely

If you cannot physically reach the base station and you want to restart it, you can use the **Base Configuration** web page.

1. Open the **Base Configuration** web page.

2. In the **Remote Restart** section, tap **Restart**.

Reset the base station's configuration

If you change the base station's **DHCP Mode** setting or **Network** mode, you can reset them to the default configuration.

Ensure that the base station has fully started before resetting the configuration.

1. If necessary, disconnect the base station from any multi-base station environments.
2. On the base station, press and hold  and  at the same time until  appears on the base station's LCD screen.
3. While  is flashing, press  .
4. Wait for approximately one minute for the change to take effect.

If  stops flashing before you press  , the base station's configuration did not reset.

PERFORMING MAINTENANCE ON THE SYSTEM

You must regularly perform maintenance on the system to keep it operating at its best and to reduce the potential of performance issues during a flight.

For more information on all maintenance activities for the system, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for "Maintenance Manual."

When performing maintenance and cleaning, use the following items:

- A magnifying glass for inspection
- Alcohol wipes
- Foam swabs
- A lint-free cleaning cloth

For more information on the recommended maintenance schedule, see "Scheduled maintenance checklist" on page 383.

Check the flight time

Right-tap the aircraft information label.

In the **Aircraft Odometer** dialog box, you can view your flight time and distance.

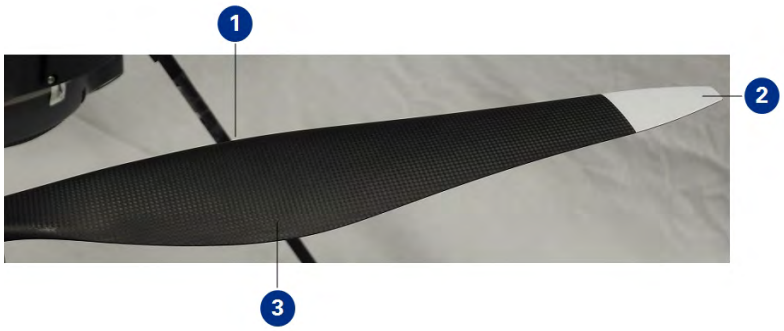
You can also view the flight time in ELB. In the **Equipment** module, select an aircraft. In the **Odometer** column, the total number of flight minutes appears. This amount only updates if you upload flight logs to ELB.

Inspect the propulsion arms and propellers

You should inspect the propulsion arms and propellers of your aircraft after every 5 flight hours or if you fly in winds greater than 40 km/h / 25 mph. You should also inspect the propulsion arms and propellers if your aircraft lands hard or if it lands on rough terrain.

If the aircraft reports yaw errors consistently, land the aircraft and perform a propulsion arm and propeller inspection before continuing.

When you inspect the propulsion arms and propellers, you are looking for stress cracks. When inspecting the propellers, check the following areas closely:



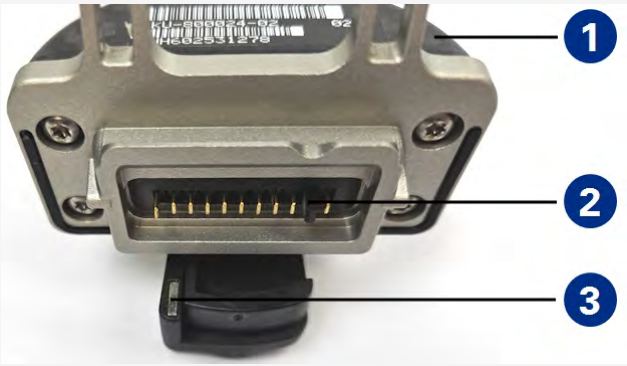
1. Leading edge
2. Propeller tip
3. Trailing edge

Propeller inspection locations

Perform the inspection in adequate lighting. Stress cracks can be very small and difficult to see. If you see any stress cracks in a propulsion arm or propeller, do not fly the aircraft with those parts.

You must also regularly inspect the arm latch on the propulsion arms. If you notice that a latch shifted after a flight, contact Support.

1. Remove the propulsion arm from the aircraft body. See "Remove the propulsion arms" on page 243.
2. Inspect the outside of the propulsion arm, including the arm itself, as well as the housing around the motor assembly.
3. Ensure the lock and latch are in the close position.
4. Turn the propulsion arm so the propeller is facing down.
5. On the underside of the lock, ensure that the magnet is present.

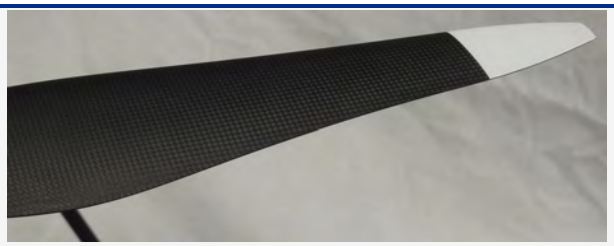


1. Propulsion arm
2. Arm connector
3. Arm lock magnet

6. Turn the propulsion arm so that the propeller is facing up.
7. Slowly rotate each propulsion arm and listen for any cracking or scratching sounds at the motor assembly.
8. If you are inspecting the propulsion arms with 18.5 inch propellers, blow off any dust that has collected in the motor assembly.
9. Bracing your thumb against the motor assembly, gently move each propeller tip up and down slightly and listen for any cracking sounds. Ensure that there is no gap between the motor assembly and arm.

1. Motor assembly
2. No gap between motor assembly and arm

10. Look for cracks along the leading edge of the propeller.
11. Look for cracks along the trailing edge of the propeller.
12. Inspect the tips of each propeller.



13. To inspect the arm latch, perform the following actions:

    a. Hold the propulsion arm at the propeller end.

    b. Gently shake the propeller back and forth. If the arm latch moves, it should be replaced.

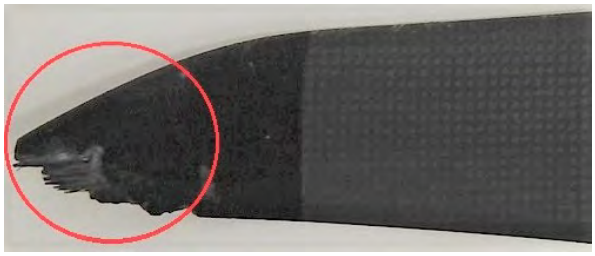
If you see any cracks or have issues with the arm latch, do not fly the aircraft until you replace the part. If necessary, contact Support to order replacement parts.

⚠ If you continue to fly the aircraft with a damaged propulsion arm, propeller, or latch, you might lose control of the aircraft. Injury or damages to people, property, and the aircraft can result.

Examples of propulsion arms and propellers that are not suitable for flight

The following examples show cracks in the propulsion arms and propellers. These parts are not suitable for flight.

Example	Location
	Crack in the propeller
	Crack at the propeller tip

Example	Location
	Split layers at the propeller tip
	Separation at the arm latch

Clean the leg contacts

You should clean the leg contacts every 5 flight hours to remove any dirt that has built up over time. If you don't, the dirt can interfere with the connection between the legs and the aircraft.

⚠ When cleaning the leg contacts, do not sweep down along the short edges of the pads. Doing so can damage the contacts and potentially prevents the contacts from connecting to the aircraft.

1. Position the leg with the contact board facing up.
2. Using a folded alcohol wipe, gently sweep across the contacts in the direction of the long edge of the connecting pads.

3. Repeat step 2 at various positions across the row of pads until you have cleaned them all.

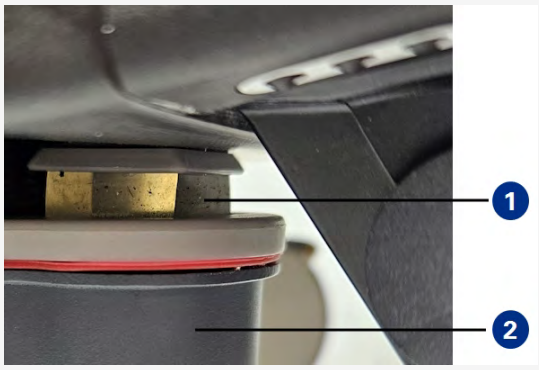
✓ If you fly in dirty or dusty environments on a regular basis, clean the contacts more frequently.

Inspect and clean the aircraft body

You need keep the aircraft body and, in particular, the vibration isolation dampers, clean.

The vibration isolation dampers separate the propulsion part of the aircraft from the main aircraft body and help to improve the quality of videos and pictures. There are eight clear-colored vibration isolation dampers on the aircraft body – four along the top and four along the bottom.

1. After flights, wipe down the system using the following guidelines:
    - In marine environments, clean the aircraft after every flight.
    - In regular environments, clean the aircraft after every 10 flights.
2. After every 5 flight hours, after every 30 days, or if your aircraft lands hard or lands on rough terrain, inspect the aircraft body.
3. After every 5 flight hours or every 30 days, inspect the aircraft's vibration isolation dampers. Inspect dampers at each leg while holding the main flight ring and gently rocking the main body back and forth, ensuring that the dampers remain in place.



1 Vibration isolation damper

2 Aircraft body

If the vibration isolation dampers appear to be separated from the aircraft, contact Support.

Clean the battery compartments

You should clean the battery compartments after every 5 flight hours or every 30 days.

If you fly in dirty or dusty environments on a regular basis, clean the battery compartment more frequently.

1. Remove the batteries from the aircraft.
2. Using a folded alcohol wipe, gently wipe along the edges of the battery compartment,

along the seal.

3. Clean the inside of the battery compartment.

Clean the camera lenses

Clean the camera lenses on a regular basis to ensure the best image quality.

To avoid scratching the surface, do not rub the surface with the cloth. Wipe across in single swipes, using a consistent direction, instead of rubbing back and forth.

1. Blow off any loose debris.
2. Fold a lint-free cloth in quarters.
3. Dampen the cloth with an optical quality cleaning fluid, such as eyeglass cleaner.
4. To loosen any debris, dab the area gently.
5. Using the cloth, wipe the surface clean.

Clean the tablet's screen

Wipe the screen with a soft, damp cloth.

UPGRADING THE SYSTEM SOFTWARE

Periodically, Teledyne FLIR provides updates to the system software. These updates can include new features and important performance improvements.

The tablet, base station, and aircraft must use the same system software version. You can upgrade the base station and aircraft independently but performing a system upgrade is the easiest way to make sure that all components are using the same version. If you update the tablet first, it prompts you to update the entire system.

