

# FLIGHT MANUAL

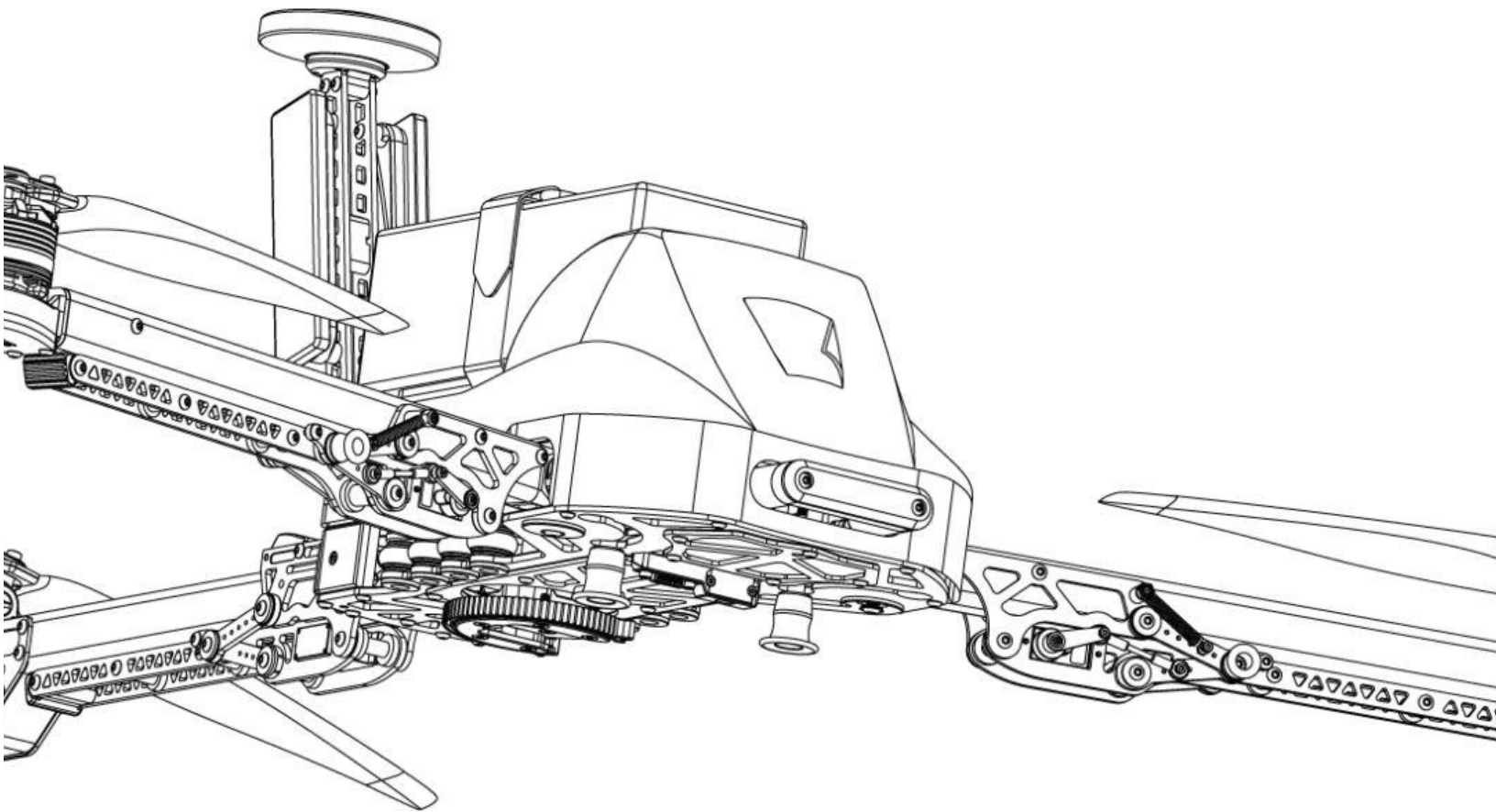
REVISION C.0 | MAY 2021

## REVISION HISTORY

Revision	Date	Description
A.0	March 2017	Initial Release
B.0	January 2018	Updated Images & Flight Modes
C.0	May 2021	Updated for Mark 2 Release

# CONTENTS

REVISION HISTORY	2
CONTENTS	3
<b>SwitchBlade-Elite Overview</b>	<b>5</b>
DISCLAIMER AND WARNING	6
SAFETY	7
LIMITATION OF LIABILITY	8
VISION AERIAL LIMITED WARRANTY	9
INTRODUCTION	11
ITEMS INCLUDED	11
SPECIFICATIONS	12
<b>SwitchBlade-Elite Setup</b>	<b>16</b>
SETTING UP THE SWITCHBLADE-ELITE	17
GROUND CONTROL STATION (GCS)	23
CONTROLS	23
<b>SwitchBlade-Elite Flight Modes</b>	<b>29</b>
FLIGHT MODES	30
<b>Operating Procedures</b>	<b>34</b>
PREFLIGHT CHECKLIST	35
ARMING / TAKEOFF	35
FLIGHT	36
LANDING / DISARMING	36
POST FLIGHT AND STORAGE	36
BATTERY SAFETY	40
<b>Emergency Procedures</b>	<b>41</b>
INTRODUCTION	42
EMERGENCY PROCEDURES	42
<b>Maintenance &amp; Support</b>	<b>48</b>
SUPPORT	49
MAINTENANCE	49
APPENDIX	52



# SwitchBlade-Elite Overview

# DISCLAIMER AND WARNING

Please read this disclaimer and warning carefully and review the SwitchBlade-Elite manual prior to flight.

By using the SwitchBlade-Elite, you acknowledge that you have read, understand, and agree to this disclaimer. You agree that you are solely responsible for your conduct while using SwitchBlade-Elite, and for any direct or indirect consequences that may result from its use. You agree to only use the SwitchBlade-Elite for proper purposes that are in accordance with all local, state, and federal rules and regulations.

The SwitchBlade-Elite is not a toy and should be operated with extreme care, as improper operation can cause damage to property, serious personal injury, or death.

As with any multi-rotor aircraft, the SwitchBlade-Elite is a precise and technical machine. Novice pilots should invest sufficient time on a flight simulator and seek training from an experienced pilot before operation. The SwitchBlade-Elite manual and a flight simulator are no substitute for training with an experienced pilot, particularly when it comes to learning how to safely operate the SwitchBlade-Elite. Novice pilots should never fly without the supervision of an experienced pilot.

- ✓ Always check the SwitchBlade-Elite and its components prior to operation (see PREFLIGHT section).
- ✓ Always maintain a safe distance from the SwitchBlade-Elite when in use.
- ✓ Never attempt to touch the SwitchBlade-Elite when the rotors are moving.
- ✓ It is strongly recommended not to fly the SwitchBlade-Elite over or around people, near power lines, or any other difficult to see obstacles.
- ✓ Never fly the SwitchBlade-Elite near manned aircraft of any kind.
- ✓ Never fly with any rotors that have visible imperfections or damage.
- ✓ Always keep children and animals a safe distance away from the SwitchBlade-Elite when in use.
- ✓ Only use rotors supplied by Vision Aerial that are designed for use on the SwitchBlade-Elite.
- ✓ Always remove the rotors when making a hardware change to prevent rotor strikes in the event of unintentional motor starts.

## SAFETY

It is your responsibility to learn how to safely operate the SwitchBlade-Elite and to adhere to all applicable rules and regulations.

Fly at your own risk.

The SwitchBlade-Elite is a tuned system with custom components selected for each application. Modification to, removal, or substitution of SwitchBlade-Elite components will void the warranty and can lead to unsafe operating conditions.

## LIMITATION OF LIABILITY

IN NO EVENT SHALL VISION AERIAL BE LIABLE TO BUYER FOR ANY INDIRECT, CONSEQUENTIAL, PUNITIVE, INCIDENTAL, SPECIAL DAMAGES, OR ANY DAMAGES WHATSOEVER RESULTING FROM THE USE OF THE SWITCHBLADE-ELITE OR FOR LOSS OF USE, DATA OR PROFITS (HOWEVER CAUSED AND UNDER ANY THEORY OF LIABILITY), EVEN IF VISION AERIAL HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT SHALL VISION AERIAL'S LIABILITY FOR A PRODUCT (WHETHER ASSERTED AS A TORT CLAIM, A CONTRACT CLAIM OR OTHERWISE) EXCEED THE AMOUNTS PAID TO VISION AERIAL FOR SUCH PRODUCT. NOTWITHSTANDING ANYTHING HEREIN, IN NO EVENT SHALL VISION AERIAL'S LIABILITY FOR ALL CLAIMS ARISING OUT OF OR RELATING TO THIS AGREEMENT EXCEED THE AMOUNTS PAID BY BUYER TO VISION AERIAL FOR PRODUCT IN THE LAST TWELVE (12) MONTHS. IN NO EVENT WILL VISION AERIAL BE LIABLE FOR COSTS OF PROCUREMENT OR SUBSTITUTE GOODS BY BUYER. THE LIMITATIONS SET FORTH HEREIN SHALL APPLY TO ALL LIABILITIES THAT MAY ARISE OUT OF THIRD-PARTY CLAIMS AGAINST BUYER. THESE LIMITATIONS SHALL APPLY NOTWITHSTANDING ANY FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY.

Vision Aerial shall not be liable for damages or injuries incurred directly or indirectly from the use of the SwitchBlade-Elite including, but not limited to, the following situations:

- Failure of the pilot to follow proper instructions and safety warnings.
- Failure of the pilot to follow and comply with local rules and regulations.
- Failure of the pilot to inspect the SwitchBlade-Elite and its components prior to operation.
- Failure of the pilot to properly maintain and/or service the SwitchBlade-Elite through an authorized Vision Aerial service center with genuine Vision Aerial parts.
- Use of third-party products on the SwitchBlade-Elite.
- Use of the SwitchBlade-Elite in a physically or mentally impaired capacity.
- Use of the SwitchBlade-Elite without sufficient training.
- Use of the SwitchBlade-Elite in unsafe conditions, including but not limited to, bad or severe weather, such as rain, wind, snow, lightning, dust storms, etc., or in areas of magnetic or radio interference, such as power stations, broadcasting and cell phone towers, government prohibited airspace, etc.
- Improper operation, misjudgment, or risky behavior while using a SwitchBlade-Elite.
- Infringement of third-party data, audio, or video rights recorded when using the SwitchBlade-Elite.

## VISION AERIAL LIMITED WARRANTY

Vision Aerial Inc. ("Manufacturer") warrants to the original end user ("Purchaser") that for one year following the date of delivery of our Product ("Warranty Period"), the Product (excluding (i) any third party made products and (ii) any third party software) will be free from defects in materials and workmanship when properly installed and used for its intended purpose and in its intended operating environment. This warranty does not apply to any Product that has been: (i) altered, repaired or modified or (ii) damaged or destroyed by accidents or similar events or by any intentional, reckless or negligent acts or omissions of any party other than Manufacturer. In the event of a defect, return the Product to the original place of purchase or Manufacturer, but only after instructed to do so by the Manufacturer. Purchaser shall ship and bear the cost of shipping the Product to Manufacturer and Manufacturer shall bear the cost of shipping the Product back to Purchaser after the completion of service under this limited warranty. Purchaser's exclusive remedy and Manufacturer's entire liability under this warranty will be for Manufacturer at its option to repair or replace the Product or refund purchase price less any rebates. Purchaser assumes all liability, and as such releases Manufacturer from any liability, for any accident, injury, damage, death, loss, illegal activity or any other claim that may occur resulting from or during use of the Product, whether or not such use is foreseeable by Manufacturer.

MANUFACTURER HEREBY DISCLAIMS ALL IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, OF MERCHANTABILITY, NON-INFRINGEMENT, OR FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED TO THE DURATION OF THE APPLICABLE EXPRESS WARRANTY. Some jurisdictions do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to Purchaser. This warranty gives Purchaser specific legal rights, and Purchaser may also have other rights which vary by jurisdiction.

All third party software provided with the Product is provided "AS IS". Purchaser assumes the entire risk as to the quality, performance, accuracy and effect of such software, and should it prove defective, Purchaser, and not Manufacturer, assumes the entire cost of all necessary servicing or repair. TO THE EXTENT NOT PROHIBITED BY LAW, IN NO EVENT WILL MANUFACTURER BE LIABLE FOR ANY LOST DATA, REVENUE OR PROFIT, OR FOR SPECIAL, INDIRECT, CONSEQUENTIAL, INCIDENTAL OR PUNITIVE DAMAGES, HOWEVER CAUSED REGARDLESS OF THE THEORY OF LIABILITY, ARISING OUT OF OR RELATED TO THE USE OF OR INABILITY TO USE THE PRODUCT, INCLUDING DAMAGE TO PAYLOAD, EVEN IF MANUFACTURER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT WILL MANUFACTURER'S LIABILITY EXCEED THE AMOUNT PAID BY PURCHASER FOR THE PRODUCT (EXCLUDING PAYLOAD OR OTHER COMPONENTS NOT MANUFACTURED BY MANUFACTURER).

The foregoing limitations will apply even if any warranty or remedy provided under this Agreement fails of its essential purpose. Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to Purchaser.





Manufacturer Disclaimer: All purchasers, users, and any or all parties involved or engaging in the use of Products agree to the following:

- Manufacturer does not promote or endorse high risk, careless and/or dangerous actions when using its products.
- Manufacturer is not liable for any use or misuse of its products.

