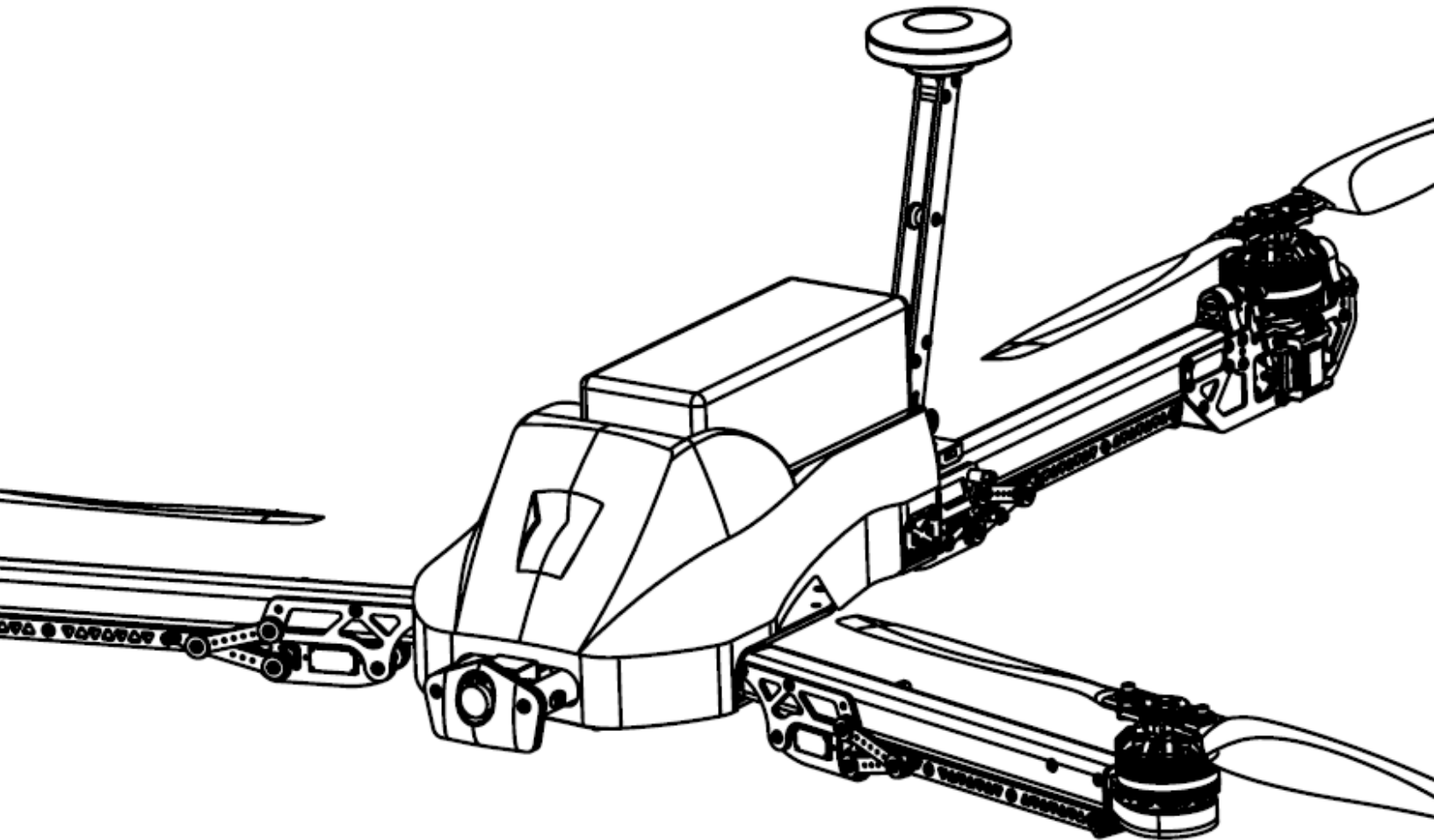




SWITCHBLADE- ELITE



FLIGHT MANUAL

REVISION B | JANUARY 2018

REVISION HISTORY

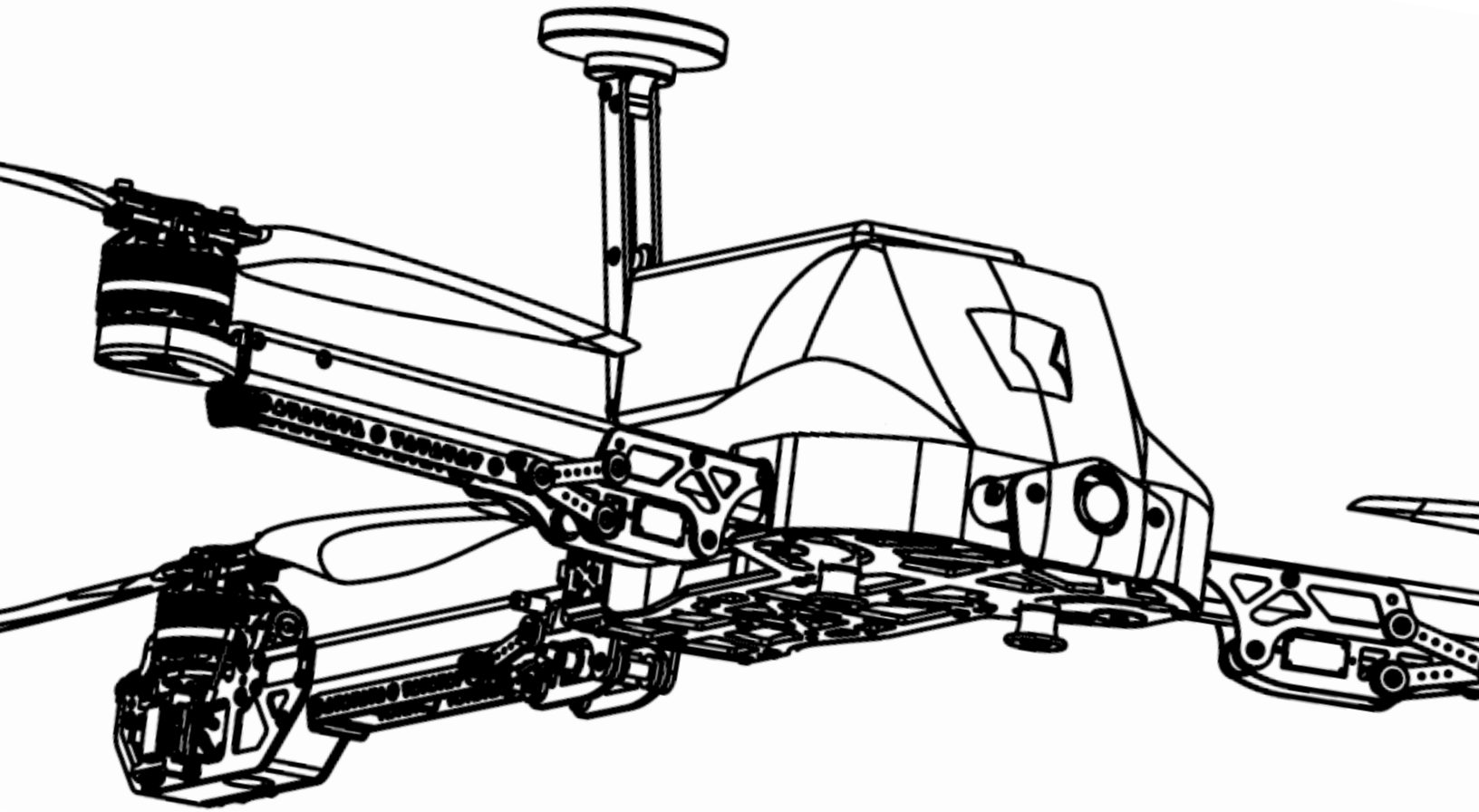
Revision	Date	Description
A	March 2017	Initial Release
B	January 2018	Updated Images & Flight Modes