About software update notifications

When you connect the tablet to the internet, if a software update is available, the following icons appear in the Windows notification area.

Icon	Description
	Software update available
	Downloading software update
	Software update downloaded and ready to install

Download software updates

If an update is available, when you connect to the internet, a notification appears in the Windows notification area.

You can also download software updates from the Customer Self-Service Portal at https://selfservice.teledyneflir.com.

1. In the Windows notification area, right-tap  .
2. Tap **Download Software Update**. While the software is downloading,  appears in the Windows notification area.
3. After the download finishes, right-tap  .
4. Tap **Install new software updates**.

Update the system

When you update the system, it must proceed without any interruptions. Before updating the software, fully assemble the aircraft. You must keep the tablet, base station, and aircraft turned on and connected during the update.

When upgrading, connect the tablet and base station to power outlets and install fully charged batteries into the aircraft. The upgrade does not proceed if the battery power level in the aircraft or base station batteries is less than 15%.

After the update of the aircraft and base station software is complete, the system updates all attached parts, including each leg, propulsion arm, payload, and battery. To update the arms, you must attach all four arms to the aircraft or take control of the aircraft in MCS first.

If you have extra batteries, legs, payloads, or propulsion arms, you must update those parts before flying with them. If you insert a part that does not match the system software, an error appears, and you cannot proceed with the flight until the part is updated. You must have at least two batteries in the aircraft to update the batteries. For more information on updating individual components, see "Update arms, legs, batteries, or payloads " on the next page.

Do not change the payload that is attached to the aircraft when an update is in progress, such as when the aircraft is updating its software or when you connect a payload that needs a software update.

1. Open MCS.
2. In the lower-left corner of the screen, tap  .
3. In the **Available Aircraft** dialog box, beside the aircraft name, tap **Update System**.
4. In the **FLIR System Update Tool** dialog box, tap **Update System**.
5. To view status information about the update, including the percentage of the update completed, select the **Show Details** check box.
6. After the update completes, close the dialog box.

After updating the system, the base station and aircraft restart and reconnect. If the update was successful, in the **Available Aircraft** dialog box, **Disconnect** appears in green beside the name of the aircraft. The aircraft's IP address appears below the aircraft name. If the aircraft does not appear in the dialog box, check that your tablet is connected to the base station. Restart the aircraft and base station.

For more information on updating the system when you are using multiple base stations, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for "multiple base stations."

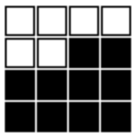
Update the components individually

If you do not update the entire system at one time, you can update the components individually. Update the aircraft first, followed by the base station.

1. In the lower-left corner of the screen, tap .
2. Tap .
3. On the **Connection** tab, select the aircraft or base station that you want to update.
4. Tap **Update**.

Update arms, legs, batteries, or payloads

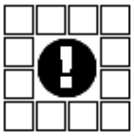
If you attach a propulsion arm or leg, insert a battery, or attach a payload that needs a software upgrade, the upgrade starts automatically. On the aircraft's LCD screen, a 4x4 grid appears. The grid shows the progress of the upgrade, filling up from the bottom right to the top left.



You must have at least two batteries in the aircraft to update the batteries.

You can also use the aircraft icon in MCS to monitor the progress of the upgrade.

If the upgrade process fails, an Upgrade Error icon appears on the LCD screen.



If the Upgrade Error icon appears, contact Support.

Do not change the payload that is attached to the aircraft when an update is in progress, such as when the aircraft is updating its software or when you connect a payload that needs a software update.

Configure the server for software updates

You can configure the server that MCS uses to check for software updates.

⚠ You should only change the server for software updates if you are instructed to do so by Support.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. On the **Preferences** tab, tap the **Advanced** tab.
5. Tap the **Configure Update Server URL** button.
6. In the **Update Server URL** dialog box, tap **Change Server**.
7. Complete the fields in the dialog box using the information provided to you by Support.
8. Tap **Save Changes**.

✓ To return to the default values, in the **Update Server URL** dialog box, tap **Reset**.

USING REMOTE ID

Certain geographical regions require that you broadcast a Remote ID to provide information about yourself as an operator, the location of your flight, the aircraft that you are using, and aircraft telemetry. In some regions, you must provide an operator ID. You might also need to specify an operator ID PIN and an aircraft registration ID. You can obtain all IDs from your local civil aviation authority (CAA).

> In some regions, you can opt out of enabling Remote ID, but others enforce its use. If the region that you are flying in enforces it, you must lock Remote ID. After you lock Remote ID, it cannot be unlocked. For more information, contact Support. As the operator of a small Unmanned Aircraft System, it is your responsibility to know and understand the rules around Remote ID, and whether you must comply with or are exempt from any enforcements in the regions where you fly. For more information on how to become compliant, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for "Remote ID compliance."

After you enable Remote ID, the aircraft broadcasts Remote ID information whenever it is turned on. You can set some Remote ID information before takeoff but specific information about the flight is also required during takeoff.

If there are any issues with the Remote ID broadcast before takeoff or during a flight, in the aircraft status label, the wireless signal strength flashes between and . Verify your settings. If the issue persists, contact Support.

> The aircraft's Remote ID configuration transmits at a power compatible with all ETSI EN 300 328 countries. You do not need to change anything for this power requirement. Remote ID operates regardless of the aircraft's Regional Power setting.

Enable Remote ID

If the regulatory region for your flight requires Remote ID, you must enable it for your flight.

In some cases, Remote ID might already be locked for your aircraft. After it is locked, you cannot turn it off.

> If Remote ID is not already locked, the regulatory region for your flight enforces Remote ID, and you are not exempt from the enforcement, you must enable Remote ID and then lock it, even if you are only flying in that region temporarily. For more information, see "Lock Remote ID" on the next page.

Always enable Remote ID before takeoff. Do not enable it when the aircraft is flying.

1. In the lower-left corner of the screen, tap .

2. Tap  .
3. On the **Connection** tab, tap the aircraft for which you want to enable Remote ID.
4. Tap  .
5. In the **Remote ID Settings** dialog box, select the **Enable Remote ID** check box.
6. Tap **Done**.

If you are using the system in dual operator mode, after you enable Remote ID, any operators that request control of the aircraft's movement must specify their operator ID to continue.

Lock Remote ID

If your home region enforces Remote ID, you must lock Remote ID for your aircraft. When Remote ID is locked, all flights broadcast the required Remote ID information.

After you lock Remote ID, it cannot be unlocked. If your region does not enforce Remote ID, do not lock it. For more information, contact Support.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap the aircraft for which you want to lock Remote ID.
4. Tap  .
5. In the **Remote ID Settings** dialog box, select the **Lock Remote ID** check box.
6. In the **Locking Remote ID** dialog box, read the statement carefully.
7. Select the check box.
8. Tap **OK**.
9. In the **Remote ID Settings** dialog box, tap **Done**.

About icons for Remote ID

A Remote ID icon appears beside the aircraft on the **Connection** tab of the **System Configuration** dialog box.

Remote ID icon	Description
	This icon appears when Remote ID is available but not enabled.
	This icon appears when Remote ID is available, enabled, but not broadcasting yet.
	This icon appears when Remote ID is available, enabled, and broadcasting.

Configure Remote ID settings before takeoff

You can configure the regulatory region for your flight, the registration ID that you obtained for your aircraft, and an operator ID. Depending on the regulatory region, you can also configure your operator ID PIN.

If you configure an operator ID, it becomes the default operator ID for the next flight. If other operators are flying the aircraft, they should change this setting or change the operator ID during takeoff. For more information, see "Take off with Remote ID enabled" on the next page.

1. In the lower-left corner of the screen, tap .
2. Tap .
3. On the **Connection** tab, tap the aircraft for which you want to configure Remote ID settings.
4. Tap .
5. In the **Remote ID Settings** dialog box, complete the **Regulatory Region**, **CAA Registration ID**, and **CAA Operator ID** fields.
6. If you set the **Regulatory Region** field to **European Union**, complete the **Operator ID PIN** field.
7. Tap **Done**.

After configuring Remote ID, if there are any issues with the Remote ID broadcast before takeoff, in the aircraft status label, the wireless signal strength flashes between and . Verify your settings. If the issue persists, contact Support.

Remote ID settings

You can configure the following Remote ID settings.

Setting	Description
Regulatory Region	This field specifies which regional Remote ID regulations and laws to adhere to. You can select the **United Kingdom (UK)**, **United States (US)**, or **European Union (EU)**. If you are flying outside of these regions, select which regional laws to adhere to. If you select **United Kingdom** or **European Union**, you must complete the **CAA Operator ID** field. This ID is called an Operator Registration Number (OPRN). If you select **European Union**, you must also complete the **Operator ID PIN** field.
CAA Registration ID	This field specifies the registration ID for the aircraft that you obtained from your local civil aviation authority.
CAA Operator ID	This field specifies the operator ID that you obtained from your local civil aviation authority.
Operator ID PIN	For European Union operators, this field specifies the operator ID PIN. Typically, this PIN is the last three digits of your operator ID.

Take off with Remote ID enabled

If you are using Remote ID, you must specify some information about your flight before taking off.

If you are connected to ELB, you set the required Remote ID information in the **Select Pilot** dialog box.

1. On the map, tap the body of the aircraft icon.
2. In the **Remote ID** dialog box, set the **Operation Category** drop-down list.
3. In the **CAA Operator ID** field, specify or change the operator ID. You can type a value or select one from the list of previous operator IDs.
4. If you configured the **Regulatory Region** of your Remote ID settings to **European Union**, specify the **Operator ID PIN** field.
5. Change the **Flight Description** field. You can type a description or select one from the list of previous flight descriptions.
6. Tap **Continue**.
7. Complete the remaining steps of the takeoff process. For more information, see "Take off"

on page 66.

During the flight, if there are any issues with Remote ID, a warning appears below the aircraft icon. In the aircraft status label, the wireless signal strength flashes between and . If there are issues during the flight, land the aircraft as soon as possible. Verify your Remote ID settings and try to take off again. If the issue persists, contact Support.