Governing Law and Arbitration. This Limited Warranty shall be governed by the laws of the State of Montana without giving effect to any conflict of laws principles that may provide the application of the law of another jurisdiction. Any claim or dispute in connection with this Limited Warranty shall be resolved in a cost effective manner through binding non-appearance-based arbitration. The arbitration shall be initiated through an established alternative dispute resolution provider mutually agreed upon by the parties. The alternative dispute resolution provider and the parties must comply with the following rules: a) the arbitration shall be conducted by telephone, online and/or be solely based on written submissions, the specific manner shall be chosen by the party initiating the arbitration; b) the arbitration shall not involve any personal appearance by the parties or witnesses unless otherwise mutually agreed by the parties; and c) any judgment on the award rendered by the arbitrator may be entered in any court of competent jurisdiction. If the foregoing arbitration clause does not apply for any reason, you agree to submit to the personal jurisdiction of the state courts located within Gallatin County, Montana for the purpose of litigating all such claims or disputes, which courts shall have exclusive jurisdiction of such claims or disputes. Notwithstanding the foregoing, Manufacturer may seek injunctive or other equitable relief to protect its intellectual property rights in any court of competent jurisdiction.

#### CAUTIONS AND WARRANTY



**Warning: Failure to follow these safety instructions could result in injury or damage.**

Repairing or Modifying: Never attempt to repair or modify any Product yourself. Disassembling a Product, including the removal of external components, may cause damage that is not covered under the warranty. The Product does not contain any user-replaceable parts.

## INTRODUCTION

The SwitchBlade-Elite is a tri-rotor drone with an articulating tail, powerful and efficient electric motors, and cutting-edge flight components. Not only is the SwitchBlade-Elite fast and easy to fly, it is also capable of flying for over 30 minutes on a single charge. With an articulating rear rotor, the SwitchBlade-Elite has substantially better yaw authority than a typical quad-rotor and can therefore achieve faster, more precise turns. Better aerodynamics and a high power-to-weight ratio mean that the SwitchBlade-Elite is fast. Whether in a car, on an ATV, or on foot, the SwitchBlade-Elite is light and folds up small so you'll never be unprepared. When you need to fly, you can transition from case to in the air in less than two minutes.

This manual intends to inform and educate the user on how to properly and effectively control, fly, and utilize the full functionality of the SwitchBlade-Elite. It is ill-advised to operate and fly the SwitchBlade-Elite without first reading and understanding the information and guidelines presented in this document.

## ITEMS INCLUDED

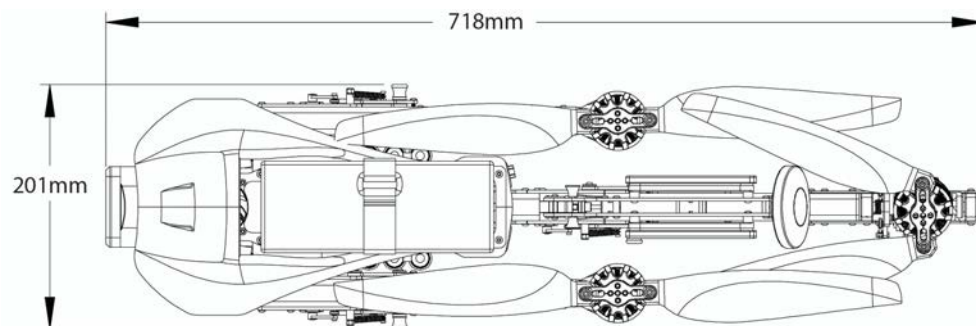
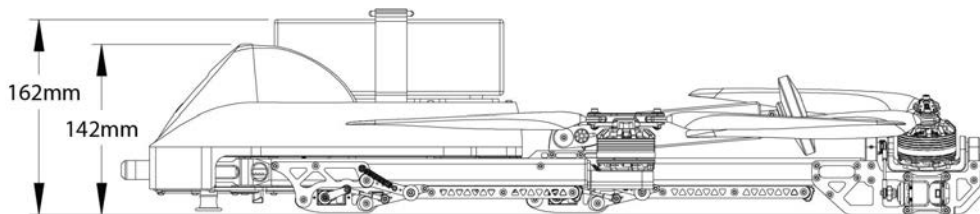
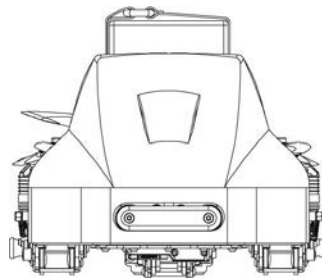
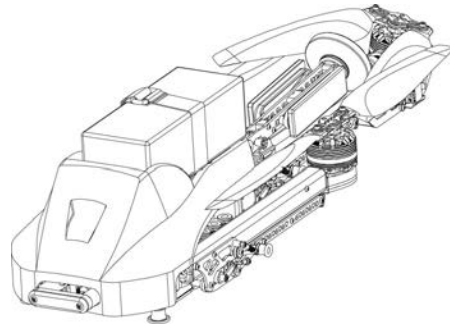


### **The SwitchBlade-Elite package includes:**

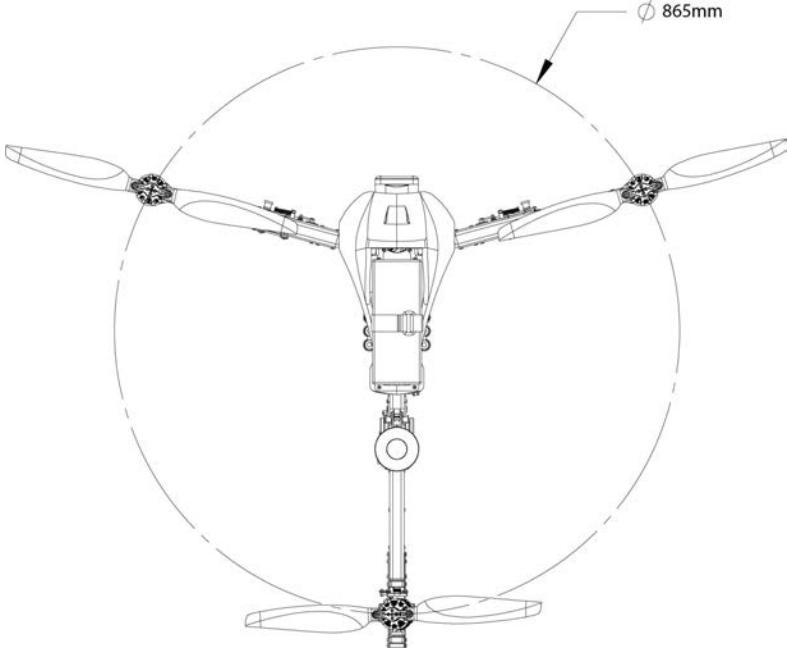
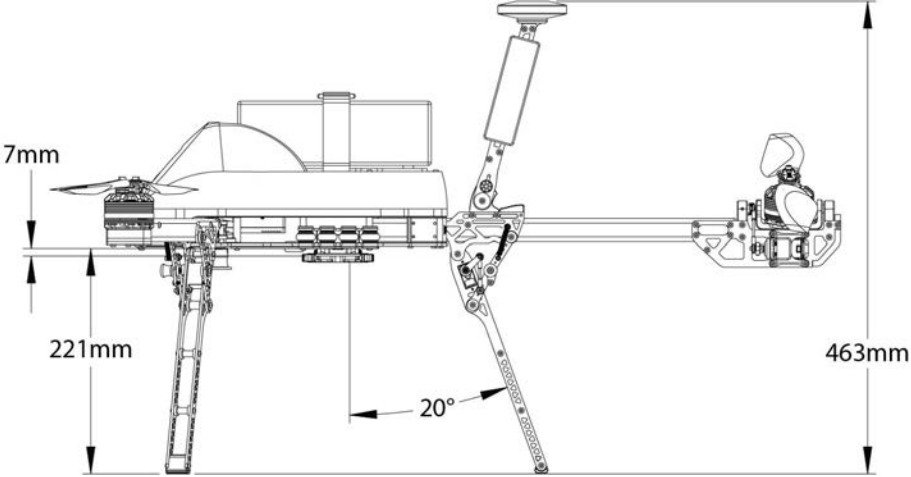
1. (1) SwitchBlade-Elite Tricopter
2. (1) Controller & Charger
3. (1) Battery
4. (1) Battery Charger & Accessories
5. (1) Hard Transport Case

# SPECIFICATIONS

## Storage Configuration Dimensions



# Flight Configuration Dimensions



## Aircraft Specifications

Empennage	Carbon Fiber
Arms	Carbon Fiber
Frame & Hardware	Aluminum / Stainless Steel
Body	Polycarbonate
Motors	360kv (1125W)
Rotors	Carbon Fiber, Folding and Precision Balanced
Flight Controller	Cube
Controller	Herelink
Flight Dimensions	865 mm Diameter
Storage Dimensions	730 mm x 192 mm
Case Dimensions	120 cm x 42 cm x 23 cm
Aircraft Weight (Without Battery)	2.9 KG
Aircraft Weight (With Battery)	4.9 KG

## Battery / Charger

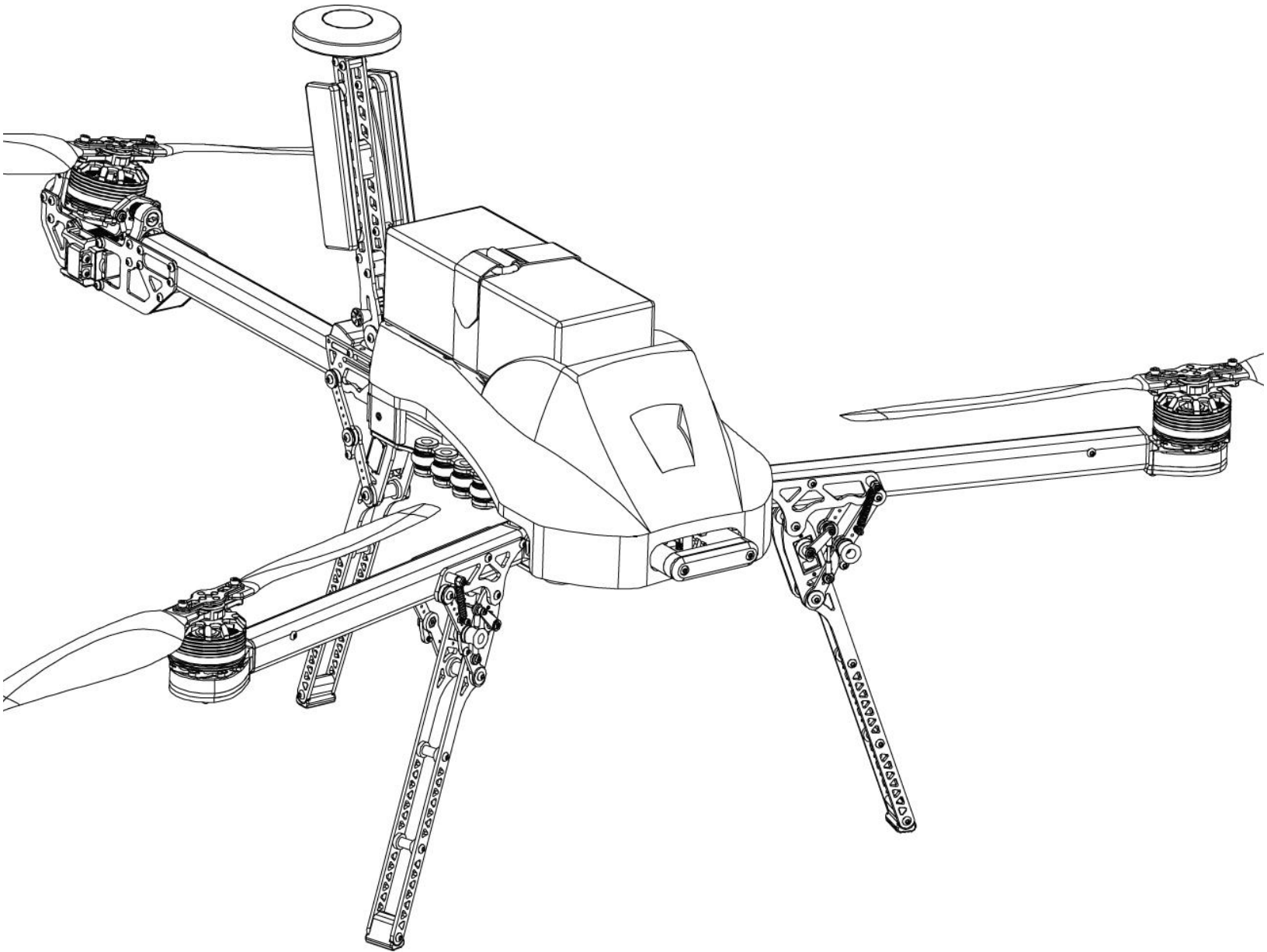
Flight Battery Included	16,000 mAh 6S Lithium Polymer
Flight Battery Optional	22,000 mAh 6S Solid State Lithium Ion
Battery Charger	High Capacity AC dual battery charger

## Flight Operations

Direct Control Range	20 km (12.4 miles)
Autonomous Flight Range (dependant on environmental conditions)	Over 25 km (16 miles)
Max Operational Wind Speed	Over 40 KPH (25 MPH)
Max Operational Altitude	4500 m (14,800 ft) Above Sea Level
Operational Temperature Range	-15° C to 45° C (5° F to 113° F)
GPS Accuracy non-RTK corrected	±2.5 meters (± 8.2 feet), typically < ±1 meter
GPS Accuracy RTK corrected (Optional)	±0.1 meters (±0.33 feet)

## Payloads

Max Payload	2.3 KG (5 LBS)
Recommended Payload	< 1.5 KG (3.3 LBS)
Payload Mounting: Vision Aerial - Payload Connection System	M3 Flathead x 20mm circular M3 Flathead x 25mm square
Electrical Connections	See Payload Connection System Section
Center of Mass	Adjustable Using Battery Positioning



# SwitchBlade-Elite Setup

# SETTING UP THE SWITCHBLADE-ELITE

## Charge Flight Batteries

The SwitchBlade-Elite kit includes a battery charger. Remove the battery from the SwitchBlade-Elite, attach the charger to a power source, and attach the battery cell balance connector to the battery charger.