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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 prior to 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 propellers 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 propellers that have visible imperfections or damage.

Always keep children and animals a safe distance away from the SwitchBlade-Elite when in use.

Only use propellers supplied by Vision Aerial that are designed for use on the SwitchBlade-Elite.

Always remove the propellers when making a hardware change to prevent propeller strikes in the event of unintentional motor starts.



SAFETY

When testing the SwitchBlade-Elite drive system be sure the propellers are removed. Make sure that the motors are spinning in the correct direction and that the motor assignment is correct with respect to the flight controller. If you have either of these wrong, the SwitchBlade-Elite will be uncontrollable.

Once preflight checks are complete, use the throttle to gently rotate the propellers and check that each prop is rotating in the correct direction.

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, OR SPECIAL DAMAGES, OR ANY DAMAGES WHATSOEVER RESULTING FROM THE USE OF THE SWITCHBLADE-ELITE OR FROM 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 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 the SwitchBlade-Elite.
- Infringement of third party data, audio or video rights recorded when using the SwitchBlade-Elite.

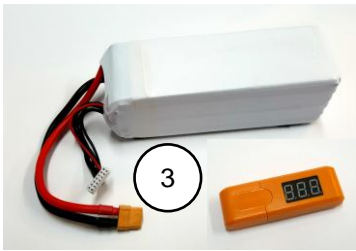
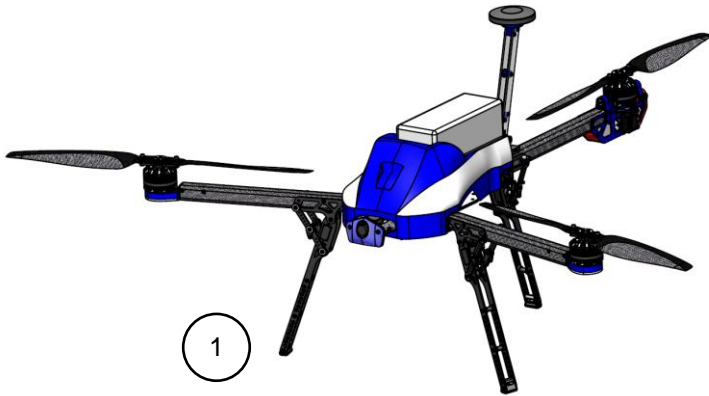


INTRODUCTION

The SwitchBlade-Elite is a tri-rotor drone with an articulating tail, with ultra-powerful and efficient electric motors and cutting-edge flight components. Not only is the SwitchBlade-Elite fast and easy to fly, it is 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 means that the SwitchBlade-Elite is fast. You'll be able to keep up with virtually any action shot with a top speed of over 60 MPH (100 KPH). 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 under two minutes.

The intent of this manual is 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.

INCLUDED ITEMS

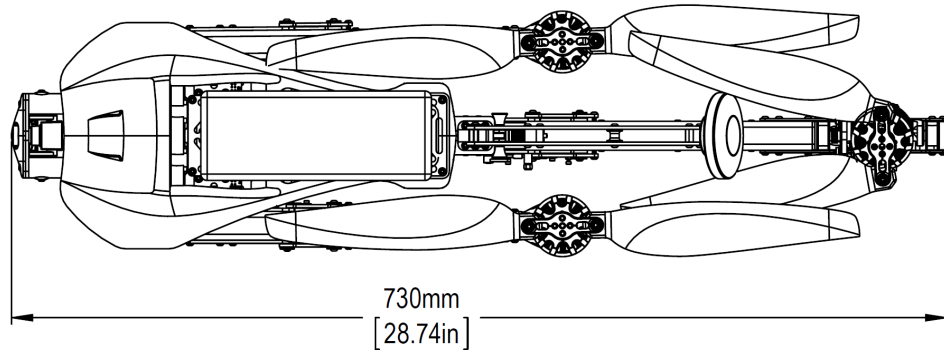
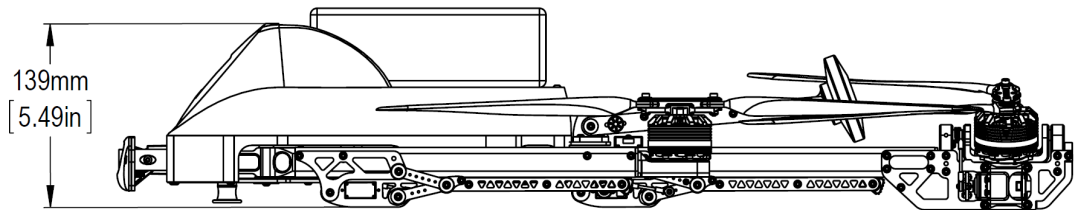
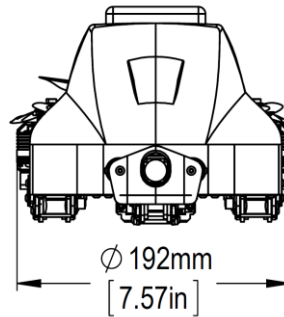
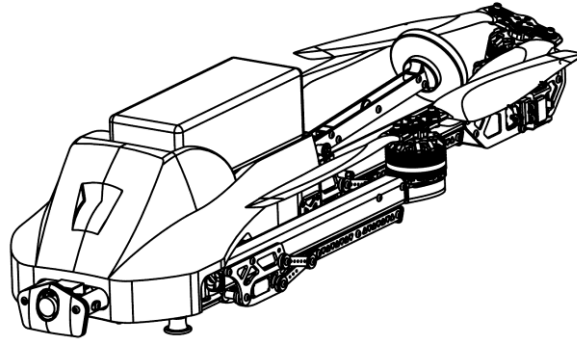