Remote ID takeoff settings

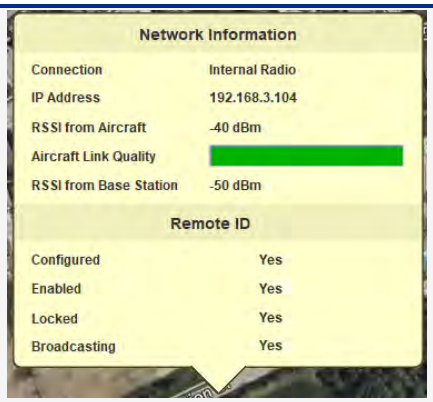
You can configure the following Remote ID settings during takeoff.

Setting	Description
Operation Category	This drop-down list specifies the type of flight that you are flying. You must select an option if you are flying in the EU. For definitions on each operations category, contact your local civil aviation authority.
CAA Operator ID	This field specifies the operator ID that you obtained from your local civil aviation authority.
Operator ID PIN	For European Union operators, this field specifies the operator ID PIN. Typically, this PIN is the last three digits of your operator ID.
Flight Description	This field specifies a description of your flight. This description is optional and can contain a maximum of 23 characters.

View Remote ID status information

In the **Network Information** dialog box, you can view more information about your aircraft's Remote ID status.

1. In the aircraft status label, tap .
2. In the **Network Information** dialog box, review the information in the **Remote ID** section.



Remote ID status information

Field	Description
Configured	If this field is **Yes**, the aircraft received a valid Remote ID configuration from MCS. If this field is **No**, there is a problem with the Remote ID configuration, such as an invalid or missing operator ID.
Enabled	If this field is **Yes**, Remote ID is enabled. If this field is **No**, Remote ID is not enabled.
Locked	If this field is **Yes**, Remote ID is locked. If this field is **No**, Remote ID is not locked.
Broadcasting	If this field is **Yes**, the aircraft is broadcasting the Remote ID. If the **Enabled** field is **Yes**, but the **Broadcasting** field is **No**, restart the aircraft. If the problem persists, contact Support.

Turn off Remote ID

You can only turn off Remote ID if the regulatory region for your flight does not enforce using Remote ID. If Remote ID is locked on your aircraft, you cannot turn it off.

1. In the lower-left corner of the screen, tap .
2. Tap .
3. Tap the aircraft for which you want to turn off Remote ID.

4. Tap  .
5. In the **Remote ID Settings** dialog box, clear the **Enable Remote ID** check box.
6. Tap **Done**.

USING ELB

The Electronic Log Book (ELB) solution is a subscription-based solution consisting of two applications: a web application and the Squad View mobile application. As an observer in the field, you can use the Squad View mobile application to broadcast video to a mission from your smartphone. You can broadcast video from various sources, including an aircraft, a third-party device, or your smartphone camera. Remote users can use either the web application or the mobile application to view the videos that are broadcast to the mission.

Users of the web application can also plan flights, track equipment, view flight details, and track pilot currency.

> To access ELB, you must be connected to the internet. You must also have an ELB username and password.

For more information on ELB, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for the *Electronic Log Book User Guide*.

Connect MCS to ELB

Before flying a mission, you should connect MCS to ELB by logging in. When you do, MCS updates the list of missions and pilot names.

You should also log in to ELB so that your flight logs are uploaded to ELB. MCS uploads the logs automatically if it is configured to do so and an internet connection is available.

Connecting MCS to ELB alone does not allow you to broadcast video. You must use the Squad View mobile application or a supported third-party transmitter to broadcast the video from your aircraft. For more information on broadcasting video, search the Customer Self-Service Portal at https://selfservice.teledyneflir.com for the *Electronic Log Book User Guide*.

> When you installed MCS, if you agreed to share log information with Teledyne FLIR, but you do not connect MCS to ELB, logs are sent to Teledyne FLIR and are not added to ELB. (If you are not logged in, MCS cannot associate the logs with your ELB account.) If you connect MCS to ELB later, you must add any previous logs to ELB. For more information, see the *Electronic Log Book User Guide*.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .

4. If necessary, at the top of the **Cloud Services** tab, set the drop-down list to **ELB**.
5. Tap the **Login** tab.
6. Tap **Login**.
7. Type your ELB username and password.
8. Tap **Sign In**. The software updates the **Last Update**, **Pilot Count**, and **Mission Count** fields.

To log out, on the **Cloud Services** tab, click **Logout**.

When you are logged in to ELB, you can refresh the tablet's list of pilot names and available missions at any time. On the **Cloud Services** tab, click **Refresh**. The **Refresh** button turns gray. When the button is available again, MCS has the updated list of pilots and missions.

Configure how flight logs are sent to ELB

After the system downloads flight logs to the tablet, you should upload the logs to ELB so that your equipment and flights are tracked. You can configure how the flight logs are sent.

If you choose to send flight logs to ELB, you must connect the tablet to the internet and connect MCS to ELB. For more information, see "Connect the tablet to the internet" on page 45 or "Connect MCS to ELB" on the previous page.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. If necessary, at the top of the **Cloud Services** tab, set the drop-down list to **ELB**.
5. In the Windows notification area, tap  .
6. Perform one or more of the following actions:
   - To send flight logs from the aircraft to ELB automatically (after the tablet is connected to the internet and after you open MCS), ensure that **Upload Logs To ELB** is selected.
   - To start the upload process when you turn on the tablet (after the tablet is connected to the internet but before you open MCS), ensure that **Open on Start-Up** is selected.

Transfer flight logs to ELB manually

If you are logged in to ELB, you configured MCS to send flight logs to ELB, and you connected the tablet to the internet, the system should transfer flight logs automatically. If the flight logs are not transferred automatically, you can transfer them manually.

In the lower-left corner of the screen, tap . Tap . Tap . Ensure that the drop-down list at the top of the **Cloud Services** tab is set to **ELB**.

1. If you are not logged in to ELB, perform the following actions:
    a. In the Windows notification area, tap .
    b. Tap **Log In**.
    c. Type your ELB username and password.
    d. Tap **Sign In**.
2. In the Windows notification area, tap .
3. Tap **Upload Logs Now**.

If the log upload is not successful, in the Windows notification area, tap . Tap **Retry Log Upload**.

View information about transmitters

If you use a Dejero GoBox or Dejero EnGo to transmit video to ELB, you can view information about the transmitter in MCS.

Connect the GoBox or EnGo to the base station using an Ethernet cable.

1. In the lower-left corner of the screen, tap .
2. Tap .
3. Tap .
4. If necessary, at the top of the **Cloud Services** tab, set the drop-down list to **ELB**.
5. Tap the **Transmitter** tab.

You can view the connection status of the transmitter, the transmitter's IP address, and its serial number.

Disconnect MCS from ELB

You can disconnect MCS from ELB so that you are not prompted to log in to ELB when you start MCS.

If you disconnect MCS from ELB, after a flight, MCS does not upload flight logs to ELB automatically. If you want to track your flight logs using ELB, you must upload them manually.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. At the top of the **Cloud Services** tab, set the drop-down list to **None**.

Configure MCS for an on-premises installation

If your organization is using an on-premises solution for ELB, you can configure MCS to connect to your local server. For more information, contact your Organization Administrator.

1. In the lower-left corner of the screen, tap  .
2. Tap  .
3. Tap  .
4. If necessary, at the top of the **Cloud Services** tab, set the drop-down list to **ELB**.
5. Tap the **ELB Server** tab.
6. To unlock the fields, tap **Change Server**.
7. Perform the following actions:
    a. In the **Current Server** field, type the location for the server.
    b. Set the **Client ID** and **OAuth URL** fields to the appropriate values for your authentication server.
8. To accept the change and lock the fields, tap **Save Changes**.

If you want to reset the fields to the default values, tap **Reset Server**.

SETTING UP VIDEO MULTICASTING

You can set up video multicasting to stream the video from any camera to multiple devices simultaneously. You might want to configure this feature if the aircraft's video needs to be available on a remote device, such as a PC, tablet, or smartphone.

Open the multicast web page

1. Verify that the tablet is connected to the base station and the aircraft.
2. Open MCS.
3. In the lower-left corner of the screen, tap  .
4. Tap  .
5. In the lower-left corner of the **Available Aircraft** dialog box, beside  , tap  .
6. In **Network Information** dialog box, note the IP address for the base station.
7. On the second device, perform the following actions:
    a. Connect the device to the base station using a wired Ethernet connection or a wireless connection.
    b. Open a browser.
    c. In the address bar of your browser, type the IP address of the base station.
    d. Press Enter.

The multicast web page appears.

Start a UDP video stream

You can use UDP to push the aircraft's video stream to other devices.

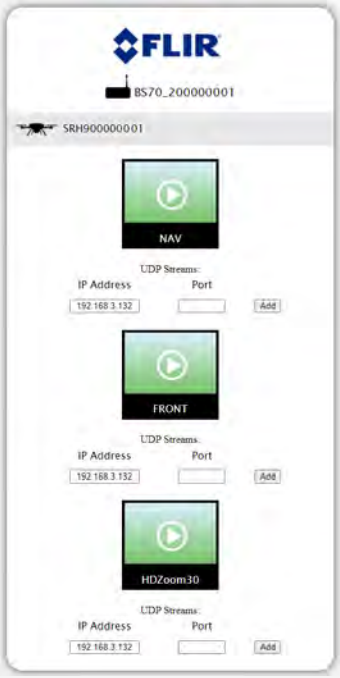
To start a UDP video stream, you must have the IP address and port of the device that you are streaming to. The device must be on the same network as the base station.

1. On the multicast web page, below a video stream, in the **UDP Streams** section, perform the following actions:

a. In the **IP Address** field, type the IP address for the device that you want to stream to.

b. In the **Port** field, type the port for the device that you want to stream to.

c. Tap **Add**.



2. In your device's streaming application (such as VLC), manually open the multicast stream to the IP address and port that you specified on the multicast web page.

Start an RTSP video stream

On the multicast web page, tap a video stream.

Your device's RTSP streaming application, such as VLC, opens.

✓ To copy the RTSP address, right-click the RTSP video stream. Tap **Copy link address**.

TROUBLESHOOTING

You can start to resolve issues that might arise by reviewing the notifications that appear on the tablet.

Review notifications

You can use the **Notifications** dialog box to review any notifications, such as error or warning messages.

When notifications are available, appears at the bottom of the screen. If you have not read the notifications, the icon is blue. When you open the **Notifications** dialog box, the icon turns white.

If the number of unread notifications is less than ten, the number appears beside . If there are more than ten unread notifications, **10+** appears with the icon. The number remains beside the icon until you clear the notifications.