- It is recommended to always use the "balance" charge cycle.
- It is recommended to not charge the pack at a greater rate than its capacity rating.

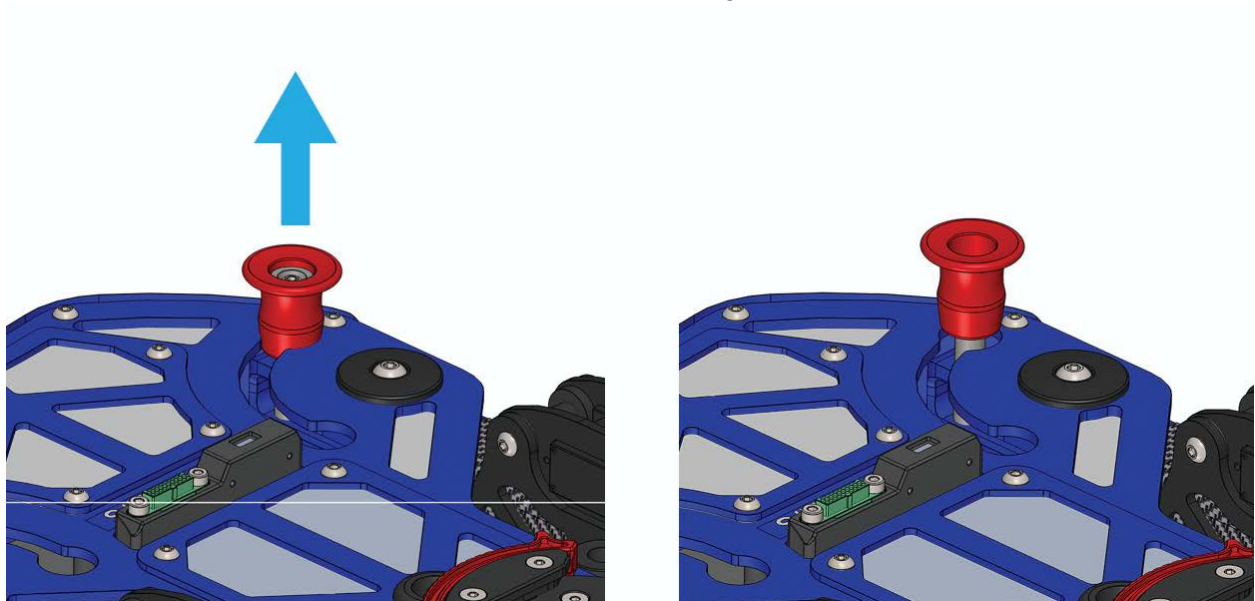
[See Appendix](#) for full instructions.

[See Battery Safety](#) for more information.

## Extending the Arms

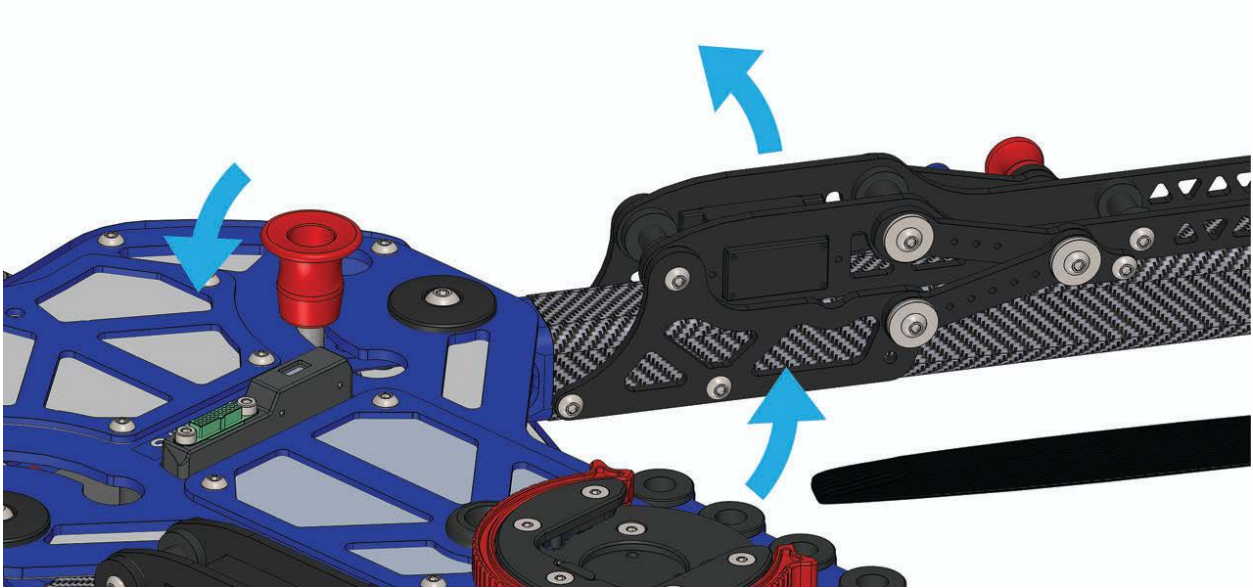
The SwitchBlade-Elite features two arms that fold in and lock for compact travel, protection, and safety. The arms are secured with red, spring-loaded pull knobs underneath the chassis.

- Remove the SwitchBlade-Elite from its case.
- Select one arm and pull out on the corresponding red knob.

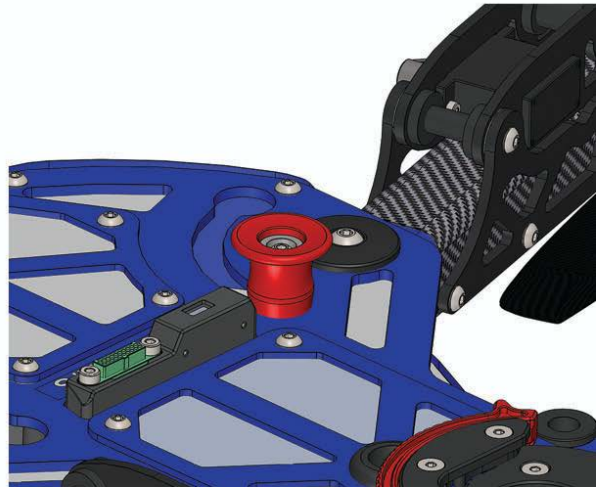
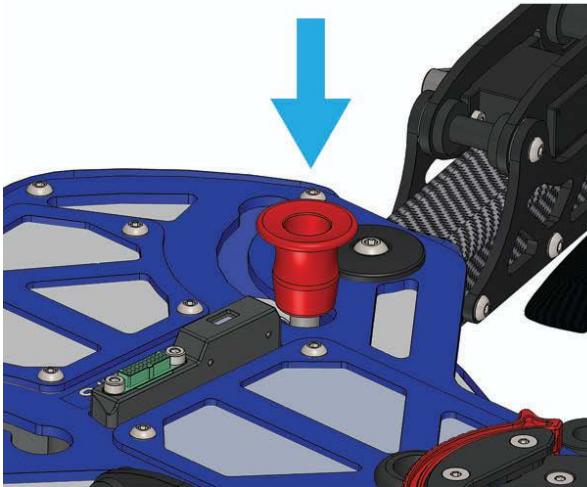




- Rotate the arm away from the tail.



- Once reaching the stop, release the knob to allow locking.



- Gently move the arm back and forth to verify the knob is engaged and seated thoroughly.
- Repeat the process with the other arm.



**Raise and secure the GPS mast.**

Slide the blue pins back to unlock them from the stowed position.



Once the pins are released, gently lift the mast to raise it into an upright position. The blue pins will lock into place once the mast is properly seated.



### Extend Rotors

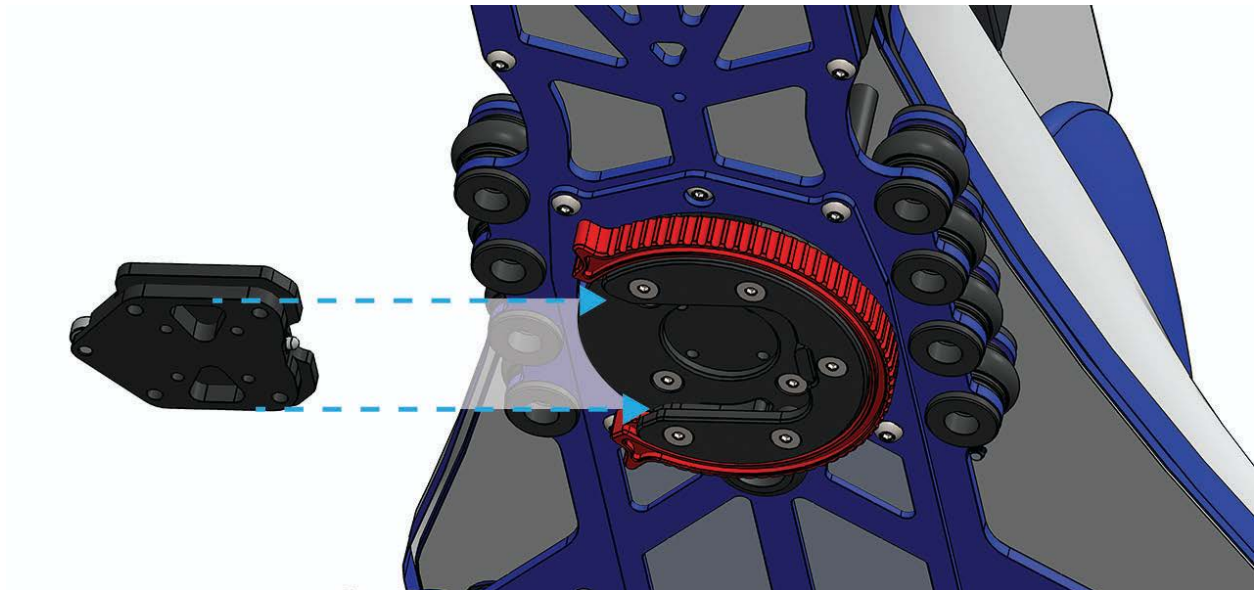
Unfold each rotor so the blades point in opposite directions along the long dimension of the blade mount for all three rotors.



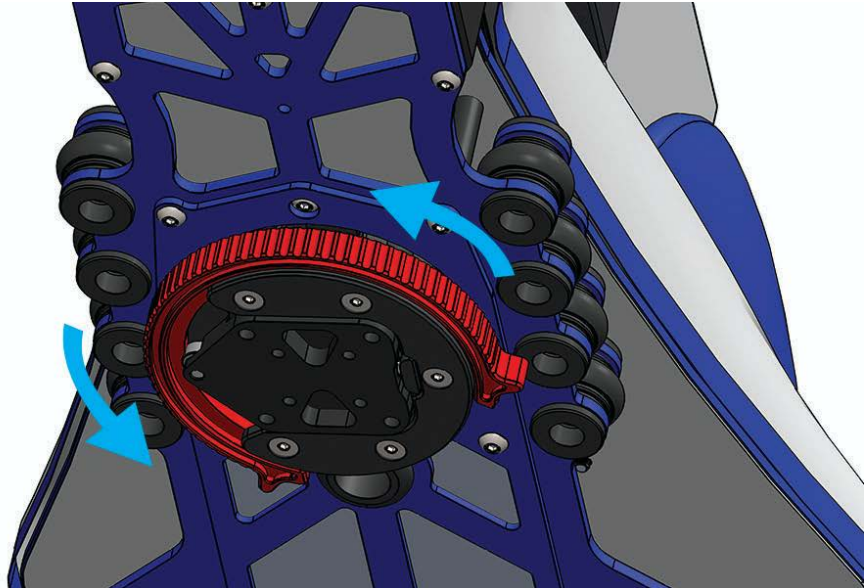
### Attach Payloads Using the Payload Connection System (PCS)

If flying with a payload, attach it to the airframe with the Payload Connection System.

Slide the payload into place. The payload mounting bracket on the top slides into the opening on the payload connection system on the belly of the aircraft. (Note: Payload is not shown in this illustration for clarity.)



Once the payload is seated, rotate the red ring to secure it.



**!** NOTE: *Payloads cannot be hot swapped. Power shall be removed for payload changes.*

**!** NOTE: *If applicable, ground test the payload and associated equipment.*

### Set Up Additional Equipment

- If using a tablet or PC, launch the mission planning app, and connect to the GCS.
- Ensure battery level of the connected telemetry device if applicable (tablet, phone, PC) is adequate for the duration of the flight.