The SwitchBlade-Elite package includes:

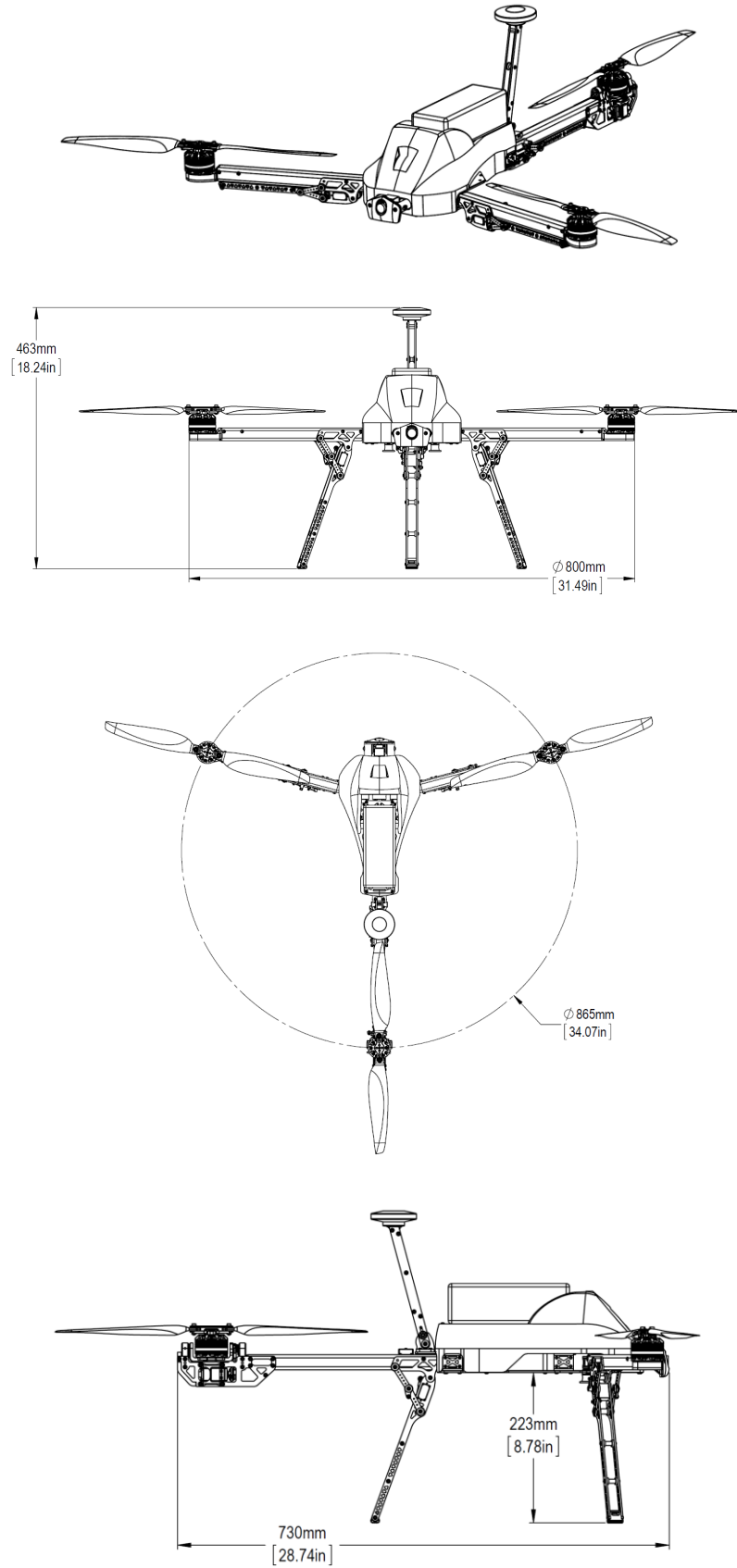
1. SwitchBlade-Elite TriCopter (Ready-to-Fly)
2. Controller & Charger
3. Battery (1x) & Voltage Checker
4. Battery Charger
5. Hard Transport Case
6. Mission Planning Tablet & Telemetry Radio
7. Video Receiver / Monitor (optional)

SPECIFICATIONS

STORAGE CONFIGURATION DIMENSIONS



FLIGHT CONFIGURATION DIMENSIONS



AIRCRAFT

Empennage	Carbon Fiber
Arms	Carbon Fiber
Frame & Hardware	Aluminum / Stainless Steel
Body	Polycarbonate
Motors	360kv (1125W)
Propellers	Carbon Fiber, Folding and Precision Balanced
Flight Controller	PixHawk
Controller/Transmitter	Graupner MZ-18
Flight Dimensions	865 mm Diameter
Storage Dimensions	730 mm x 192 mm
Case Dimensions	120 cm x 42 cm x 23 cm
Aircraft Weight (No Battery)	2.7 KG