✓ In MCS, a tone plays any time a notification appears in the **Notifications** dialog box.

1. At the bottom of the screen, tap .
2. Review the notifications from the flight.

In the **Notifications** dialog box, the color beside each notification indicates the severity of the message. Red appears beside fatal errors, yellow appears beside non-fatal warnings, and blue appears beside informational warnings and messages.

Clear notifications

In the **Notifications** dialog box, all notifications remain until you close the software, or you clear them manually.

1. At the bottom of the screen, tap .
2. In the **Notifications** dialog box, tap **Clear** .

Replace the aircraft's memory card

You might need to replace the aircraft's memory card if it is full or if memory card errors appear.

Before replacing the aircraft's memory card, turn off the aircraft.

1. Remove the payload from the aircraft.
2. In the payload compartment of the aircraft, to remove the memory card from the memory card slot, push the memory card in and pull it out.
3. Slide a different memory card into the memory card slot.

Reconnect the tablet to the base station's Wi-Fi network

If you change the password for the base station’s Wi-Fi network or you forget the password, you must reconnect the tablet to the base station.

If you do not have the password for the base station's Wi-Fi network, you must connect the base station and the tablet using an Ethernet connection. When they are connected, open the **Base Configuration** web page. In the **Wi-Fi Command Network** section, copy the value that appears in the **Passkey** field.

1. In the Windows notification area, tap .
2. In the list of networks, tap the base station’s Wi-Fi network name.
3. Select the **Connect automatically** check box.
4. Tap **Connect**.
5. Paste the base station's Wi-Fi password.
6. Tap **Connect**.

Pair an aircraft with a base station

If the aircraft does not appear in the **Available Aircraft** dialog box or on the **Connection** tab of the **System Configuration** dialog box, you might need to pair it with the base station.

1. On the base station, press and hold until appears on the base station’s LCD

screen.

2. On the aircraft, press and hold  until  appears on the aircraft's LCD screen.

When a check mark replaces the magnifying glass, the aircraft pairs with the base station. On the tablet, the aircraft name appears in the **Available Aircraft** dialog box and on the **Connection** tab of the **System Configuration** dialog box.

If you cannot access the base station to pair with the aircraft, you can use the **Base Configuration** web page to pair remotely. For more information, "Pair an aircraft to a base station remotely" below.

Pair an aircraft to a base station remotely

If you cannot reach the base station physically, and you want to pair an aircraft to it, you can use the **Base Configuration** web page to pair them remotely.

If you pair the aircraft to a base station remotely, the LCD screen on the base station does not update to show that pairing is in progress.

1. Open the **Base Configuration** web page.
2. In the **Pairing** section, tap **Start Pairing**.
3. On the aircraft, press and hold  until  appears on the aircraft's LCD screen.

When a check mark replaces the magnifying glass on the aircraft's LCD screen, the aircraft pairs with the base station.

Stream video in standard definition

During regular flight operations, the aircraft captures videos in high definition. If, during a flight, communications are intermittent due to range or interference, you can force the aircraft to stream video in standard definition to conserve bandwidth and battery life.

1. In the toolbar of the primary video panel, tap  .
2. Tap **View Options**.
3. Select the **Enforce SD Video Stream** check box.

Manage magnetic interference during flight

If the aircraft detects strong magnetic interference, the early warning detection indicator appears prior to a non-fatal warning. For more information on the early warning detection indicator, see "Detect warnings early" on page 247.

1. Move the aircraft out of the strong magnetic area. As the aircraft accelerates, the aircraft resets the magnetic error estimate.
2. Continue to fly the aircraft, monitoring the early warning detection indicator until it returns to green.

After the early warning detection indicator returns to green, you can continue your flight and position the aircraft in the magnetic area again.

Manage issues with battery temperature during flight

If the aircraft detects an increase in the battery temperature, the early warning detection indicator appears on the tablet, along with a non-fatal warning. If this warning appears, perform the following actions:

1. Return the aircraft to the home position.
2. Land the aircraft.
3. Replace the batteries immediately.

It takes time for the aircraft to fly home and land. Battery temperature levels can rise quickly, causing a fatal error. Do not ignore the non-fatal warning message.

Manage your video stream files

If you are recording your video stream while flying the aircraft, a Disk Usage warning might appear on the tablet. You can stop recording the video stream or delete the video stream files, but you can also move the video stream files to an external drive to free up space on the tablet.

1. Connect an external hard drive to the tablet.
2. Using Windows, move video stream files from the tablet to the external drive.

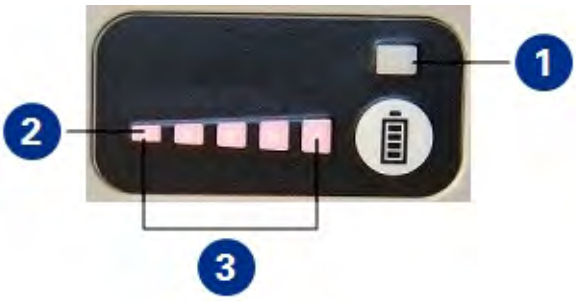
If you know that you need to record the video stream, before your flight, connect an external drive to the tablet and change the default folder for videos and pictures. For more information, see "Change the default folder for pictures and videos" on page 102.

Check the status of an aircraft battery

Not only do the lights on the side of the battery provide information about the battery's power level, but they also provide information on the status of the battery, its temperature, and health.

On the side of a battery, press  .

The status LED indicates the health of the battery. A combination of the LED lights and the status light indicates errors with the battery, such as temperature fluctuations or poor battery health.



1. Status LED
2. First LED
3. LED lights

Battery error codes

Battery activity	Description
Third LED blinks	The battery requires a software update. For more information, see "Update the components individually" on page 339.
Fourth LED blinks	The battery is too cold. Let the battery warm up before flying with it or charging it.
Fifth LED blinks	The battery is too hot. Let the battery cool down before flying with it or charging it.
Status LED blinks quickly	The battery health is less than 80%, meaning that the battery cannot be fully charged. The battery can only charge to less than 80% of the capacity of a new battery. The LED lights indicate the current charge level as a percentage of that reduced capacity. To see the battery health level, check the status in MCS. To replace the battery, contact Support.
Status LED blinks and any other LED blinks	There are problems with this battery. Contact Support.

Drain an aircraft battery using the battery diverter

Before shipping the aircraft batteries, use the battery diverter to drain the power level of each battery to approximately 30%.

You can use the battery diverter to drain the battery, but, depending on the battery level, it can take a long time to discharge the battery to 30%. Flying the aircraft is the fastest way to drain a battery.

Insert an aircraft battery into the battery diverter. The LED on the battery diverter turns red to indicate that the diverter is draining power from the battery.

If the aircraft battery is already below 30%, the LED on the battery diverter does not turn on when you insert the battery into the diverter.

When the battery is below 30%, the LED on the diverter turns off.

When the LED on the diverter turns off, remove the battery from the diverter. If you keep the battery on the diverter, the battery remains turned on, so it continues to drain lower than 30%.

Calibrate the compass manually

If a compass error appears before takeoff or if you are flying in an area with limited takeoff space, you can calibrate the compass manually. The aircraft keeps the manual compass calibration setting until you change the payload, legs, or batteries, or you turn off the aircraft and turn it on again.

You should only need to calibrate the compass manually if you are instructed to do so by Support. It is easier to complete the calibration with two people.

Before calibrating the compass manually, ensure that:

- You remove all metal objects that might interfere with the magnetometer, such as watches, belts, or rings.
- You are outdoors and away from buildings.
- You insert the batteries into the aircraft and attach the legs and payload. Ensure that the payload is fully initialized.
- You take control of the aircraft in MCS, and the aircraft is not in simulator mode.

During the compass calibration, the **Calibration confidence** field shows a percentage and a color to represent how accurate the compass calibration was. The value should be higher than 80%.

To perform a manual compass calibration, you turn the aircraft at a constant height to establish the compass' directions. Always hold the aircraft at approximately chest height and turn it in the same direction when you turn it 360°. For example, if you turn the aircraft toward yourself the first time that you turn it 360°, turn it toward yourself for the next turn.

1. Verify that you have attached the payload and legs properly.
2. If necessary, connect to the aircraft.
3. In the aircraft status label, tap . A dialog box with the aircraft settings appears on the right side of the screen.
4. Tap **Compass Calibration**.
5. To use more sample points during the calibration, perform the following actions:
    a. Tap **Show Diagnostics**.
    b. Tap **Medium**.
6. Tap **Start**.
7. While monitoring the calibration status on the tablet, perform the following actions:
    a. Hold the aircraft at chest height from the ground with the batteries facing upward.
    b. Rotate the aircraft 360° in pitch.
    c. Rotate the aircraft 45° in yaw.
8. Repeat step 9 until the compass directions change from yellow to green. When all directions turn green, the **Calibration confidence** field is above **80%**, and the settings are stable, the calibration is complete.
9. Tap **Store**.
10. Tap **OK**.

Recover a lost aircraft

If you lose the aircraft, you can use MCS and the last known GPS location of the aircraft to identify a search zone.

1. If you lose an aircraft, keep MCS open on the tablet.
2. In the lower-right corner of the screen, tap .

3. Tap  .
4. Add a POI where the aircraft icon appears on the screen.
5. Beside the POI, tap  .
6. Record the location of the POI.
7. Save the flight plan.
8. Carrying the base station and tablet, move toward the last known location of the aircraft. Use the map to match the base station icon that appears on the map with the POI. When you reach the last known location, the base station icon appears on top of the aircraft shadow.
9. Start searching downwind.

You can also use the tablet's GPX file to assist with the recovery of a lost aircraft. On the tablet, navigate to **C:\Users\user_name\FLIR_MCS\Downloads\GPSLogs**.The file format is <aircraft name_serial number><Date><Time>. Copy the current flight's .gpx file to the tablet's desktop. In Google Earth or GPS Visualizer, open the file. The flight path of the aircraft appears on a map and it includes the aircraft's takeoff and landing locations, as well as its last reported position.

Reset the aircraft's configuration

If you change the aircraft's **Network** mode, you can reset it to the default configuration.

Ensure that the aircraft has fully started before resetting the configuration.

1. On the aircraft, press and hold  and  at the same time until  appears on the aircraft's LCD screen.
2. While  is flashing, press  .
3. Wait for approximately one minute for the change to take effect.