### Visual PreFlight


Perform a visual survey of all electrical & mechanical connections to ensure proper connection.

[See Appendix for Checklists](#)

## Power On the Controller

To power up the controller, press and hold the power button on the Herelink controller for 5 seconds.

The herelink battery level can be checked in the upper right corner of the powered GCS in the Control Center.

 **WARNING:** *Ground controller power level should not be less than 25% for flight. An auxiliary power source may be used during operation to supplement the controller battery.*

Power up the aircraft by plugging the battery connector in. Leave the aircraft motionless for 10 seconds to allow the gyroscopes to calibrate. (Indicator light will flash red/blue during calibration.)

When the vehicle is powered the GPS antenna will display various LED light colors:

**Pulsing Blue-Disarmed, No GPS Lock:** Similar to above, but your vehicle is disarmed. This means you will not be able to control motors, but all other subsystems are working.

**Solid Blue-Armed, No GPS Lock:** Indicates vehicle has been armed and has no position lock from a GPS unit.

**Pulsing Green-Disarmed, GPS Lock:** Similar to above, but your vehicle is disarmed. This means you will not be able to control motors, but all other subsystems including GPS position lock are working.

**Fast Flashing Green-Armed, GPS Lock:** Indicates vehicle has been armed and has a valid position lock from a GPS unit with more than DGPS signal attained.

**Solid Green-Armed, GPS Lock:** Indicates vehicle has been armed and has a valid position lock from a GPS unit.

**Solid Purple-Failsafe Mode:** This mode will activate whenever vehicle encounters an issue during flight, such as losing link with GCS, a critically low battery, or an internal error. In the event of a critically low battery or loss of GPS signal, default failsafe settings will execute a landing sequence (user definable).

**Solid Amber-Low Battery Warning:** Indicates your vehicle's battery is running dangerously low. After a certain point, vehicle will go into failsafe mode. However, this mode should signal caution that it's time to end this flight.

**Blinking Red-Error / Setup Required:** Indicates that your autopilot needs to be configured or calibrated before flying.

 **Note:** *Vehicle will not arm unless GPS status is a pulsing or fast flashing green LED.*

## GROUND CONTROL STATION (GCS)

The SwitchBlade-Elite comes with a Herelink ground control station. To charge the controller, plug the included charger into a power source and the other end into the charging socket on the back of the controller (Micro USB port).

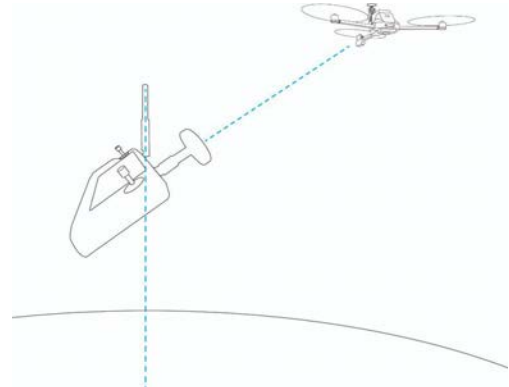
**⚠ WARNING: Do not intentionally turn the controller off during flight. Any loss of communication or GCS power will initiate an immediate a lost link failsafe.**

For additional information [see Appendix](#).

Keep the controller away from liquids, fire, microwaves, and other hazardous or combustible materials. Don't expose the controller to extreme temperatures. If the controller is hot to the touch, wait for it to cool before using or charging. Perform periodic visual inspections of the controller battery to check for any damage and handle the controller battery using the same safety precautions as the flight battery.

### Controller Antenna Configuration

For the strongest connection to the SwitchBlade-Elite, position the Omni-Directional antenna so its vertical axis is in alignment with the center of the earth, or perpendicular to the ground. Position the Directional antenna so it points at the aircraft.

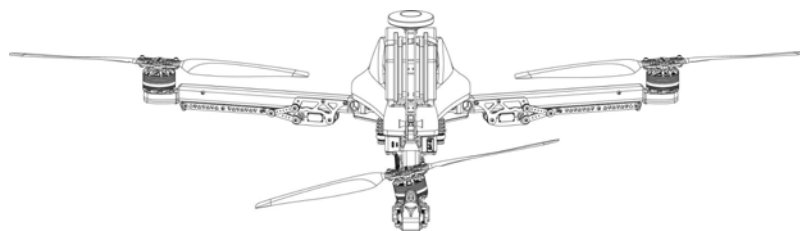


## CONTROLS

**⚠ CAUTION: This document is for reference only and should not be considered a substitute for flight training.**

**⚠ CAUTION: The SwitchBlade-Elite is a precision machine designed to be controlled with very disciplined and smooth inputs. During familiarization of the aircraft, small subtle inputs result in a smooth flight.**

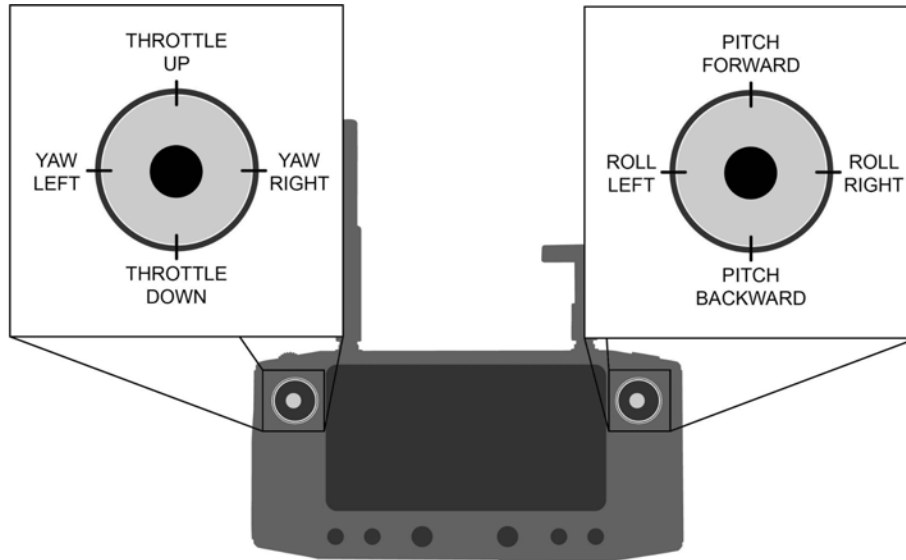
**⚠ NOTE: All controls are given from the perspective of a "tail-in" orientation with respect to the pilot.**



The controller features and control inputs are shown below.



Left Joystick	Controls altitude and yaw.
Right Joystick	Controls pitch and roll.
Upper Left Wheel	Controls camera tilt.
Upper Right Button	Toggle between Loiter and Brake Mode.
Button A	Landing Gear: Tap to deploy. Press and hold to and retract.
Button B	Payload-specific functions.
Power Button	Controller Power Button. Press and hold for 5 seconds to turn on or off. Tap to put it into power save (sleep) mode.
Home Button	No function.
Button C	Payload-specific functions.
Button D	Payload-specific functions.




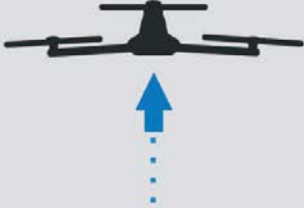
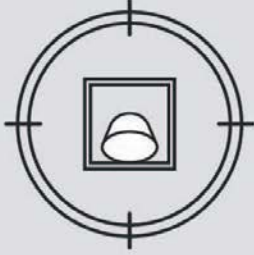





The left stick controls the altitude (throttle) and rotation (yaw) of the SwitchBlade-Elite.

Use the right stick to fly the SwitchBlade-Elite forward, back, left, and right. These movements are relative to the SwitchBlade-Elite's tail-in orientation, so always maintain awareness of SwitchBlade-Elite's forward-facing direction before inputting control.



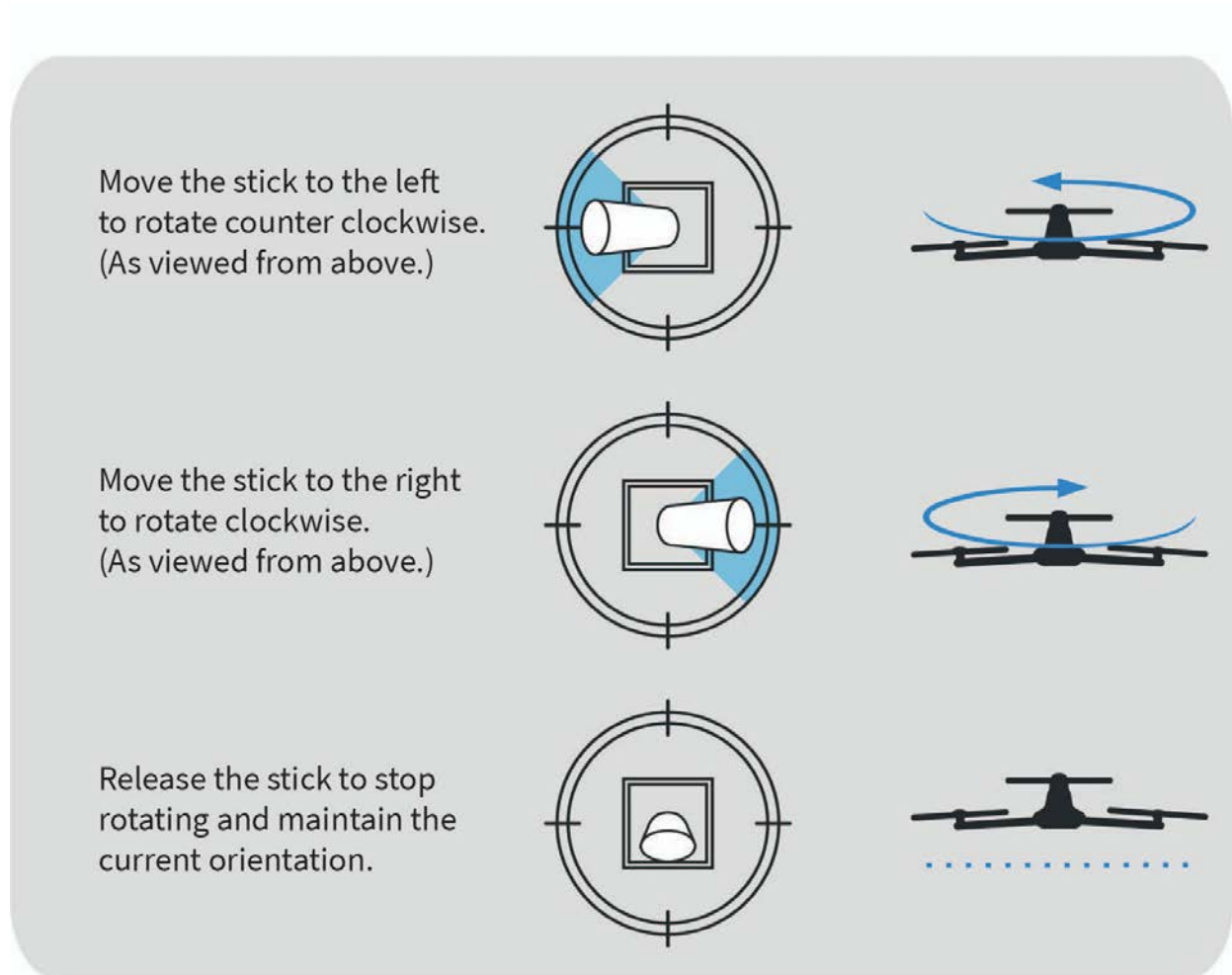
## Left Stick (Throttle)

Move the left stick vertically to control the SwitchBlade-Elite's altitude and vertical acceleration.

<p>To take off and gain altitude, move the throttle above the center position.</p>		
<p>Set the throttle to center to maintain current altitude.</p>		
<p>Move the throttle below center to decrease altitude.</p>		
<p>Set the throttle to full down once the SwitchBlade-Elite has made contact with the ground.</p>		

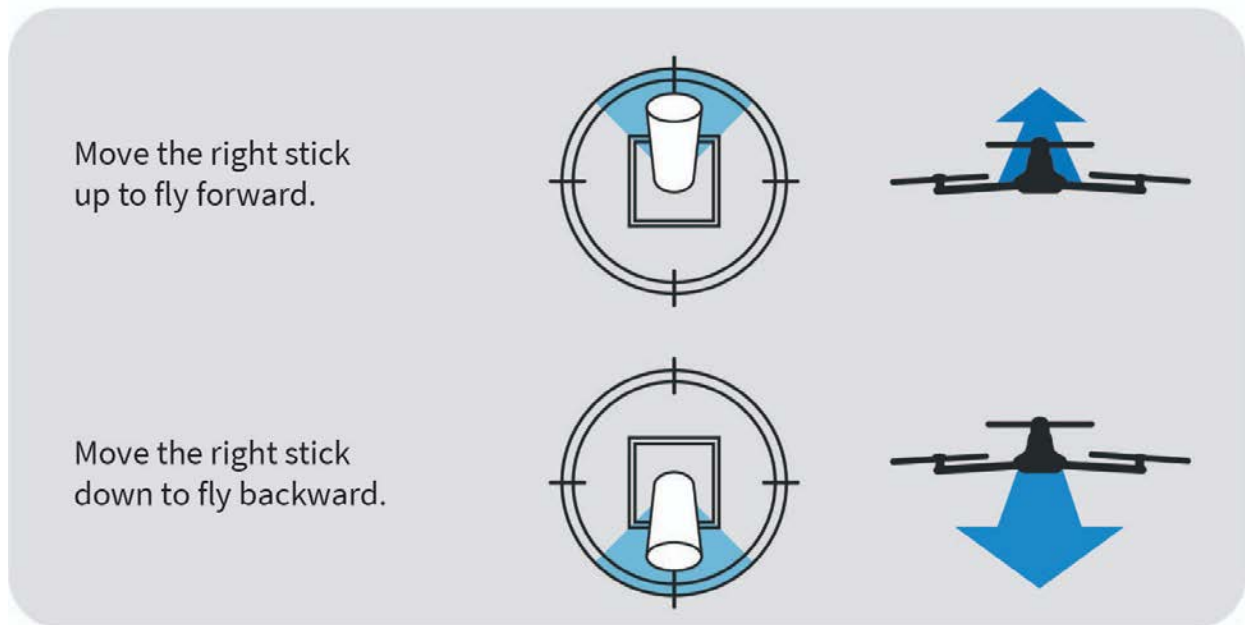
## Left Stick (Yaw)

Move the left stick horizontally to rotate or "yaw" the SwitchBlade-Elite and control orientation.