BATTERY / CHARGING

Flight Battery Included	13,000 mAh 6s Lithium Polymer
Battery Charger	6A AC/DC

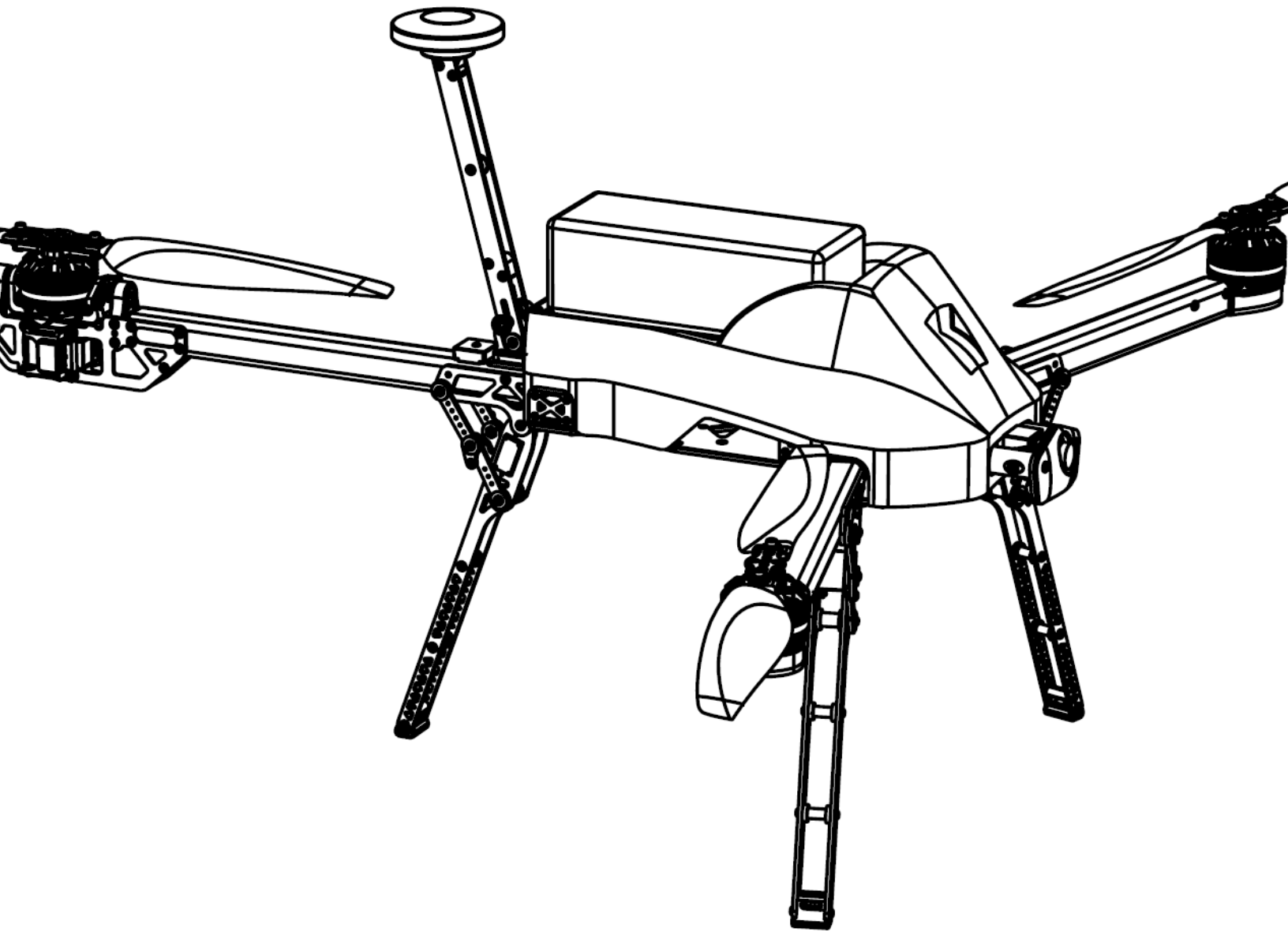
FLIGHT OPERATIONS

Manual Flight Range	4 km (2.5 miles)
Autonomous Flight Range	Over 25 km (16 miles)
Max Operational Wind Speed	Over 48 KPH (30 MPH)
Max Operational Altitude	4500 m (14,800 ft) Above Sea Level
Operational Temperature Range	-5° C to 40° C (23° F to 104° F)
GPS Accuracy	± 2.5 meters (± 8 feet), typically less than ± 1 meter
Position Hold Accuracy	± 2.5 meters (± 8 feet), typically less than ± 1 meter
Live First Person Video Range	Up to 8 km (5 miles) (topography may impact range)

PAYLOADS

Max Payload	2.3 KG (5 LBS)
Recommended Payload	< 1.5 KG (3.3 LBS)
Payload Mounting	45 x 45 mm M3 Threaded Mounts 16mm diameter x 50mm Carbon Fiber Rail Mounts (Optional)
Center of Mass	Adjustable Using Battery





SWITCHBLADE-ELITE SETUP

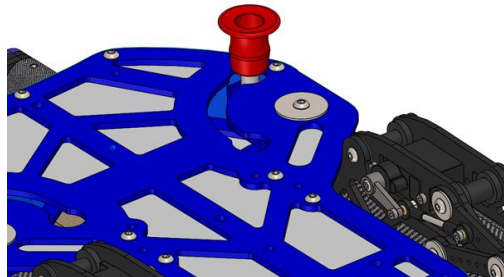
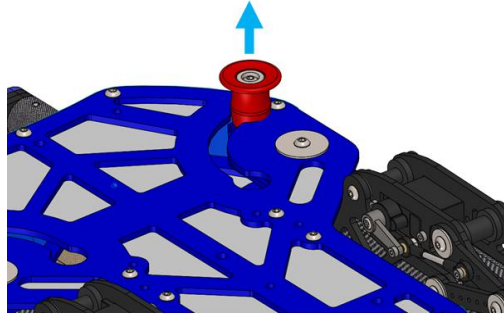
SETTING UP THE SWITCHBLADE-ELITE

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.

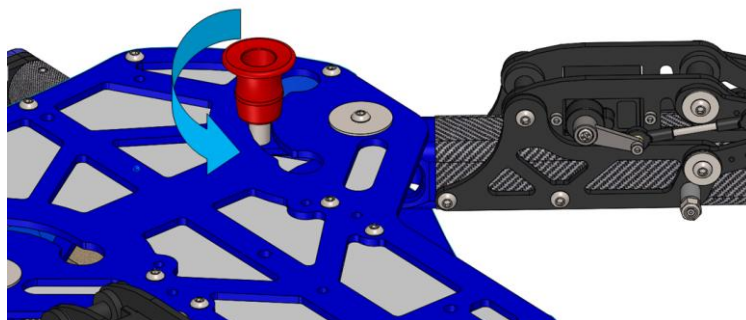
***IMPORTANT: Do NOT manually operate the retractable landing gear!**

(Doing so may cause damage to the landing gear servos.)

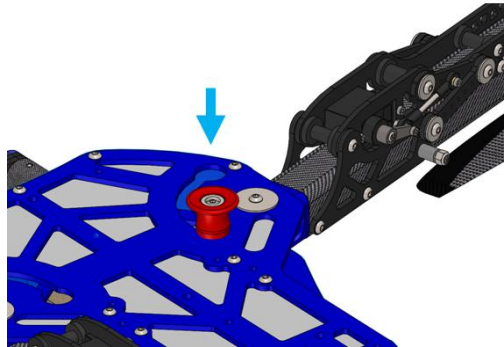
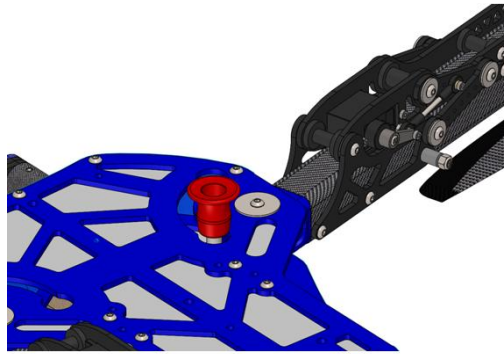
- Remove the SwitchBlade-Elite from case.
- Select one arm and pull out on the corresponding red knob.



- Rotate the arm away from the tail.