If  stops flashing before you press  , the aircraft's configuration did not reset.

Resetting the aircraft's configuration only changes the aircraft's **Network** mode. It does not affect any other settings, such as the aircraft's SSID.

Stop the motors

If there is an emergency, you can stop the aircraft's motors immediately. This action shuts down the propellers on the arms and the aircraft falls from its current height to the ground.

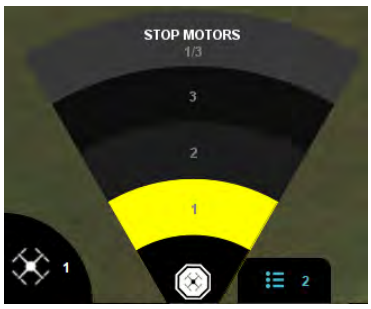
⚠

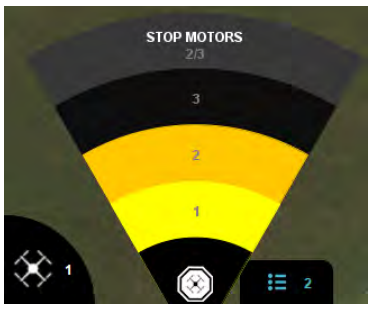
- Use this feature in emergencies only.
- All motors stop and, if the aircraft is in the air, it falls to the ground.
- If you begin to stop the motors when the aircraft is landing, but do not complete the procedure before it times out, the aircraft continues to land.
- After you complete the process to stop the motors, you cannot cancel, stop, or undo the command.
- Depending on the height of the aircraft, damage to the propulsion arms, legs, payload, or aircraft body can result. Injury or damages to property can also occur.

1. At the bottom of the screen, hover the stylus over . The aircraft information label changes to **STOP MOTORS** and turns red. A graphic appears over the aircraft shadow.

2. Tap . The **Stop Motors** indicator appears on the screen.
3. Within 3 seconds, tap the icon two more times, with a deliberate pause between each tap.

As you tap , the **Stop Motors** indicator changes to show you are moving through the process:





The aircraft falls from its current height to the ground.

You can also stop the motors when landing the aircraft using video assistance. In the toolbar of the primary video panel, tap . Tap the icon two more times with a deliberate pause between each tap.

TECHNICAL SPECIFICATIONS

Category	Details
Endurance	Using arms with 18.5 inch propellers: Greater than 40 minutes Using HL-LE arms and front EO/IR camera only, with standard batteries: Greater than 45 minutes Using HL-LE arms and XL batteries: 59 minutes
Wind speed tolerance	65 km/h / 40 mph sustained; 90 km/h / 56 mph gust
Dust tolerance	IP54
Rain tolerance	IP54 and MIL-STD-810G
Environmental temperature range	-20°C to 50°C / -4°F to 122°F
Beyond line-of-sight range	5 km / 3 miles integrated capability; extensible beyond 8 km / 5 miles
Altitude	Sea level to 4572 m / 15000 ft MSL
Ascent and descent rates	Maximum Ascend Speed: 6.0 m/s / 13.1 ft/s Maximum Descend Speed: 3.5 m/s / 11.5 ft/s Minimum Descend Speed: 1.8 m/s / 5.9 ft/s Descend Speed (at approximately 10 m to 20 m / 33 ft to 66 ft above estimated ground height): 1.2 m/s / 3.9 ft/s Landing Speed: 0.3 m/s / 0.98 ft/s
Launch and recovery method	Vertical takeoff and landing (VTOL)
Payload capacity	Using arms with 18.5 inch propellers: 2 kg / 4.4 lb Using HL-LE arms and standard batteries: 3.5 kg / 7.7 lb Using HL-LE arms and XL batteries: 2 kg / 4.4 lb
Navigation LEDs	Red/Green/NIR

Category	Details
	IR navigation LEDs operate at 850 nm
Radio frequencies	900MHz, 915MHz, 922MHz, 2.2GHz, or 2.489GHz
Base station	Removeable antennas The battery runs for up to 6 hours per charge.

EQUIPMENT WEIGHTS

The following equipment weights are subject to change.

Part	Weight	
Aircraft body	Block 1 aircraft: 1.6 kg / 3.6 lb	
	Block 2 aircraft: 1.9 kg / 4.2 lb	
Arms	Each arm with 18.5 inch white-tipped propeller:	292 g / 10.3 oz
	Each arm with 18.5 inch black-tipped propeller:	282 g / 9.9 oz
	Each HL-LE arm (white-tipped propeller):	348 g / 12.3 oz
	Each HL-LE arm (black-tipped propeller):	335 g / 11.8 oz
	Each HL-LE arm (white-tipped propeller, with retention slots):	356 g / 12.6 oz
	Each HL-LE arm (black-tipped propeller, with retention slots):	345 g / 12.2 oz
	Each HL-LE V2 arm (white-tipped propeller):	377 g / 13.3 oz
	Each HL-LE V2 arm (black-tipped propeller):	366 g / 12.9 oz
Legs	Each 295 mm leg:	1-dot: 51 g / 1.8 oz 2-dot: 48 g / 1.7 oz 3-dot: 44 g / 1.6 oz
	Each 417 mm leg:	1-dot: 56 g / 2 oz 2-dot: 52 g / 1.8 oz 3-dot: 50 g / 1.8 oz
	Each 417 mm leg (with retention hooks):	1-dot: 60 g / 2.1 oz 2-dot: 59 g / 2.1 oz 3-dot: 56 g / 2 oz
	Each 542 mm leg:	1-dot: 62 g / 2.3 oz 2-dot: 51 g / 2.2 oz 3-dot: 57 g / 2.1 oz
	Each 542 mm leg (with retention hooks)	1-dot: 67 g / 2.4 oz

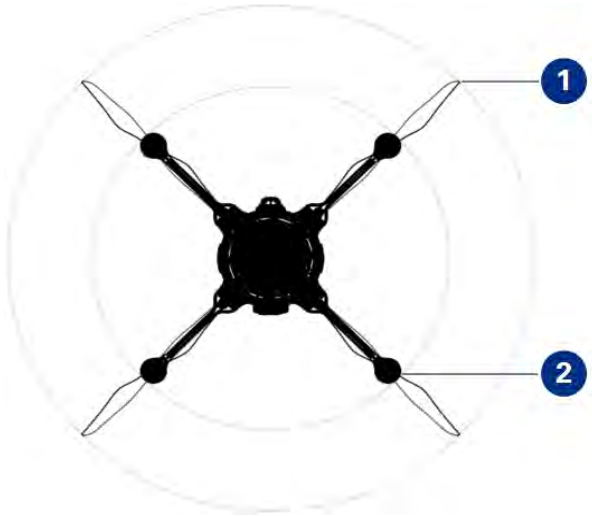
Part	Weight
	2-dot: 65 g / 2.3 oz 3-dot: 62 g / 2.2 oz
Standard aircraft battery	478 g / 1.1 lb
XL aircraft battery	949 g / 2.1 lb
Osprey	150 g / 5.3 oz
Base station (with four antennas attached)	2.440 kg / 5.379 lb

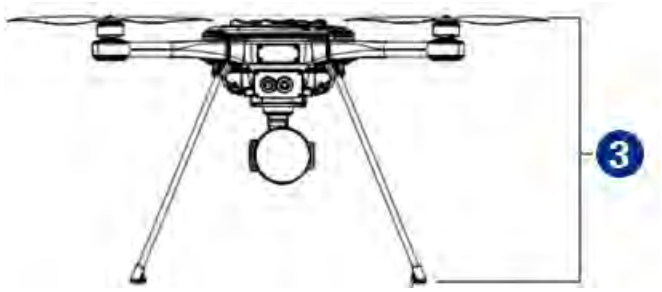
EQUIPMENT DIMENSIONS

The following equipment dimensions are subject to change.

18.5 inch propellers configuration

The following images outline the dimensions of the aircraft when it is using the 18.5 inch propellers and the 325 mm legs.

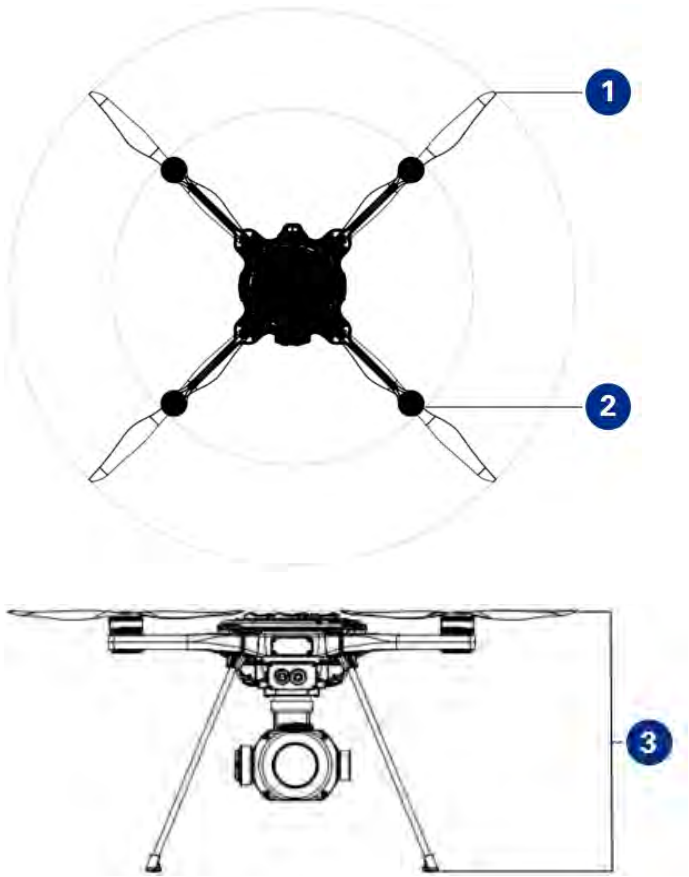




1. Distance from propeller tip to propeller tip (across the body of the aircraft): 1270.15 mm / 50 inches
2. Distance from arm tip to arm tip (across the body of the aircraft): 862 mm / 34 inches
3. Height from propeller tip to the bottom of the foot: 452.73 mm / 18 inches