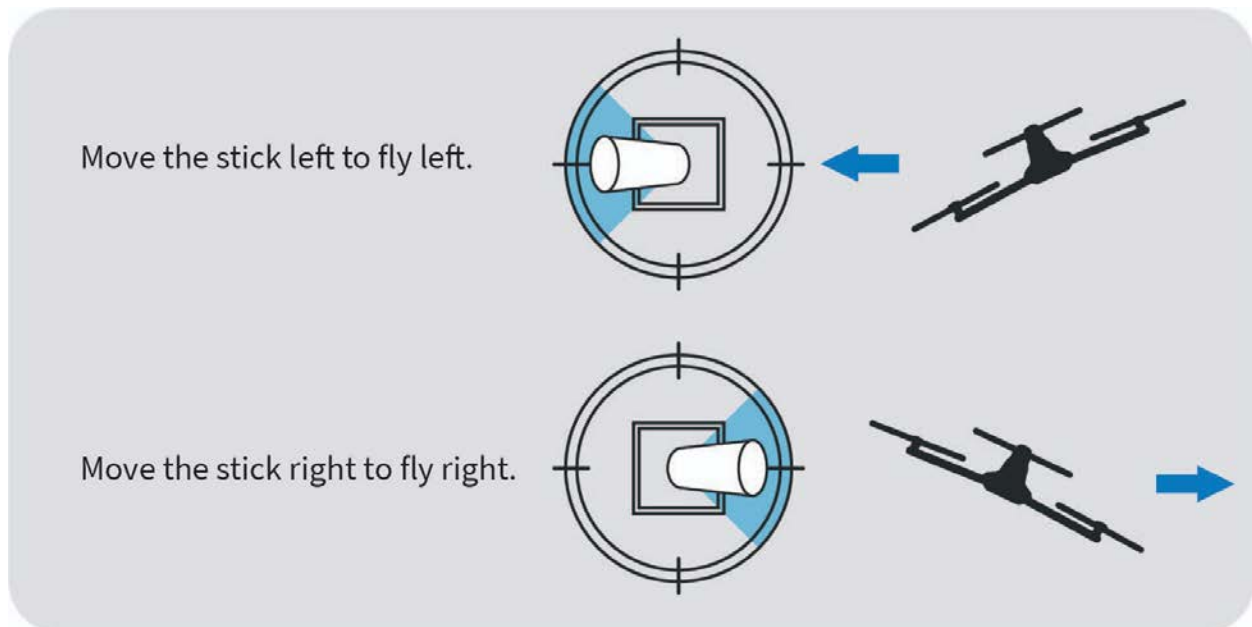
## Right Stick (Pitch)

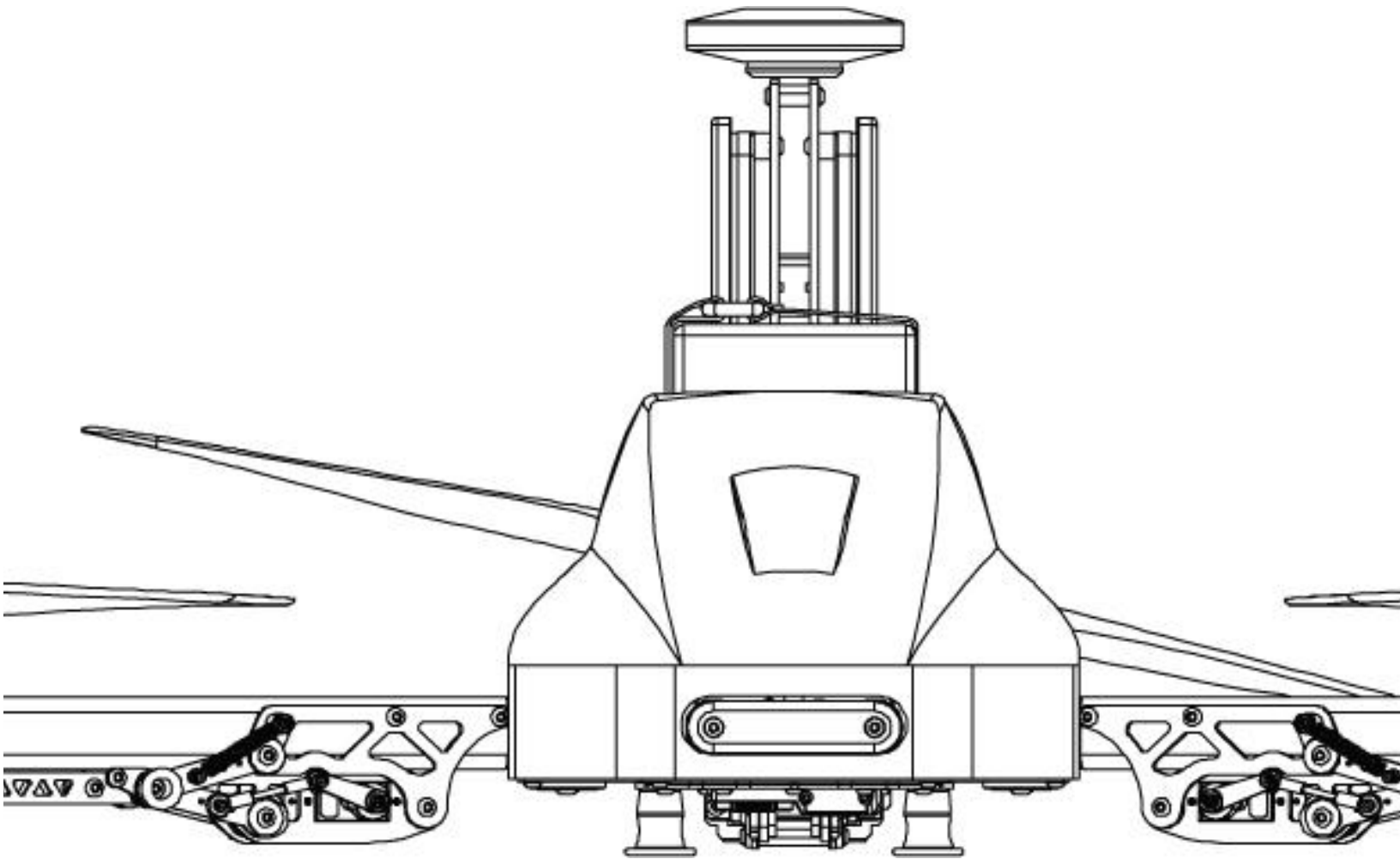
Move the right stick vertically to control pitch.



## Right Stick (Roll)

Move the right stick horizontally to control roll.





# SwitchBlade-Elite Flight Modes

# FLIGHT MODES

The SwitchBlade-Elite comes programmed standard with five different flight modes:

- **Loiter:** Manual flight mode
- **Brake:** Vehicle holds position, joysticks deactivated (Prevents unintentional user input)
- **Auto:** Engages pre-programmed autonomous mission (User adjustable)
- **Land:** Land vehicle at current location
- **RTL:** Return-To-Launch site at pre-programmed altitude (User adjustable)

## Loiter Mode

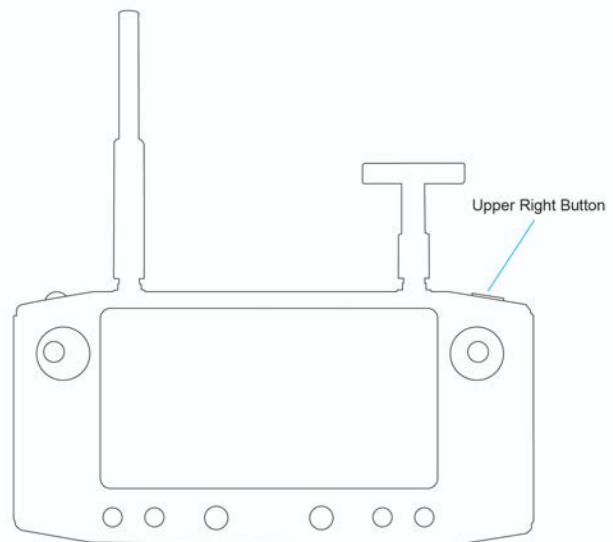
The active flight mode, Loiter Mode, is adjusted by tapping the upper right button on the Herelink Controller.

**!** **NOTE:** *In Loiter Mode, the joystick movements are directly proportional to the ground speed of the SwitchBlade-Elite.*

*For example: If the roll joystick is moved left to half of its travel, the SwitchBlade-Elite will choose its roll angle to achieve 50% of the programmed max ground speed for that direction.*

This can be useful for applications like aerial filming when keeping the ground speed constant is desirable.

**!** **NOTE:** *The throttle does not directly correlate to the RPM of the motors. The throttle correlates to the desired climb and descent rates.*

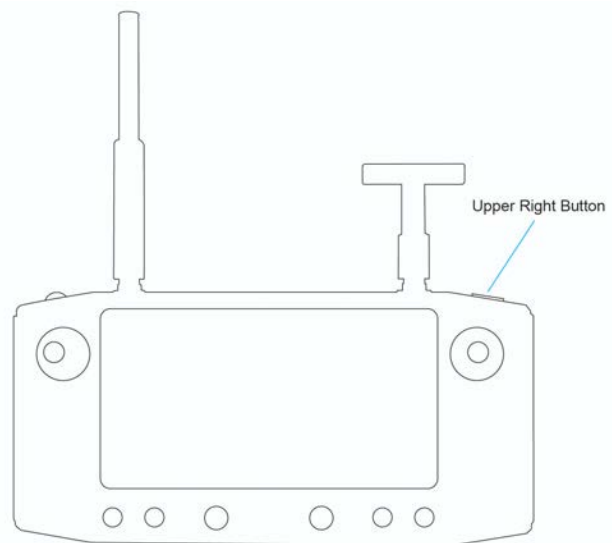


## Brake Mode

*Brake Mode functions similarly to Loiter Mode except the control sticks are completely deactivated. This mode is useful when the pilot wishes to reduce the risk of unintentional control input.*

**!** **CAUTION:** Never leave an airborne aircraft unattended.

This mode is activated by tapping the upper right button on the Herelink Controller.



## Autonomous Flight (Auto)

*Autonomous Mode is for use with pre-planned missions created in advance using mission planning software. A best practice is to design the missions so the pilot launches in Loiter Mode and then, once airborne, enables Auto to execute the mission. This increases the pilot's ability to adapt to unpredicted events during launch (such as non-participants, bird activity, sudden changes in the flight environment, etc).*

### How to use Auto Flight Mode:

1. *Pre-plan the mission using mission planning software in the Herelink.*
2. *Power and connect the Herelink to the aircraft.*
3. *When the pattern or waypoints are complete, select "Upload" to send the mission to the vehicle.*
4. *Manually launch the aircraft and perform systems check.*
5. *Select the "Action" soft key on the touch screen, then select the "Slide to confirm" soft key under "Continue Mission" for the uploaded mission*
6. *Now the SwitchBlade-Elite will perform the mission according to the uploaded plan.*

**!** **NOTE:** To pause or stop an autonomous mission, activate Brake Mode by tapping the button on the top right edge of the Herelink Controller. Once a mission is paused, the SwitchBlade will hover in place. To resume a mission, "Slide to confirm" the "Continue Mission" button on the Herelink screen and the vehicle will continue as previously programmed.

To learn more about Mission Planning, [see Appendix](#).

## Land Mode


When Land Mode is activated, the SwitchBlade-Elite will deploy its landing gear and begin a gentle descent over its current position. It is recommended to use a 6 meter diameter or larger landing environment, as the accuracy of the GPS can vary up to  $\pm 2.5\text{m}$ .

Land Mode is initiated by pressing “Land” on the Herelink screen and slide to confirm.

### Land Mode as a Failsafe Protocol

Land Mode will automatically be activated if the battery becomes critically low. In most situations, this failsafe will prevent the aircraft from uncontrolled descents from altitudes of  $< 10\text{m}$ . It is not recommended to fly the SwitchBlade-Elite when it has less than 20% of its available battery capacity, to ensure an adequate margin of safety.

To learn more about failsafe modes, [see Emergency Procedures](#).