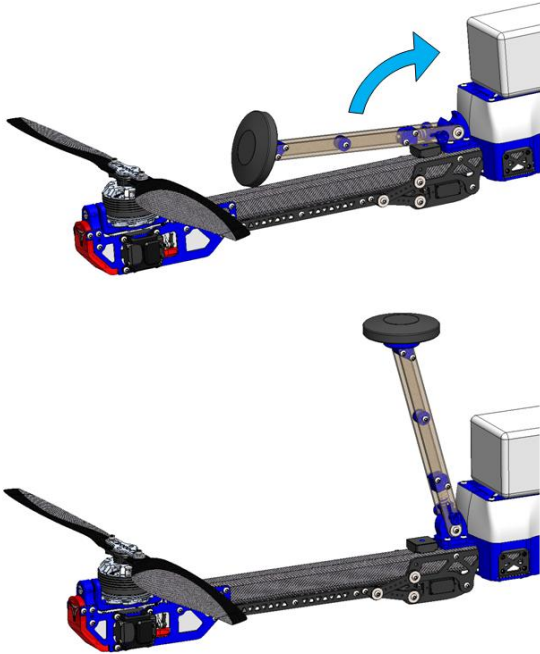
- Once reaching the stop, release the knob to allow locking.



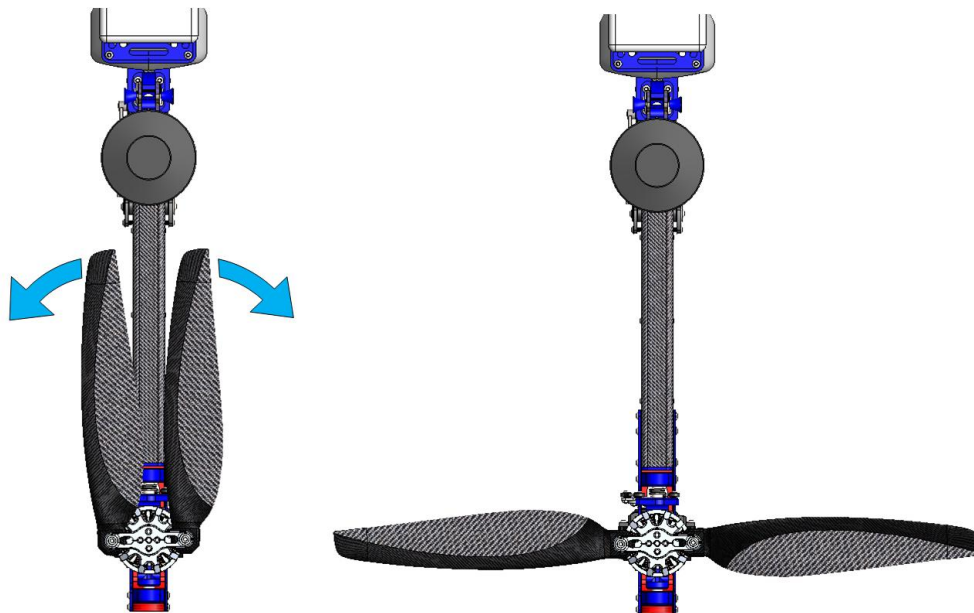
- Gently move the arm back and forth to verify the knob is engaged and seated thoroughly.



- Repeat process with other arm.
- Raise and secure the GPS mast.



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



- Check propeller hub tightness by moving the prop back and forth, should be just tight enough to hold itself straight if motor axis is held parallel to the ground (see the Propeller section on page 30 for more details).
- Check the battery voltage with the supplied voltage checker (4.20V/cell = fully charged).



- Check that the battery is properly secured.
 - Position the battery pack so that the center of mass is in the center of the aircraft.
(see the Battery Installation section on page 24 for more details)
 - Battery Velcro is in contact with the battery plate Velcro.
 - Strap is securely tightened and well adhered.
- Visually survey all electrical & mechanical connections.
- Before powering the transmitter be sure all the switches are in their default positions.
- Power up the transmitter, select “On” on the touch screen menu to activate the radio and check transmitter battery level.
- 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)
- Confirm the radio link is active by changing the flight mode (an audible tone will sound).
- Deploy the landing gear by lifting the aircraft off the ground by hand and flip the gear switch on the transmitter to the deployed position. Once deployed set the aircraft back on the ground.

***NOTE: Do not manually raise or lower the retractable landing gear!**

(This can cause permanent damage to the servos.)

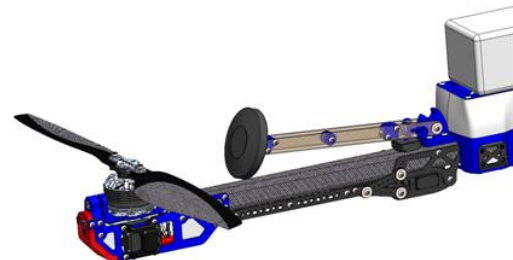
- If flying with a payload, attach it to the airframe now.
- If applicable ground test the payload and associated equipment (i.e. monitor).
- If using tablet or PC, launch mission planning app and connect to the aircraft.
- Check battery level of connected telemetry device (tablet, phone, PC).
- Again survey the flight environment (power lines, people, wind, birds, etc).
- Arm aircraft by holding the throttle at zero and full right yaw for 5 seconds (be sure not to hold more than 15sec or the aircraft will enter 'AutoTrim' mode).
- Smoothly & slowly bring up the throttle and initiate take-off.

TEARING DOWN THE SWITCHBLADE-ELITE

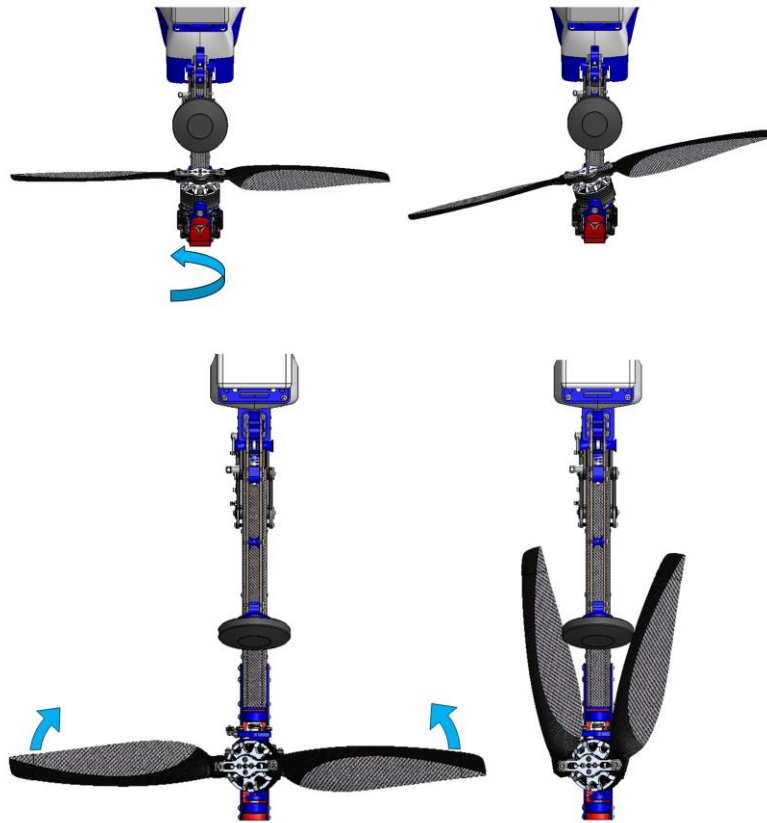
- Prior to landing the aircraft, check the landing site environment (power lines, people, animals, etc).
- Land the aircraft (ideally on a level surface).
- Disarm by holding zero throttle and full left yaw.
- If carrying a payload, remove it.
- Lift the aircraft off the ground by hand and use the transmitter to retract the landing gear.