Heavy Lift - Long Endurance propellers configuration

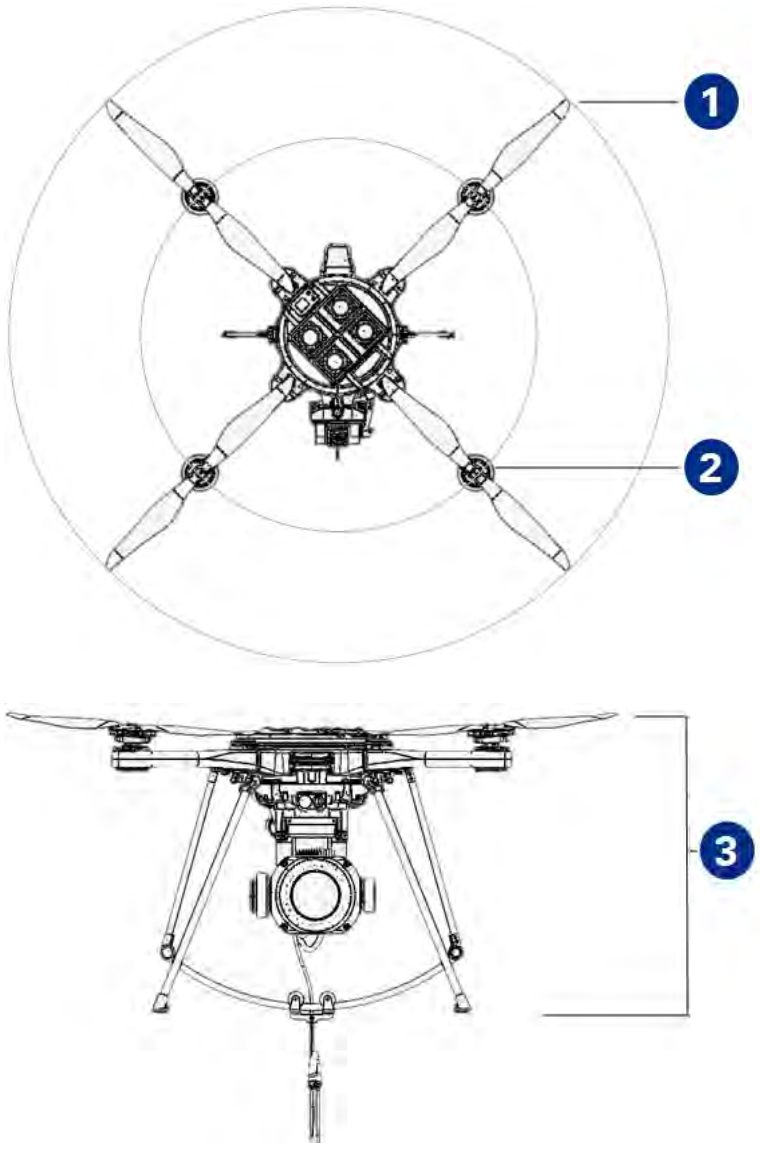
The following images outline the dimensions of the aircraft when it is using the Heavy Lift - Long Endurance arms and the 417 mm legs.



1. Distance from propeller tip to propeller tip (across the body of the aircraft): 1346.36 mm / 53 inches
2. Distance from arm tip to arm tip (across the body of the aircraft): 862 mm / 34 inches
3. Height from propeller tip to the bottom of the foot: 449.75 mm / 18 inches

Heavy Lift - Long Endurance propellers with tether configuration

The following images outline the dimensions of the aircraft when it is using the Tether Kit, along with the Heavy Lift - Long Endurance V2 arms and the 417 mm legs.



1. Distance from propeller tip to propeller tip (across the body of the aircraft): 1346.36 mm / 53 inches
2. Distance from arm tip to arm tip (across the body of the aircraft): 875 mm / 34 inches
3. Height from propeller tip to the bottom of the foot: 453 mm / 18 inches

CAMERA SPECIFICATIONS

This section contains information for each camera available with the aircraft.

Front EO/IR camera

The front EO/IR camera offers un-stabilized, EO (RGB color) and IR cameras. This camera is factory installed and perfect for providing situational awareness when non-camera payloads are attached or for enhancing camera payloads with additional information.

The thermal imaging allows you to alternate between White-hot, Black-hot, Rainbow, and Ironbow IR color palettes. You can stream either EO or IR feeds securely and simultaneously to multiple devices in a C4ISR or another IP network.

With a Block 1 aircraft, you can also quickly switch between streaming daylight imaging, thermal imaging, picture-in-picture, and daylight/IR fuse modes.

Camera features

- Low-latency, all-digital network
- Can stream video to multiple devices
- Field of vision for pictures that matches the EO or IR setting
- Default capture interval for pictures of one second

Front EO/IR camera on a Block 1 aircraft

- Operating temperature range 0°C to 40°C / 32°F to 104°F
- EO camera:
    - Uses 90° wide field of view
    - 1080p30 H.264 HD recorded and streaming video
    - Picture resolution: 1920 x 1080 px
- IR camera:

- 160 x 120 H.264 video
- Uses 57° x 44° field of view
- White-hot, Black-hot, Rainbow, and Ironbow color palettes
- Fuse and picture-in-picture camera modes
- Picture resolution: 160 x 120 upscaled to 1920 x 1080 px

Front EO/IR camera on a Block 2 aircraft

- Operating temperature range -20°C to 50°C / -4°F to 122°F
- EO camera:
    - Uses 80° wide field of view
    - 720p24 H.264 HD recorded and streaming video
    - Picture resolution: 4056 x 3040 px
- IR camera:
    - Uses 34° wide field of view
    - White-hot, Black-hot, Rainbow, and Ironbow color palettes
    - 640x512p24 (upscaled) recorded and streaming video
    - Picture resolution: 320 x 256 px

Navigation cameras

Four seamlessly integrated navigation cameras provide a field of view below the aircraft. Use these cameras to aid navigation, improve situational awareness in beyond-visual-line-of-sight scenarios, and place objects more accurately.

Camera features

- Low-latency, all-digital network
- Can stream video to multiple devices

Navigation cameras on a Block 1 aircraft

- 170° view below the aircraft
- 640 x 480 (monochrome VGA) H.264 HD recorded video
- Operating temperature range of -20°C to 50°C / -4°F to 122°F

Navigation cameras on a Block 2 aircraft

- 202° view below the aircraft
- 1920 x 1200 (monochrome VGA) H.264 HD recorded video
- Operating temperature range of -20°C to 50°C / -4°F to 122°F

OSPREY PAYLOAD SPECIFICATIONS

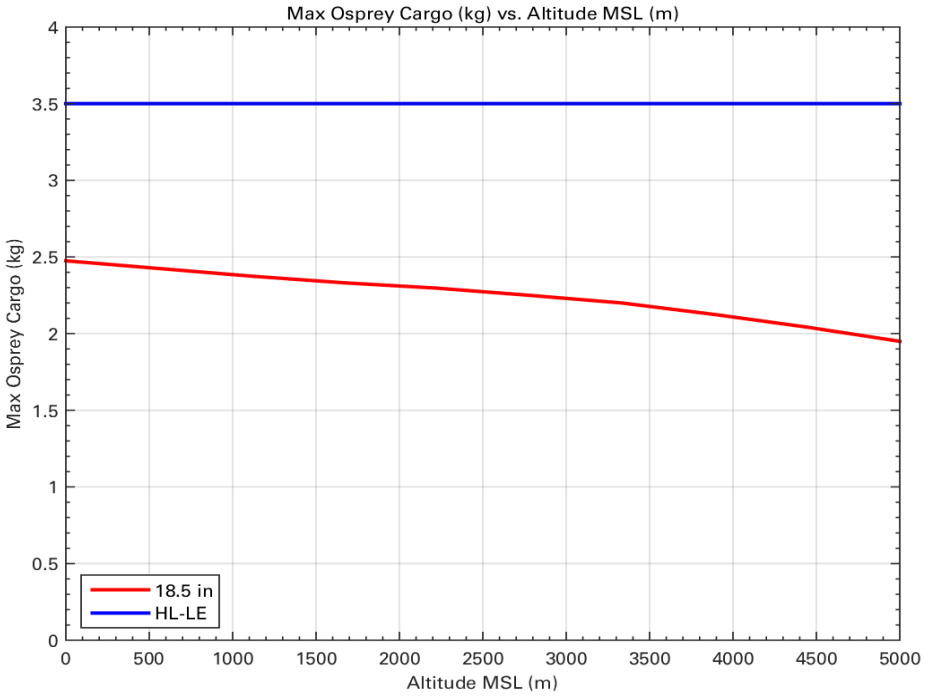
With the Osprey drop payload, you can attach and, locally or remotely, drop almost any user-specified package weighing up to 3.5 kg / 7.7 lb (depending on the propulsion arms used with the aircraft.) An industrially rated servo, coupled with both hardware and software controls, gives you the flexibility to deliver needed supplies, retrieve critical packages, or fly with a mounted package (such as an independently powered, standalone sensor or radio). A selection of mounting plates provides a flexible platform, so that you can affix a large variety of packages safely. The payload can also accept custom mounting plates.

Features

- Industrially rated servo
- Carrying capacity up to 2 kg / 4.6 lb (when using 18.5 inch propellers)
- Carrying capacity up to 3.5 kg / 7.7 lb (when using HL-LE arms)
- Temperature range of -20°C to 50°C / -4°F to 122°F
- Weather and rain resistant

Flight performance with the Osprey payload

The following chart shows the weight of cargo that the Osprey payload can carry and the corresponding height that the aircraft can fly:



DATA LOCATIONS

Any data captured during a flight, including metadata for pictures is stored on the aircraft memory card.

If the system saves data in folders by date and time, the folder naming conventions follow DCIM standards.

Camera or camera payload	Data type	Data location	Comments
Front EO/IR camera	Pictures Videos	Aircraft memory card in folders by date and time.	If you are using a Block 1 aircraft, picture and video file names contain **FRONTCAM** and the active camera mode. If you are using a Block 2 aircraft, picture and video file names contain **FRONT_EO** or **FRONT_IR**.
Navigation cameras	Videos	Aircraft memory card in folders by date and time.	Video file names contain **NAV**.

CHECKLISTS

Mission and flight checklist

Before and after every flight, use the following checklist. It includes the minimum number of recommended activities, but you can add any site- or corporate-specific policies, if necessary.