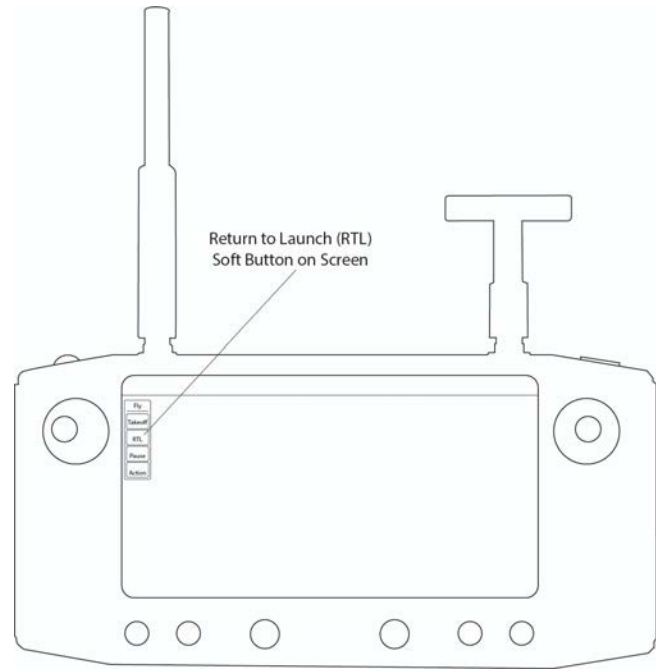
 **NOTE:** *If the pilot wishes to retake control during the descent portion of Land Mode, they may do so by moving the left joystick to full up position (full throttle) or by enabling Brake/Loiter Mode by tapping the button on the top right edge of the Herelink controller.*

## Return to Launch (RTL)

When RTL is activated (and the vehicle has GPS lock), the SwitchBlade-Elite will autonomously climb to 50 meters (user adjustable) or maintain altitude if above 50 meters. The vehicle will then return to the launch location on a direct path, hover for 5 seconds, deploy its landing gear, and begin a slow landing descent sequence. It is recommended to use a 6 meter diameter or larger launch/land environment, as the accuracy of the GPS can vary up to  $\pm 2.5\text{m}$ .

There are three ways RTL Mode can be activated:

1. Return to Launch Mode is initiated automatically when battery voltage drops below 21.6 volts for 60 continuous seconds. The GCS will produce an audible “Low Voltage” warning followed by a “Return to Launch” audible warning.
2. Return to Launch can also be manually activated by selecting the “RTL” soft button on the main menu of the Herelink screen. The user will need to verify this action by the “Slide to confirm” soft key. The Herelink will also produce an audible “Return to Launch” cue.
3. Return to Launch can also be activated as a final stage in [Mission Planning](#).



RTL can be overridden by changing to any other flight mode.

If the flight environment is significantly higher than the launch location, a 50 m climb altitude may not be adequate. If 50 m is not adequate for your flight environment, the setting can be changed in the parameters section of the Mission Planner software. Additionally, if the launch location itself is moving (such as on a moving vessel) it is best to avoid the use of Return to Launch Mode.

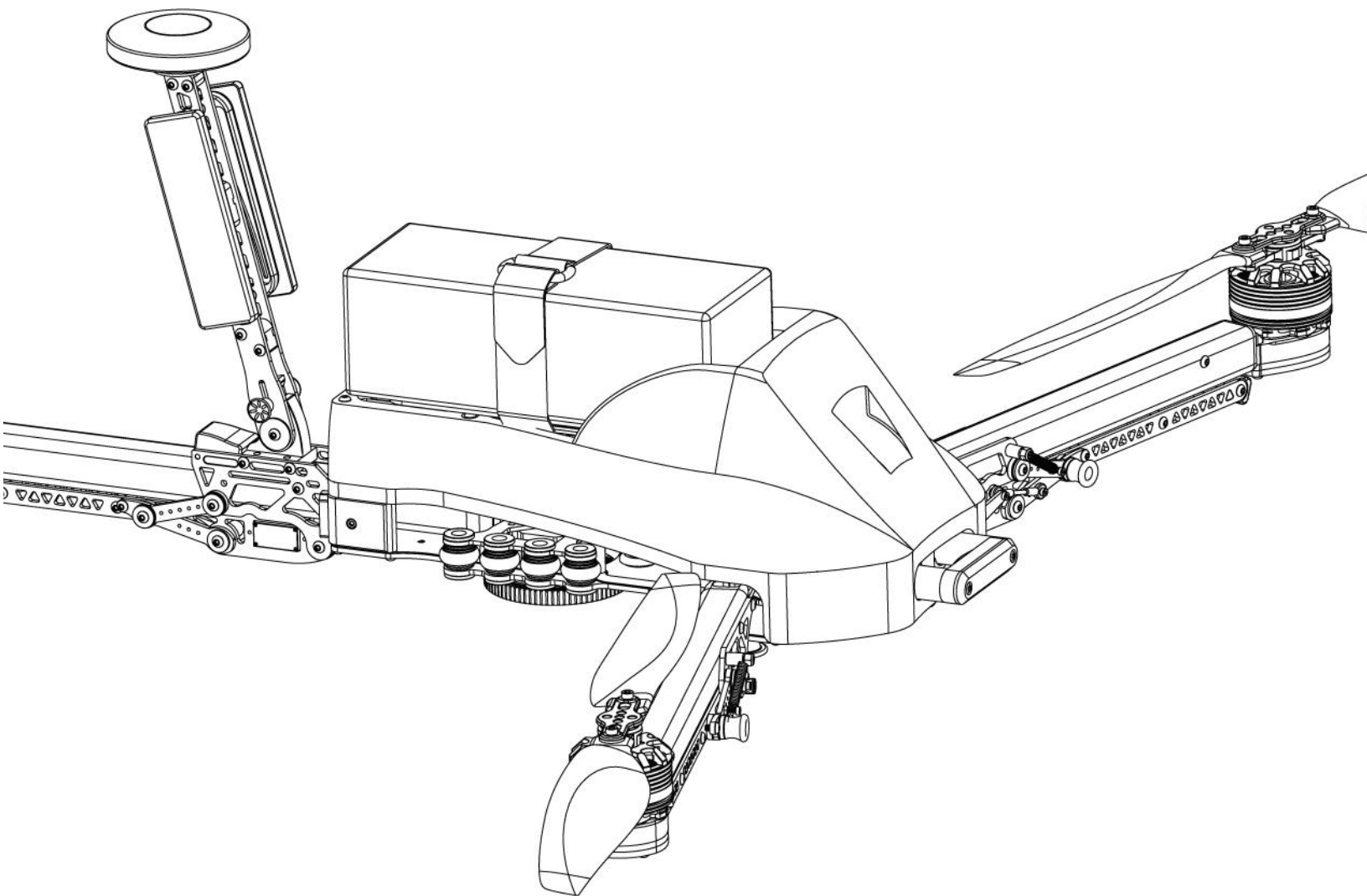
### Return to Launch (RTL) Mode as a Failsafe Protocol

Return to Launch will be activated automatically if the SwitchBlade-Elite loses communication with the controller. To learn more about failsafe modes, [see Emergency Procedures](#).

**!** **NOTE:** *If the pilot wishes to retake control during RTL Mode, by enabling Brake /Loiter Mode by clicking the button on the top right edge of the Herelink controller.*

**!** **NOTE:** *During the descent portion of the landing sequence the landing cycle can be aborted by holding the throttle at 100%.*





# Operating Procedures

# PREFLIGHT CHECKLIST

The first step for any flight is to make sure the environment is safe for flight.

**! WARNING:** *Don't fly the SwitchBlade-Elite indoors. Always fly outside in clear, open areas at a safe distance from yourself, other people, power lines, obstacles, and buildings. As the pilot, you are responsible for navigating the SwitchBlade-Elite to avoid obstacles.*

**! CAUTION:** *Don't fly within 5 miles of an airport or any airspace restricted by your local, state, or national airspace authority without proper authorization. As the pilot, you are responsible for knowing and understanding the regulations that govern small unmanned aircraft like the SwitchBlade-Elite in your jurisdiction (check resources like the B4Ufly app).*

**! CAUTION:** *Don't fly the SwitchBlade-Elite in extreme weather conditions such as rain, high winds, snow, or fog. Extreme weather conditions can permanently damage the SwitchBlade-Elite or cause instability in flight.*

**! CAUTION:** *Determine safe flight boundaries at your location. Be aware of any risks, including bodies of water, structures, trees, power lines, etc, and designate a few areas where you can land the SwitchBlade-Elite in case of an unsafe situation. Throughout your flight, be prepared to recover the SwitchBlade-Elite manually or use an [emergency procedure](#) if the SwitchBlade-Elite flies outside the safe flying area.*

Once a suitable environment is selected, [prepare the SwitchBlade-Elite for flight](#).

## ARMING / TAKEOFF

- Arm the aircraft by holding the left joystick at the bottom right position for 5 seconds . When it arms an audible cue will be initiated stating "Arming."
- Gently bring up the throttle (left joystick) and initiate take-off



Arming for Takeoff

## FLIGHT

Fly safely by remaining in the line-of-sight (LOS), while staying aware of your flight environment.

## LANDING / DISARMING

- Before landing the aircraft, check the landing site environment to ensure it is clear of power lines, people, animals, etc.
- If landing manually, deploy the landing gear. [See Landing Checklist.](#)
- Land the aircraft (ideally on a level surface).
- Disarm by holding the left joystick in the bottom left position.
- If carrying a payload, remove it. [See Payload Connection System.](#)



## POST FLIGHT AND STORAGE

- Disconnect the battery from the aircraft.
- Power down the GCS.
- Visually survey all electrical and mechanical connections.
- Using the red knobs, manually retract the landing gear.

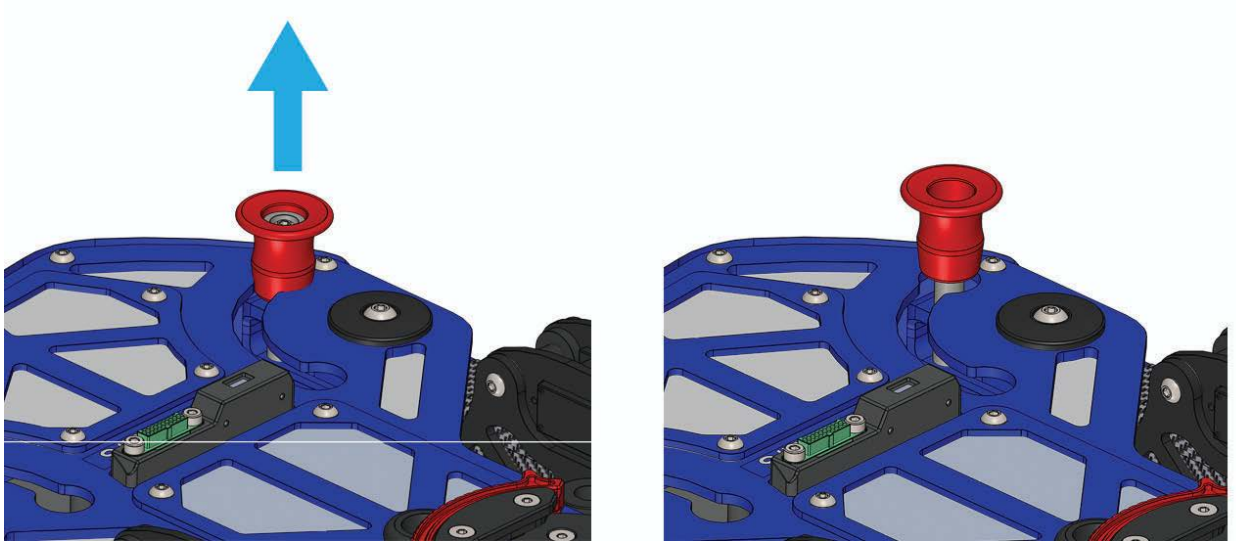
- Unsecure and lower the GPS mast by lifting the pull pin vertically and rotating the mast back toward the tail motor.



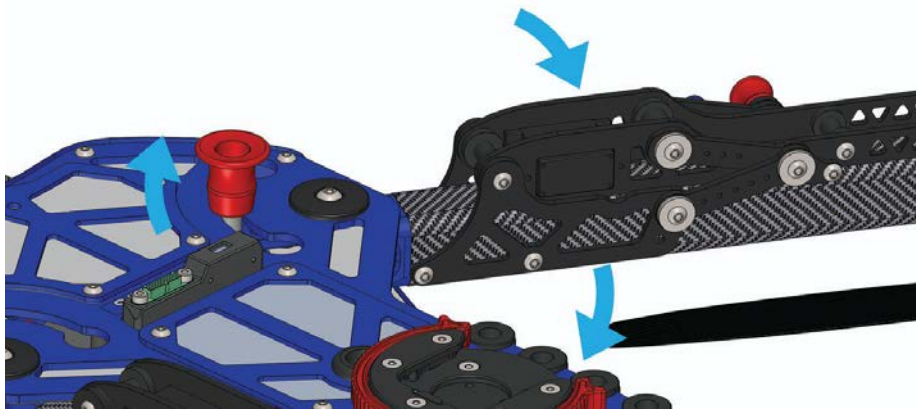
- Fold in the tail rotors so the blades point forward.