***NOTE: Do not manually raise or lower the retractable landing gear!**
(This can cause permanent damage to the servos.)

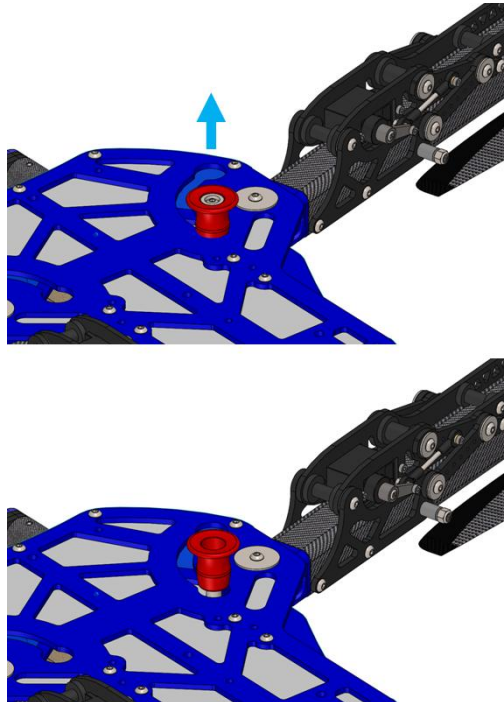
- If using telemetry disconnect it from the tablet, phone or PC.
- Disconnect the battery from the aircraft.
- Power down the transmitter and return the switches to their preflight positions.
- If using payload accessories power them down (i.e. monitor).
- Visually survey all electrical and mechanical connections.
- Unsecure and lower the GPS mast by lifting the pull pin vertically and rotating the mast back toward the tail motor.



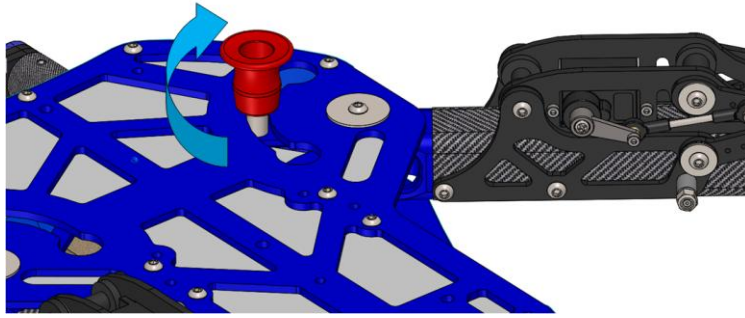
- Fold the tail rotor so the blades point forward. Note: It may be helpful to manually tilt the tail mechanism to allow enough clearance to prevent the blades from touching.



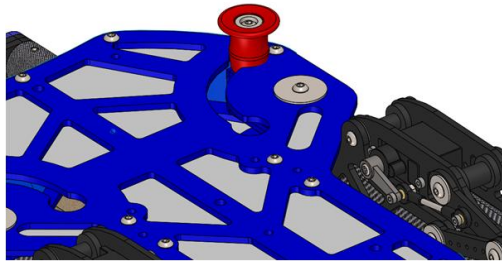
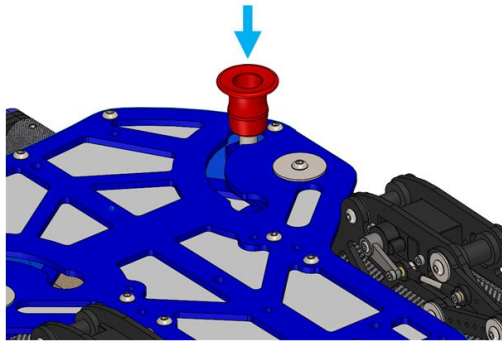
- Select one arm and pull out on the corresponding red knob.



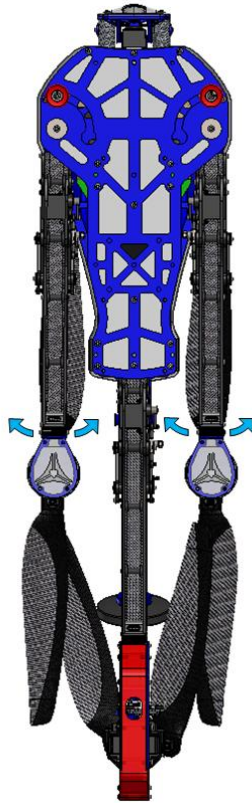
- Rotate the arm towards the tail.



- 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.



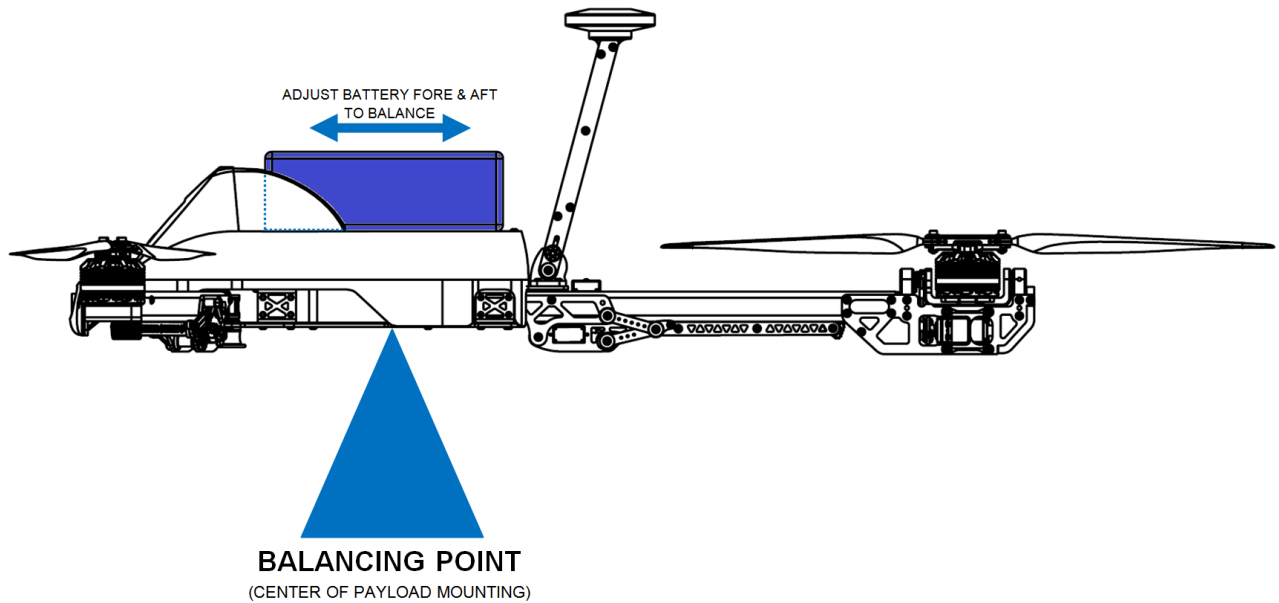
- Repeat process with other arm.
- Check the battery voltage with the supplied voltage checker and note the flight time (3.60V/cell is lowest recommended discharge level if lower than 3.60V/cell reduce flight time on future flights).