Mission planning	Status
File regulatory paperwork for federal, provincial/state, and local agencies.	☐
Check the weather forecast.	☐
Complete any jobsite forms, such as risk mitigation and regulatory compliance.	☐
Download maps for the area to MCS.	☐
Map all waypoints, objects, and POIs in the flight plan.	☐
Determine safe flight radius and map any no-fly zones in the flight plan.	☐
Check the airspace for controlled and special-use airspace and airports using the Flight Plan module in ELB.	☐
Fully charge the base station, aircraft, and tablet batteries.	☐
Ensure that you have safety equipment for the flight, including a first-aid kit, an ABC fire extinguisher, and any required personal protective equipment.	☐
Ensure that you have a VHF radio to monitor any local tower communications.	☐
Ensure that you have the proper supplies for the environment, such as hat, gloves, sunscreen, and insect repellent.	☐
Determine and secure a secondary location to land the aircraft in case of an emergency.	☐

Preflight	Status
Identify a location with a minimum clearance radius of 10 m / 33 ft where you can take off and land the aircraft.	☐
Establish a safety zone for vehicles and people not involved in the flight.	☐

Preflight	Status
Confirm that there is no damage to the aircraft body, propellers, propulsion arms, legs, or payloads.	☐
Ensure that the propulsion arms are connected to the aircraft body and that they are properly latched.	☐
Ensure that the legs are securely inserted into the aircraft.	☐
Check that the batteries are secure.	☐
Check that the aircraft sensors, lenses, and memory cards are secure.	☐
Ensure that the payload latches are secure.	☐
Ensure that the aircraft and tablet are connected to the base station.	☐
If necessary, verify that the Dejero GoBox battery is fully charged and that the GoBox is connected to the system.	☐
Review the flight settings and behaviors, including the speed, MSH, and battery margin.	☐
Review the roles and responsibilities for the operator and any observers.	☐
Review the emergency procedures.	☐
Provide a brief safety overview to all participants and observers, including keeping a safe distance.	☐
Review the flight plan with all participants and observers.	☐
Review the position of the base station and the angle of the antennas.	☐
In MCS, orient the map for the flight.	☐
Check the signal strength between the aircraft and the base station.	☐
Check the wind speed and verify that it is below 45 km/h / 28 mph for takeoff.	☐

Takeoff	Status
Determine if the weather is safe for operations, including the wind speed, humidity, temperature, ceilings, and visibility.	☐

Takeoff	Status
Confirm that the takeoff location is not a high-traffic area.	☐
Verify that all preflight checks pass and announce that the aircraft is spinning up.	☐
Listen to the system to see if it sounds normal.	☐
When the surrounding area is free of air and ground traffic, announce that the aircraft is taking off.	☐
Verify that the flight control optimization happened within a 3 m / 10 ft radius.	☐

Landing	Status
Confirm that the airspace is free of incoming air and ground traffic.	☐
Announce “Returning Home.”	☐
Verify that the landing zone is clear.	☐
If landing on a target, ensure that the landing target is visible and free of any obstructions.	☐
Announce “Landing.”	☐
Monitor the landing zone and adjust the aircraft’s position, if necessary.	☐

Postflight	Status
Download log files to the MCS tablet.	☐
Connect the tablet to the internet (when available).	☐
Upload log files into ELB.	☐
Turn off the aircraft, base station, and tablet.	☐
Remove the batteries from the aircraft.	☐
Charge the aircraft, base station, and tablet batteries.	☐
Confirm that there is no damage to the aircraft body, propellers, propulsion arms, legs, or payloads.	☐

Emergency procedures checklists

Review the following checklists to understand what to do if an emergency arises.

You should also review "Recover a lost aircraft" on page 361.

Lost link or lost communications	Status
Announce “Lost comms.”	☐
If the aircraft re-establishes communications, continue with the flight.	☐
If the communications remain intermittent, land the aircraft as soon as possible.	☐
Verify that the landing zone is clear.	☐

Low aircraft battery	Status
If a low battery warning appears in MCS, announce “Battery low; aircraft returning home.”	☐
Verify that the landing zone is clear.	☐

Fatal condition response	Status
If a fatal condition response message appears in MCS, announce “Emergency Landing.”	☐
Identify a safe landing zone.	☐
Verify that the landing zone is clear.	☐
Land the aircraft, maintaining a stable landing and using minimal movements.	☐
Add a POI in MCS to identify the aircraft’s position.	☐

Lost sight of aircraft	Status
If the operator or the observer loses sight of the aircraft, announce “Lost visual.”	☐

Lost sight of aircraft	Status
Stop flying. Have the aircraft hover in place and hold.	☐
Add a POI in MCS to identify the aircraft's last known position.	☐
If the operator or the observer has not re-established sight of the aircraft after 10 seconds, increase the height of the aircraft to the maximum allowed height. Attempt to confirm sight of the aircraft.	☐
If the operator or the observer has not re-established sight of the aircraft after 30 seconds, bring the aircraft home until you can see the aircraft.	☐
When the operator or the observer re-establishes sight of the aircraft, continue the flight.	☐

Lost GPS lock – aircraft in visual navigation mode	Status
Continue your flight, but monitor the aircraft's position closely.	☐
If the aircraft drifts considerably, land the aircraft as soon as possible.	☐

Lost GPS lock – aircraft in recovery mode	Status
Have the observer verify that the landing zone under the aircraft is clear.	☐
If the area is not clear, move the aircraft to a safe area.	☐
Land the aircraft as soon as possible.	☐

Unstable flight	Status
Bring the aircraft home or to a safe area to land.	☐
Have the observer verify that the landing zone under the aircraft is clear.	☐
If the area is not clear, move the aircraft to a safe area.	☐
Land the aircraft as soon as possible.	☐

Compass error	Status
Show the grid on the map.	☐
Adjust for any offset.	☐
Bring the aircraft home or to a safe area to land.	☐
If the flight is an automated flight, switch to a manual flight.	☐
Have the observer verify that the landing zone under the aircraft is clear.	☐
If the area is not clear, move the aircraft to a safe area.	☐
Land the aircraft as soon as possible.	☐

Loss of joystick control	Status
Verify that the joystick is turned on.	☐
Check that the joystick is unlocked.	☐
Disconnect the USB cable between the tablet and the joystick. Connect the cable again.	☐
If the joystick fails to reconnect, use the stylus to bring the aircraft home or to a safe area to land.	☐
Have the observer verify that the landing zone under the aircraft is clear.	☐
If the area is not clear, move the aircraft to a safe area.	☐
Land the aircraft as soon as possible.	☐

Scheduled maintenance checklist

As part of the regular maintenance of your system, perform the following regular maintenance activities:

Maintenance activity and tasks	Timing
Inspect propulsion arms and propellers.	Every 5 flight hours
Monitor and clean leg contacts.	Every 5 flight hours, or more often in dirty environments

Maintenance activity and tasks	Timing
Inspect legs.	Every 3 months
Clean battery compartments.	Every 5 flight hours, or more often in dirty environments
Inspect the aircraft body.	Every 5 flight hours
Update the software.	When an update notification appears in Windows or when notified by Support.

For more information on checking the flight hours for your aircraft, see "Check the flight time" on page 330.

Unscheduled maintenance checklist

The aircraft might need other maintenance from time to time. This maintenance is unscheduled and depends on the flight circumstances.

Maintenance activity and tasks	Timing
Clean camera lenses.	As needed. For more information, see "Clean the camera lenses" on page 336.
Inspect propulsion arms and propellers.	If a flight involved winds higher than 40 km/h / 25 mph or involved a hard landing
Inspect the aircraft body.	If the aircraft landed hard or landed on rough terrain
Inspect the legs.	If the aircraft landed hard or landed on rough terrain
Replace propellers.	If a propeller has stress cracks or chips

STANAG 4609 METADATA

The following STANAG 4609 metadata fields are supported.

Key ID	Key name	Description
2	UNIX timestamp	Coordinated UTC timestamp
65	UAS LS Version Number	6
3	Mission ID	Flight number
4	Platform Tail Number	Hostname of the aircraft
10	Platform Designation	SkyRanger
11	Image Source Sensor	Model number of the camera sensor
12	Image Coordinate System	WGS-84
59	Platform Call Sign	Serial number of the aircraft
5	Platform Heading Angle	Aircraft heading angle
6	Platform Pitch Angle	Aircraft pitch angle
7	Platform Roll Angle	Aircraft roll angle
90	Platform Pitch Angle (Full)	Aircraft pitch angle
91	Platform Roll Angle (Full)	Aircraft roll angle
13	Sensor Latitude	Latitude of the camera sensor
14	Sensor Longitude	Longitude of the camera sensor
15	Sensor True Altitude	Altitude of the camera sensor as measured from MSL
18	Sensor Relative Azimuth Angle	Relative rotation angle of the camera sensor to the aircraft's longitudinal axis
19	Sensor Relative Elevation Angle	Relative elevation angle of the camera sensor to the aircraft's longitudinal axis
20	Sensor Relative Roll Angle	Relative roll angle of the camera sensor to the aircraft

Key ID	Key name	Description
16	Sensor Horizontal Field of View	Horizontal field of view of the selected camera sensor
17	Sensor Vertical Field of View	Vertical field of view of the selected camera sensor
21	Slant Range	Slant range distance to the target
22	Target Width	Target width within the camera sensor field of view
23	Frame Center Latitude	Latitude of the center of the frame, calculated using a perfectly flat earth model
24	Frame Center Longitude	Longitude of the center of the frame, calculated using a perfectly flat earth model
25	Frame Center Elevation	Elevation of the center of the frame, calculated using a perfectly flat earth model
26	Offset Corner Latitude Point 1	Latitude of the frame, offset for the upper left corner, calculated using a perfectly flat earth model
27	Offset Corner Longitude Point 1	Longitude of the frame, offset for the upper left corner, calculated using a perfectly flat earth model
28	Offset Corner Latitude Point 2	Latitude of the frame, offset for the upper right corner, calculated using a perfectly flat earth model
29	Offset Corner Longitude Point 2	Longitude of the frame, offset for the upper right corner, calculated using a perfectly flat earth model
30	Offset Corner Latitude Point 3	Latitude of the frame, offset for the lower right corner, calculated using a perfectly flat earth model