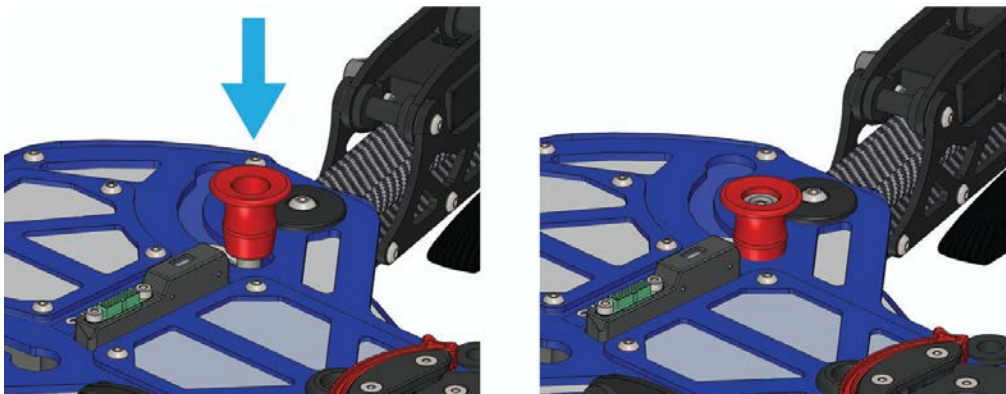
- Select one arm and pull out on the corresponding red knob.



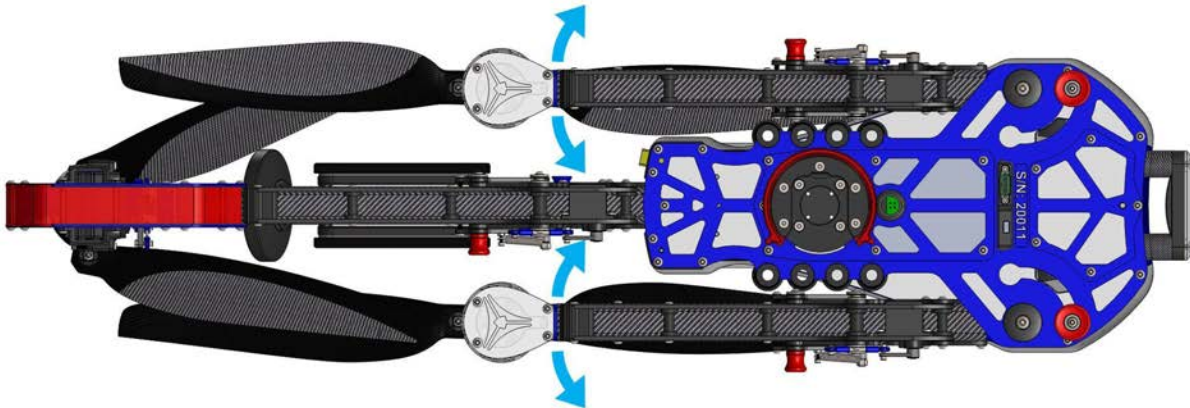
- Rotate the arm towards the tail.



- Once reaching the stop, release the knob to allow locking.



- Gently move the boom back and forth to verify the knob is engaged and seated.



- Repeat this process with the other arm.
- Place aircraft in its case and secure latches.

# BATTERY SAFETY

Use caution when handling the lithium batteries as they can cause a fire if handled incorrectly.

- ✓ Never alter, puncture, throw, bend, or impact the battery.
- ✓ Keep the battery away from liquids, fire, microwaves, and other hazardous or combustible materials.
- ✓ Don't expose the battery to extreme temperatures.
- ✓ If the battery is hot to the touch, wait for it to cool before using or charging.

## Damaged Batteries

Be sure to inspect the battery before and after each flight. Batteries can be damaged in shipping, use, or charging. If you notice any abnormal features such as damage to the exterior shell, swelling, deformation of the battery, abnormal smell, leakage, or other unexpected behavior, do not use the battery! These can be signs of serious damage that can cause the battery to catch fire. To prevent a hazard in case of fire or explosion:

- Disconnect the battery, then place it in a safe area outside of any buildings or vehicles and away from flammable materials.
- Do not dispose of the battery in the trash; dispose of the battery at a local battery recycling center as soon as possible. In the US and Canada, visit [call2recycle.org](http://call2recycle.org) to find a recycling location.

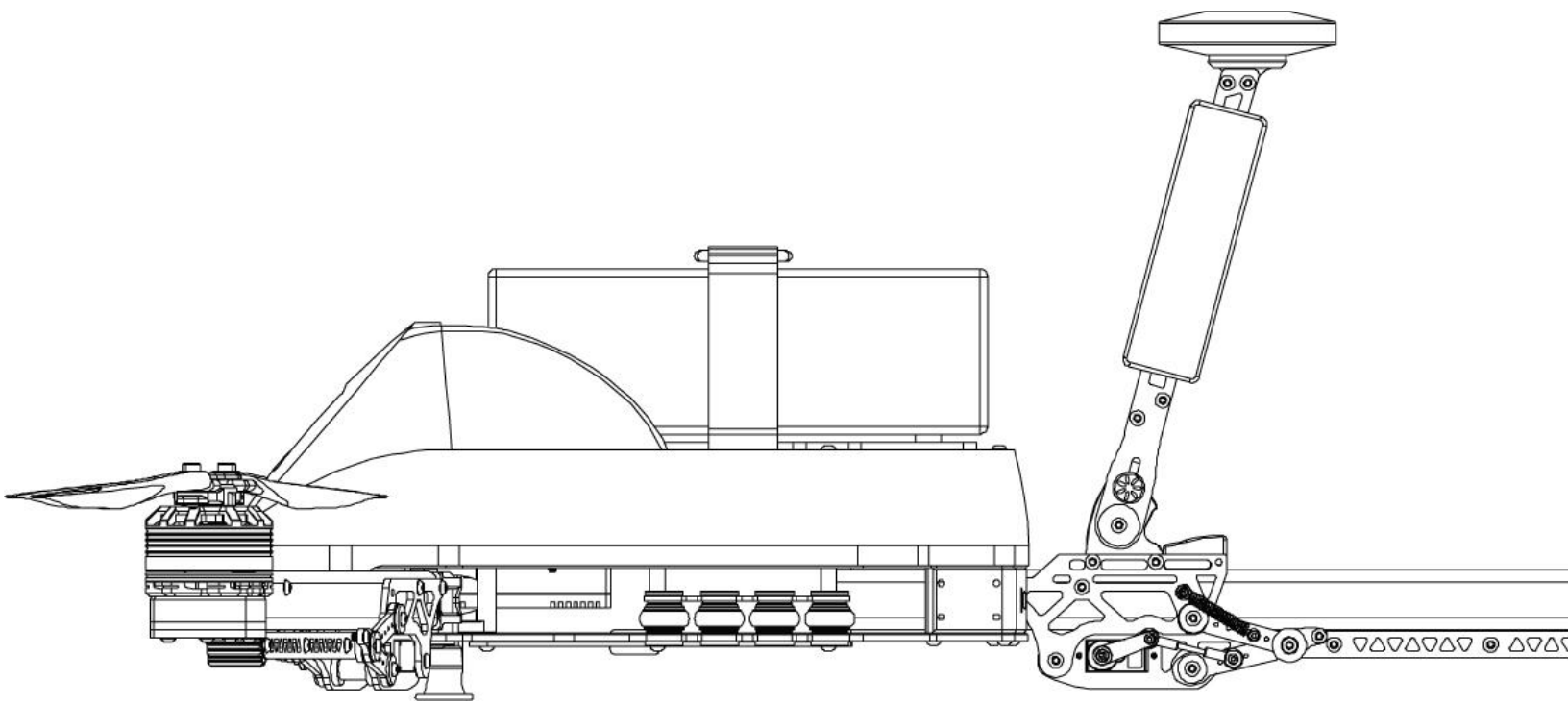
## Proper Battery Storage

For long term storage, the following conditions are recommended:

- Environmental temperature range of 18° C to 28° C (64° F to 82° F)
- 45-85% relative humidity
- Storage charge level
- Ensure the battery won't be exposed to extreme temperatures or direct sunlight

## Battery Voltage Testing

Battery voltage can be checked with a voltage tester. For additional information [see Appendix](#).



# Emergency Procedures



## INTRODUCTION

The emergency procedures listed in this section are the recommended practices for handling the aircraft in an emergency. This guidance should be considered and applied as necessary.

The risk of an emergency occurring can be reduced substantially through proper aircraft maintenance, by performing thorough inspections before and after all flights, careful pre-flight planning, and thorough flight environment surveying prior to flight.

Emergency situations are dynamic events, and not all conditions or procedures can be anticipated or applied during the event. These procedures are not a substitute for a thorough understanding of aircraft systems and sound pilot judgment.

If an emergency occurs, three basic actions can be applied to most situations:

1. **Maintain aircraft control**  
Small emergencies can quickly escalate if the pilot is distracted by attempting to troubleshoot the problem. Always maintain visual contact with the aircraft during an emergency to reduce the likelihood of losing orientation.
2. **Analyze the situation**  
Once the aircraft is stabilized, begin to assess the cause of the emergency if practical.
3. **Take appropriate action**  
In many cases, the appropriate action will be to land the aircraft as soon as possible. Always consider the safety of yourself and others before attempting to save the aircraft in an emergency.

## EMERGENCY PROCEDURES

### **Aircraft Error**

During any portion of the flight if the user makes an aircraft movement that is undesired.

1. Neutralize controls
2. Select brake Mode-as required
3. Analyze Situation and continue flight as required

## **Uncontrollable Environmental Change**

An unanticipated change in environment such as pilot distraction or unforecast weather may require user action.

1. Neutralize Controls
2. Switch to Loiter Mode and pilot to a safe landing location

*If flight environment does not change or conditions warrant:*

3. Select RTL (as required)

## **Lost Orientation**

Condition of flight environment, distance/location of the vehicle and the perception of the user can all lead to a misinterpretation of the vehicle's spatial orientation. Restoration of the user to the orientation to the vehicle is paramount for mission continuation and safe vehicle recovery. Primary consideration is the orientation of the vehicle before any mission is executed or continued.

In the event of **Lost Orientation**:

1. Reference telemetry on GCS

*If telemetry is unavailable:*

2. Reference FPV (if equipped)

*If FPV is unavailable:*

3. Orientation turns (Vector 2-second, SB-E 3-second turns)
4. RTL: Select manually

## **Lost Link**

Loss of link is a condition that is the result of some interruption of communication between the vehicle and GCS. Loss of link can be the result of many situations. Loss of power in GCS, GCS Failure, unpredictable RF environment or terrain/obstructions (inside a vehicle) may cause a loss of link. Proper preflight planning by ensuring GCS charge and understanding the flight environment will mitigate the majority of lost link issues.

Loss of link will manifest in several forms. GCS will furnish an audible “Communications Lost” message. User will experience a loss of control from right and left joysticks. Vehicle will begin an RTL unless communication is regained, and the user selects a different mode.

In the event of Lost Link:

1. **Launch/Landing site:** Ensure area is clear for RTL landing
2. **Communication:** Attempt to regain by resetting GCS and/or attaching charging source to device.
3. **Monitor RTL**
4. **Launch/Landing Site:** Monitor for safe vehicle recovery

### **In-Flight Battery Emergencies (RTL)**

Battery emergencies can be classified as low battery or critical battery conditions. In either case the failsafe will be triggered by pre programmed values. The intent is to alert the user and for the vehicle to complete a flight action that will produce a favorable outcome in recovering/reusing the vehicle.


Low battery situation is triggered by battery voltage dropping below 21.6 volts continuously for 60 seconds. The GCS will produce an audible “Low Voltage” warning followed by a “Return to Launch” audible warning.

A critical battery situation is triggered when the battery is at or below 10%. The GCS will produce an audible “Critical battery” warning. The warning will be followed by a “Landing” audible cue and the vehicle will begin an immediate landing sequence.

In both cases the vehicle will continue the programmed landing sequence unless action is taken by the user.

*In the event of **Low Battery (RTL Mode):***

1. **Mode select:** Override RTL Mode if Loiter Mode is desired or required.
2. **Landing site:** Identify landing site and ensure the area is clear.
3. **Landing sequence:**
  - a. *If in RTL Mode:* Monitor landing site and landing sequence while monitoring voltage.
  - b. *If in Loiter Mode:* Maneuver vehicle to desired landing site while monitoring battery voltage.

 **WARNING:** *When Landing Mode has been engaged due to critical voltage, vehicle can land in it's immediate vicinity without operator action. In the event the operator overrides and continues extended flight, the vehicle may lose functional lift and will result in catastrophic loss of vehicle and potential damage loss of any persons/property in its flight path.*

 **CAUTION:** *Continued extended flight after RTL or Landing Mode has been engaged due to low voltage is not recommended.*

*In the event of **Critical Battery** (Landing Mode):*

1. **Mode select:** Override Landing Mode if Loiter Mode is desired or required.
2. **Landing site:** Identify landing site and note location.
3. **Landing sequence:**
  - a. *If in RTL Mode:* monitor landing site and landing sequence while monitoring voltage.
  - b. *If in Loiter Mode:* Maneuver vehicle to desired landing site while monitoring battery voltage.

### **Loss of GPS (Altitude Hold)**

Loss of GPS position will trigger a switch to Altitude hold Mode. Additionally, the user may manually select Altitude Mode for environments that lack adequate GPS signal such as under bridges, heavy vegetation, etc. The loss of GPS will create an audible "EKF Failure" tone. In the event of loss of GPS, the user will retain controllability of the vehicle. However, RTL Mode and the ability of the vehicle to maintain station will be compromised.