- Place aircraft in case and secure latches

BATTERY INSTALLATION

Battery is secured to the craft with Velcro on the support plate and battery, as well as an adjustable Velcro strap. The exact battery position relative to the craft can be adjusted to help balance the SwitchBlade-Elite during flight. The battery position will likely have to be adjusted when applying or removing different payloads. After optimizing battery placement, always make sure to secure the Velcro strap that wraps around the battery pack. The electrical connection between the craft and battery is made using an XT60 connector. Making this connection powers on the SwitchBlade-Elite.



****IMPORTANT****

Always disconnect the battery during transport.

Always secure the battery pack.

BATTERY CHARGING

The SwitchBlade-Elite kit includes a battery charger. Remove the battery from the SwitchBlade-Elite, attach the charger to a wall outlet 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.
 - Aka: "1C"
 - For example:
 - A 13Ah pack at max charge current equals a max 13A charging current.



BATTERY SAFETY

Use caution when handling the lithium polymer 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.

Inspect the battery before and after each flight. It is possible for the battery to 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, and place the battery 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 local battery recycling center as soon as possible. In the US and Canada, visit call2recycle.org to find a location.

For long term storage, store the battery in an 18° C to 28° C (64° F to 82° F) environment, between 45-85% relative humidity and with 3.80V/cell storage charge (see charge appendix, Appendix B, for details). Always make sure to store the battery in a place where it won't be exposed to extreme temperatures or direct sunlight.

Battery voltage can be checked with the included voltage tester, as shown below.



CONTROLLER

The SwitchBlade-Elite comes with a Graupner MZ-18 Transmitter/Controller included. To charge the controller, plug the included charger into a wall socket and the other end into the charging socket on the back of the controller. Only use the included controller charger, or a manufacturer recommended charger.

- **Always check the controller's battery level before flight.**
- **Always turn the controller on before powering on the SwitchBlade-Elite, and turn off after un-powering the SwitchBlade-Elite.**
- **Never turn the controller off during flight!**

For additional information see Appendix A.

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 antenna as shown below.



MISSION PLANNING APP

The SwitchBlade-Elite is capable of performing a variety of mission planning flight patterns commensurate with the PixHawk flight controller. Mission planning using a PC interface is recommended through the program: Mission Planner. Mission planning using a non-iOS mobile device interface is recommended through the use of Tower App. Additional mission planning information can be found in Appendix C.

For more information on Mission Planner, visit the Mission Planner home at:

<http://ardupilot.org/planner/index.html>.

For more information on Tower App, visit the Tower App home at:

<https://play.google.com/store/apps/details?id=org.droidplanner.android&hl=en>.

PROPELLERS

The SwitchBlade-Elite comes with three folding propellers already attached.

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



***IMPORTANT:** Anytime these bolts are removed, apply Loctite 243 (BLUE) to the bolts when reattached to keep them from loosening during transport or operation.

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

The picture below shows propellers that are sagging due to the attachment screws being too loose.