Key ID	Key name	Description
31	Offset Corner Longitude Point 3	Longitude of the frame, offset for the lower right corner, calculated using a perfectly flat earth model
32	Offset Corner Latitude Point 4	Latitude of the frame, offset for the lower left corner, calculated using a perfectly flat earth model
33	Offset Corner Longitude Point 4	Longitude of the frame, offset for the lower left corner, calculated using a perfectly flat earth model
82	Corner Latitude Point 1 (Full)	Latitude of the frame for the upper left corner, using the full range
83	Offset Corner Longitude Point 1 (Full)	Longitude of the frame for the upper left corner, using the full range
84	Offset Corner Latitude Point 2 (Full)	Latitude of the frame for the upper right corner, using the full range
85	Offset Corner Longitude Point 2 (Full)	Longitude of the frame for the upper right corner, using the full range
86	Offset Corner Latitude Point 3 (Full)	Latitude of the frame for the lower right corner, using the full range
87	Offset Corner Longitude Point 3 (Full)	Longitude of the frame for the lower right corner, using the full range
88	Offset Corner Latitude Point 4 (Full)	Latitude of the frame for the lower left corner, using the full range
89	Offset Corner Longitude Point 4 (Full)	Longitude of the frame for the lower left corner, using the full range
48	Security Local Metadata Set	Local set tag to include the Local Set Security Metadata items

The following additional security metadata fields are also supported:

Key ID	Key name	Description
1	Security Classification	Security classification of the file

Key ID	Key name	Description
2	Classifying Country Coding Method	ISO-3166 alpha-2
3	Classifying Country	Value for the classifying country
12	Object Country Coding Method	ISO-3166 alpha-2
13	Object Country Codes	Value for the country that is the object of the file
14	Comments	Security related comments
22	LDS Version Number	10

ACCESSORIES

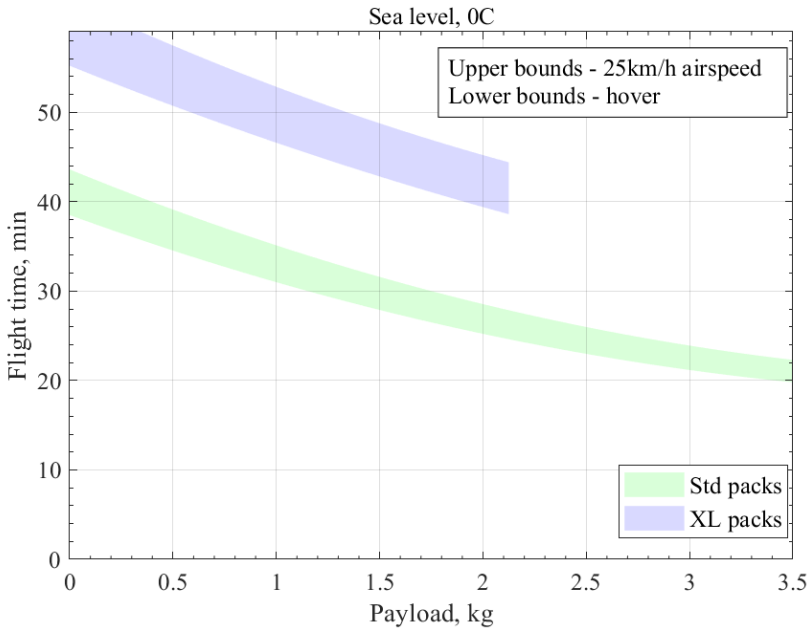
You can purchase the following accessories for the SkyRanger R70 from Teledyne FLIR. For more information about an accessory, visit the Customer Self-Service Portal at https://selfservice.teledyneflir.com to read the documentation for the accessory.

- 8-Bay Battery Charger
- Joystick
- Tether Kit
- XL batteries
- StormCaster™-E
- StormCaster™-L (supports independent camera payload yaw)
- StormCaster™-T (supports independent camera payload yaw)
- Trillium HD40-XV (supports independent camera payload yaw)

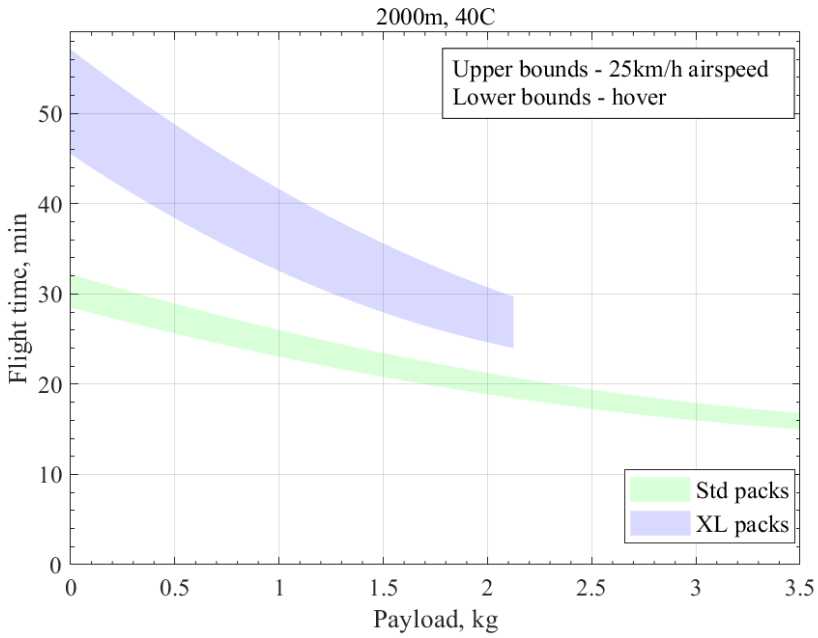
FLIGHT PERFORMANCE

Various factors can affect flight performance. For more information, see "Factors that affect flight endurance" on page 393. If you require additional information on estimated flight times under specific operational scenarios, contact your Teledyne FLIR representative.

The following two graphs compare the expected flight times (as a function of payload mass) for an aircraft when it is using standard batteries and XL batteries. The range in flight times reflects the range in operating efficiency between hover (lower bound) and 25 km/h / 15.5 mph airspeed (upper bound).



SkyRanger R70 predicted flight time at sea level, 0°C



SkyRanger R70 predicted flight time at 2000 m MSL, 40°C

The following chart outlines the estimated flight times for the various payloads when flying the aircraft with standard batteries and Heavy Lift - Long Endurance arms.

Payload	Estimated flight time at sea level, 0°C / 32°F	Estimated flight time at 2000 m / 6500 ft MSL, 40°C / 104°F
No payload (front EO/IR camera only)	Upper bound: 43.6 minutes	Upper bound: 32.2 minutes
	Lower bound: 38.5 minutes	Lower bound: 28.5 minutes
HDZOOM30	Upper bound: 38.6 minutes	Upper bound: 28.5 minutes
	Lower bound: 34 minutes	Lower bound: 25.3 minutes
EO/IR Mk-II	Upper bound: 38.8 minutes	Upper bound: 28.7 minutes
	Lower bound: 34.2 minutes	Lower bound: 25.4 minutes
StormCaster-E	Upper bound: 34.1 minutes	Upper bound: 25.3 minutes
	Lower bound: 30.1 minutes	Lower bound: 22.4 minutes
StormCaster-T	Upper bound: 34.5 minutes	Upper bound: 25.6 minutes
	Lower bound: 30.1 minutes	Lower bound: 22.7 minutes

Payload	Estimated flight time at sea level, 0°C / 32°F	Estimated flight time at 2000 m / 6500 ft MSL, 40°C / 104°F
Osprey 2.0 kg / 4.4 lb	Upper bound: 28.5 minutes	Upper bound: 21.2 minutes
	Lower bound: 25.2 minutes	Lower bound: 18.9 minutes
Osprey 3.5 kg / 7.7 lb	Upper bound: 22.3 minutes	Upper bound: 16.8 minutes
	Lower bound: 19.8 minutes	Lower bound: 15.0 minutes

The following chart outlines the estimated flight times for the various payloads when flying the aircraft with XL batteries and Heavy Lift - Long Endurance arms.

You cannot fly the aircraft with XL batteries and Osprey weights over 2 kg / 4.4 lb.

Payload	Estimated flight time at sea level, 0°C / 32°F	Estimated flight time at 2000 m / 6500 ft MSL, 40°C / 104°F
No payload (front EO/IR camera only)	Upper bound: 59 minutes	Upper bound: 57.1 minutes
	Lower bound: 55.2 minutes	Lower bound: 45.5 minutes
HDZOOM30	Upper bound: 56.8 minutes	Upper bound: 47.8 minutes
	Lower bound: 50.2 minutes	Lower bound: 37.5 minutes
EO/IR Mk-II	Upper bound: 57.1 minutes	Upper bound: 48.2 minutes
	Lower bound: 50.4 minutes	Lower bound: 37.9 minutes
StormCaster-E	Upper bound: 51.7 minutes	Upper bound: 39.8 minutes
	Lower bound: 45.5 minutes	Lower bound: 31.1 minutes
StormCaster-T	Upper bound: 52.1 minutes	Upper bound: 40.5 minutes
	Lower bound: 45.9 minutes	Lower bound: 31.7 minutes
Osprey 2.0 kg / 4.4 lb	Upper bound: 45.2 minutes	Upper bound: 30.7 minutes
	Lower bound: 39.4 minutes	Lower bound: 24.6 minutes

Depending on flight conditions, flight times can vary from those outlined above.

Factors that affect flight endurance

Camera	Example
Aircraft configuration and payload weight	Different aircraft configurations and payload weights require different thrust and energy consumption levels. Heavier aircraft configurations result in shorter endurance.
Environmental conditions	Ambient temperature and density altitude also affect endurance. If flying in an environment with a lower temperature and lower density altitude, you can expect longer endurance. Sustained and gusting winds also affect the aircraft's endurance. In higher winds, the aircraft might use more power to maintain the aircraft in a fixed location or along a flight path. If you are flying in higher temperatures or the aircraft is consuming more power, a high temperature warning might appear, which could end the flight earlier than expected.
Battery condition	The condition of the batteries also affects the aircraft's endurance. Endurance is shorter if you use batteries that are not fully charged, if they are overly warm or cold, or if they have had significant charge and discharge cycles.
General aircraft maintenance	If you do not maintain your aircraft properly (especially the propulsion arms, propellers, and motors), endurance is shorter.
Aircraft speed and acceleration	Acceleration, deceleration, and the aircraft's overall airspeed also affect the aircraft's endurance.

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