*In the event of **Lost GPS**:*

1. Altitude: Climb to avoid all obstacles
2. Manually pilot vehicle referencing telemetry as needed
3. Manual landing as required


 **NOTE:** *Loss of GPS will require the user to account for external forces like wind.*

## Failed Landing Gear

A landing gear failure can manifest in multiple ways. In a failure the landing gear may present in limited deployment/retraction of single or multiple arms. Consideration should also be given to the presence of a payload and when attached, the type of payload.

*In the event of any landing gear malfunction:*

1. Determine presence and type of payload
2. If no payload present: Belly land aircraft manually

 **NOTE: Type of payload will predicate action taken for landing. Consideration should be given for survivability of payload over vehicle.**

*Partial failed landing gear*

1. Landing gear: Cycle (If landing gear extends to full down, land as required)
2. Landing gear remains partial failed: Return to landing site
3. Prepare site to land vehicle on substitute landing device (bush, piled up clothing, etc) to facilitate a level landing which protects payload from impact
4. At minimum hover (2-3cm) disarm flight by selecting the onscreen “armed” button and sliding to confirm disarm.

*Full failed landing gear*

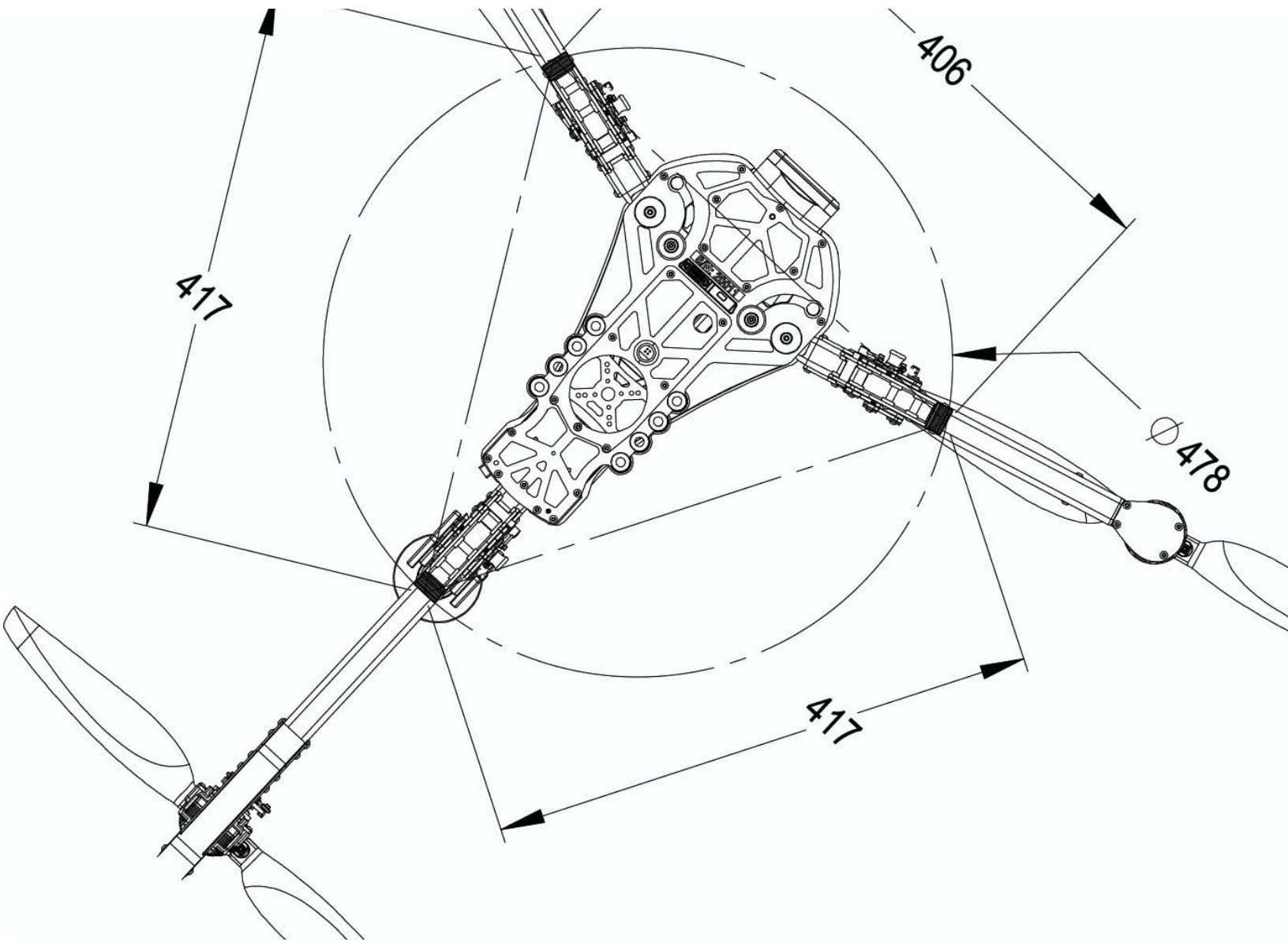
1. Landing gear: Cycle (If landing gear extends to full down, land as required)
2. Landing gear remains fully failed: Return to landing site
3. Prepare site to land vehicle on substitute landing device (trash can, bucket, etc) to facilitate a level landing which supports landing points and protects payload from impact
4. At minimum hover (2-3cm) disarm flight by selecting the onscreen “armed” button and sliding to confirm disarm.

## **Yaw Malfunctions**

Yaw Malfunctions will manifest in either a right or left uncontrollable yaw. While left joystick yaw control will be ineffective, all other controls will be fully functional. The GCS may produce an audible “EKF Failure.” In a worst case scenario the vehicle will begin to pirouette.

### *Loss of yaw control (Compromised tail )*

1. Manually engage RTL
2. If RTL is unavailable or not desired, utilize a pulsing forward movement in the direction of the landing zone.
3. If no payload present, landing with gear up on soft surface
4. If a payload is present, landing gear down.
5. Position over intended landing site
6. At minimum hover (2-3 cm): Disarm flight



# Maintenance & Support

# SUPPORT

Vision Aerial is here to help you get the most out of your SwitchBlade-Elite. If you have any questions, please contact us at [info@visionaerial.com](mailto:info@visionaerial.com) or call +1 (406) 333-1795. To submit a support request through our website, visit [www.visionaerial.com](http://www.visionaerial.com).

## MAINTENANCE

### BEFORE EVERY FLIGHT

#### 1. Arm Locks

- The arm locks should move freely and lock solidly both in the storage and flight configurations.

#### 2. Yaw Mechanism

- Inspect all four connection points of the control links between the servo and yaw motor cradle are securely attached and move freely.
- Inspect that the yaw motor cradle moves unobstructed from any debris, wires, etc.

#### 3. Rotors

- Inspect for chips, typically found on the leading edge. If chips greater than 1.5mm are found, it is recommended the rotor be replaced.
- Inspect for cracks and excessive flexibility. If significantly more flexibility in the rotor is detected, replace the rotor.
- Inspect for proper hub tension. To test, unfold the rotor and hold the aircraft on its side. The rotor should be clamped just tightly enough to ensure adequate friction such that gravity does not cause the rotor to rotate on its hub, but loose enough to be comfortably rotated by hand.
- An example of a healthy rotor is shown in the image.
- Once preflight checks are complete, use the throttle to gently rotate the rotors and check that each prop is rotating in the correct direction.





## Rotors

The SwitchBlade-Elite comes with three attached, folding rotors.

Attachment and removal of the blades is performed by tightening or loosening the two center bolts on the rotor.

**!** **CAUTION:** Anytime these bolts are removed, apply Loctite 277 (RED) to the bolts when reattached to keep them from loosening during transport or operation.



All blades in folding rotors arrive from Vision Aerial at the correct attachment screw torque. A simple way to check if they have become loose is to hold up the rotor assembly vertically and see if the blades in the rotor sag due to gravity. Sagging is an indication that the blade screw needs to be tightened slightly until they do not sag.



The picture to the right shows rotors that are sagging due to the attachment screws being too loose.

The following picture shows no sag due to properly tightened screws.

**!** **CAUTION:** Rotors should be just tight enough to not sag.





**WARNING: Avoid contact with SwitchBlade-Elite's high-speed rotors**

- ✓ ***Always disarm the SwitchBlade-Elite before handling***
- ✓ ***Before starting motors for takeoff, always ensure that the rotors are clear of any obstructions and at least 5 meters (16.5 feet) away from any people, animals, or property before activating***
- ✓ ***Do not touch moving rotors or approach the SwitchBlade-Elite while the rotors are spinning***
- ✓ ***Always disarm the SwitchBlade-Elite before picking it up***
- ✓ ***Do not approach the SwitchBlade-Elite until the rotors stop spinning***

## **EVERY 25 FLIGHTS**

Tools Needed: 2mm Allen key, thread locker, and Phillips screwdriver.

### **1. Motors**

With the aircraft unpowered, slowly rotate each motor feeling & listening for any grinding or rubbing, any significant grinding or rubbing warrants a motor replacement or rebuild.

### **2. Batteries**

Plug each battery pack into the charger and complete a full charge via the balance charging program. Once complete, compare the highest voltage cell to the lowest voltage cell. If the difference is greater than 50mV (0.05V) recycle the pack.

### **3. Arms**

Inspect carefully the carbon fiber arms & empennage for cracks and/or delamination. Small surface level delaminations of the clear coat pose no significant threat, however any crack or separation that is deeper than the clear coat warrants an immediate replacement of the arm.

# APPENDIX

## Additional Information

Checklists: Pre-Take Off, Take Off, Systems Check, Mission Checklist, Landing Checklist	<a href="https://docs.google.com/document/d/e/2PACX-1vTCXY1Xh6zIwoSkR0tqGK0dITC9j4_TdVTUZrO4sZ1NY5-BEQNGQrCR34hakntRfJw556g6J93Y38ed/pub">https://docs.google.com/document/d/e/2PACX-1vTCXY1Xh6zIwoSkR0tqGK0dITC9j4_TdVTUZrO4sZ1NY5-BEQNGQrCR34hakntRfJw556g6J93Y38ed/pub</a>
Battery Charging Instructions	<a href="https://docs.google.com/document/d/e/2PACX-1vSBx8QDI R4LbspbqtFJPR2CWLtO_zYofEge5xwvP72eNJdu9cdhZBx EIMFF3BR8G5g59scSiOzULqm8/pub">https://docs.google.com/document/d/e/2PACX-1vSBx8QDI R4LbspbqtFJPR2CWLtO_zYofEge5xwvP72eNJdu9cdhZBx EIMFF3BR8G5g59scSiOzULqm8/pub</a>
Herelink Controller Manual	<a href="https://docs.cubepilot.org/user-guides/herelink/herelink-use-r-guides">https://docs.cubepilot.org/user-guides/herelink/herelink-use-r-guides</a>
How to Download Flight Logs	<a href="https://docs.google.com/document/d/e/2PACX-1vT8Jbs6iAh1S2MB8V5toOe7BoGrCLTxdlBffzinFP3fyVQpvVQ4Bmoy4OGaEkaXm5gDGbwJpW8gHfIA/pub">https://docs.google.com/document/d/e/2PACX-1vT8Jbs6iAh1S2MB8V5toOe7BoGrCLTxdlBffzinFP3fyVQpvVQ4Bmoy4OGaEkaXm5gDGbwJpW8gHfIA/pub</a>

## Glossary of Terms, Acronyms, and Abbreviations

AS	Air Speed
APP	Application (Computing program)
AUTO	Autonomous Mode
C1	Broadcast feed for user controls. Also referred to as RC (Radio Control)
C2	Broadcast feed for soft controls. Also referred to as Telemetry
CG	Center of Gravity
Drone	Unmanned vehicle
EO	Electro-Optical
ESC	Electronic Speed Controller
FAM	Familiarization
Flight Deck	Vision Aerial Software
GCS	Ground Control Station (Herelink)
GPS	Global Positioning System
GS	Ground Speed
IOS	Internet Operating System
IR	Infrared
LED	Light Emitting Diode
Li-Po	Lithium Polymer
LOS	Line-Of-Sight
Mission	Use of GCS software to execute a preprogrammed route for vehicle
Nadir	Point on the celestial sphere directly below an observer
PC	Personal Computer
PCS	Payload Connection System
PDB	Power Distribution Board
PIDS	Proportional Integral Derivative
PITCH	Rotation around the horizontal axis
QC	Quality Control
RID	Remote Identification
ROLL	Rotation around the longitudinal axis
Rotor	Complete assembly of blades including hub
RPM	Revolutions per minute
RTL	Return to Launch

SB-E	SwitchBlade-Elite
Throttle	Left stick, vertical motion
UAV	Unmanned Aerial Vehicle
UAS	Unmanned Aerial System
YAW	Rotation around the vertical axis
V1	Video Broadcast feed-Channel 1
V2	Video Broadcast feed-Channel 2
<b>Use of Special Terms</b>	
Note	Operating procedure, practice or condition that is essential to emphasize
Caution	Operating procedure, practice or condition that may result in damage to equipment if not followed or observed
Warning	Operating procedure, practice or condition that may result in injury or death if not followed or observed
<b>Requirement for compliance</b>	
Shall	Application of a procedure is mandatory
Should	Application of a procedure is recommended
May	Application of a procedure is optional
Will	Indicates futurity
<b>Requirement for Landing</b>	
Land as soon as Practicable	Extended flight not recommended, duration is at the discretion of the operator
Land as soon as Possible	Land at the nearest safe site which a landing can be made
Land Immediately	Execute a landing without delay