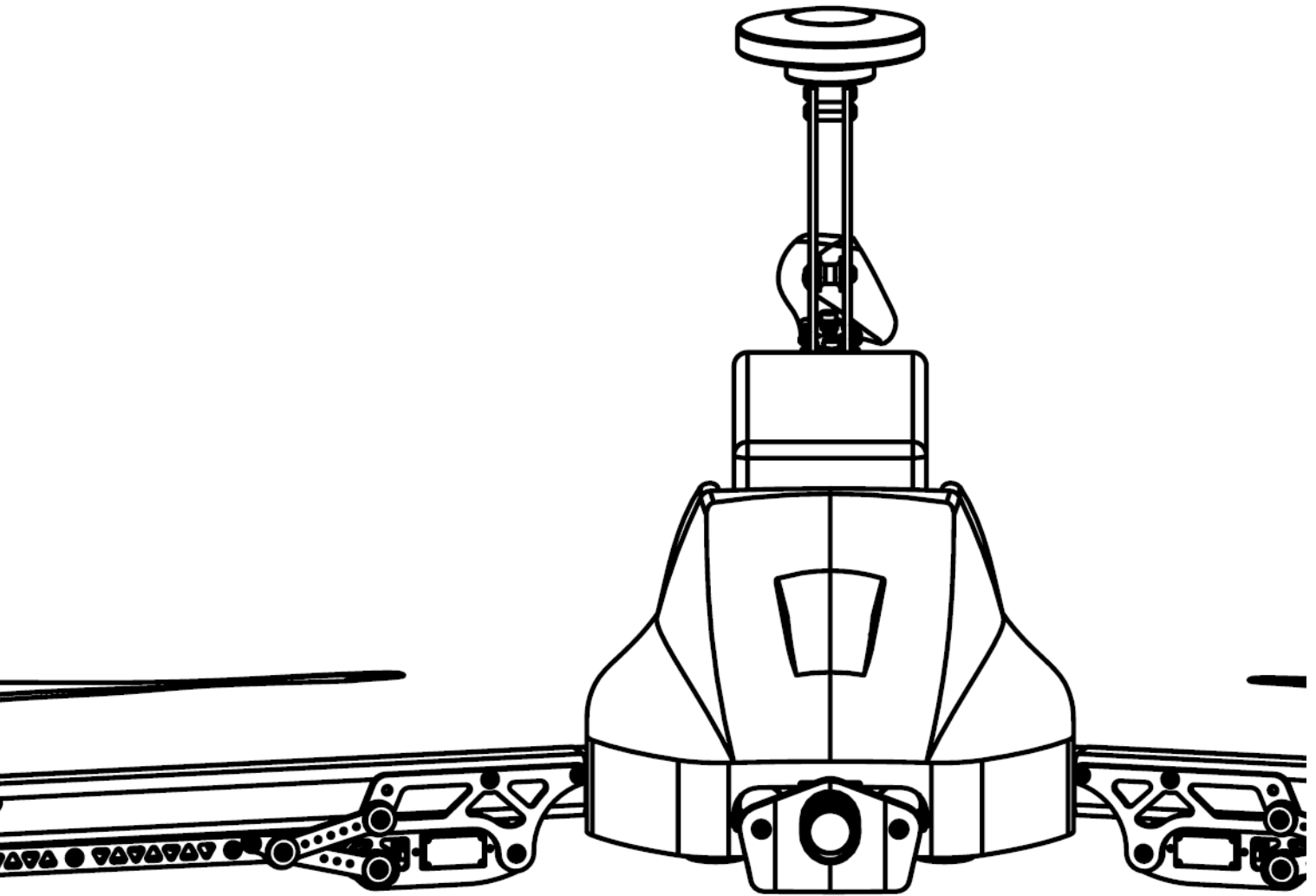


The following picture shows no sag due to properly tightened screws.

***NOTE:** Propellers should be just tight enough to not sag.



To avoid hazardous contact with SwitchBlade-Elite's high-speed propellers, always disarm the SwitchBlade-Elite before handling. When prompted to start motors before takeoff, always ensure that the propellers 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 propellers or approach the SwitchBlade-Elite while the propellers are spinning. Do not approach the SwitchBlade-Elite until the propellers stop spinning, and always disarm the SwitchBlade-Elite before picking it up.



SWITCHBLADE-ELITE
FLIGHT MODES

FLIGHT MODE SWITCHES

The SwitchBlade-Elite comes programmed with six different flight modes. The active flight mode is adjusted using different configurations of two of the switches on the controller, the two switches above the right control stick.



It is important to note that when in Position Hold, like the throttle with Altitude Hold, the joystick movements are not directly proportional to the motion of the SwitchBlade-Elite. All joystick movements are proportional to maximum programmed speed in the direction the joystick is moved. For example: If the roll joystick is moved left, say half of its travel, the SwitchBlade-Elite will choose its own roll angle in order to achieve 50% of the programmed max ground speed for that direction. This can be very useful for applications like aerial filming where keeping the ground speed constant is desirable.

POSITION HOLD

Position Hold mode is similar to Altitude Hold mode, expect that all of the sensors, including the GPS system are used to hold the SwitchBlade-Elite in position. When the controls are released to their center positions the SwitchBlade-Elite will maintain its position in three dimensional space, even in the event of external forces like wind.

Position Hold mode is initiated by moving the left switch to the away position and the right switch away from the right control stick.



***NOTE:**

It is important to note that the throttle does not directly correlate to the RPM of the motors, rather, the throttle correlates to a desired climb or descend rates. For example: when the throttle is in the center position the target climb/descend rate is zero. When the throttle is moved to say, the 75% position it will climb at half of its available max climb rate. Conversely, when the throttle is at 25% position, it will descend at half its max decent rate.

ALTITUDE HOLD

Altitude Hold mode is the closest to a manual flight mode the Elite is equipped with. When in Altitude Hold mode, the SwitchBlade-Elite will use all of its on-board sensors, excluding only the GPS system. This allows the flight controller to use the barometric pressure measurement system to maintain altitude, when the throttle centered in its travel.

Altitude Hold mode is initiated by moving the left switch it's center position and the right switch away from the right control stick.

When in Altitude Hold mode the aircraft will not resist external forces like wind, it will rather drift with the wind. Altitude Hold is useful when GPS signal cannot be reached or the pilot prefers a more manual piloting feel.



***NOTE:**

It is important to note that the throttle does not directly correlate to the RPM of the motors, rather, the throttle correlates to a desired climb or descend rates. For example: when the throttle is in the center position the target climb/descend rate is zero. When the throttle is moved to say, the 75% position it will climb at half of its available max climb rate. Conversely, when the throttle is at 25% position, it will descend at half its max decent rate.

BRAKE



Brake mode is the simplest flight mode available. It functions the identically to Position Hold with the sole difference that the control sticks are deactivated completely. This mode may be useful when the pilot wishes to set the transmitter aside for a moment and reduce the risk of an unintentional control input.

***NOTE:**

It is important to note that it is best to never leave the aircraft airborne unattended.

AUTONOMOUS FLIGHT (AUTO)

Autonomous Flight mode or “AUTO,” is engaged like the other flight modes with the use of the flight mode switches. There are a wide range of mission planning software suites available to the SwitchBlade-Elite (not covered here). Once the mission is uploaded to the SwitchBlade-Elite it can be executed by the use of the AUTO flight mode switch. It is recommended as a best practice to design the missions such that the pilot launches in Position Hold mode and then, once airborne, execute the mission. This increases the pilot’s ability to adapt to unpredictable events during launch (ie undesired non-participants, sudden changes in flight environment etc).

Autonomous Flight mode is initiated by moving the left switch away from the right control stick and the right switch furthest near to the right control stick.



LAND

Like Return to Launch mode, Land mode is also a flight mode and a failsafe protocol. When the Land mode switch is activated, the SwitchBlade-Elite will deploy its landing gear and begin a gentle decent over the position established at the moment the switch was activated. It is recommended to use a 6 meter diameter or larger landing environment, as the accuracy of the GPS system can vary by up to a maximum of $\pm 2.5\text{m}$.

Land mode is initiated by moving the left switch to the center position and the right switch furthest near to the right control stick.



Land mode is also a failsafe protocol, and will be activated if the battery becomes critically low. This failsafe will, in most situations, prevent the aircraft from uncontrolled descents from altitudes of $< 10\text{m}$. It is recommended not to fly the SwitchBlade-Elite lower than 20% of its available flight time, as to create a flight time safety buffer.

***NOTE:**

If at any time during a LAND sequence the pilot wishes to retake control, they may do so by simply moving the flight mode switch to another flight mode. If the Land was executed automatically due to a critically low battery, control can be re-established by changing the flight mode switch from any current flight mode to any other flight mode.

RETURN TO LAUNCH

Return to Launch (RTL) mode is both a flight mode and a failsafe protocol. When the RTL switch is activated (and GPS lock is present), by factory programming the SwitchBlade-Elite will deploy its landing gear, climb to 15 meters above the launch location, return on a direct path, hover for 5 seconds and then begin a slow landing sequence. It is recommended to use a 6 meter diameter or larger launch/land environment, as the accuracy of the GPS system can vary by up to a maximum of $\pm 2.5\text{m}$.

Return to Launch mode is initiated by moving both switches furthest near to the right control stick.

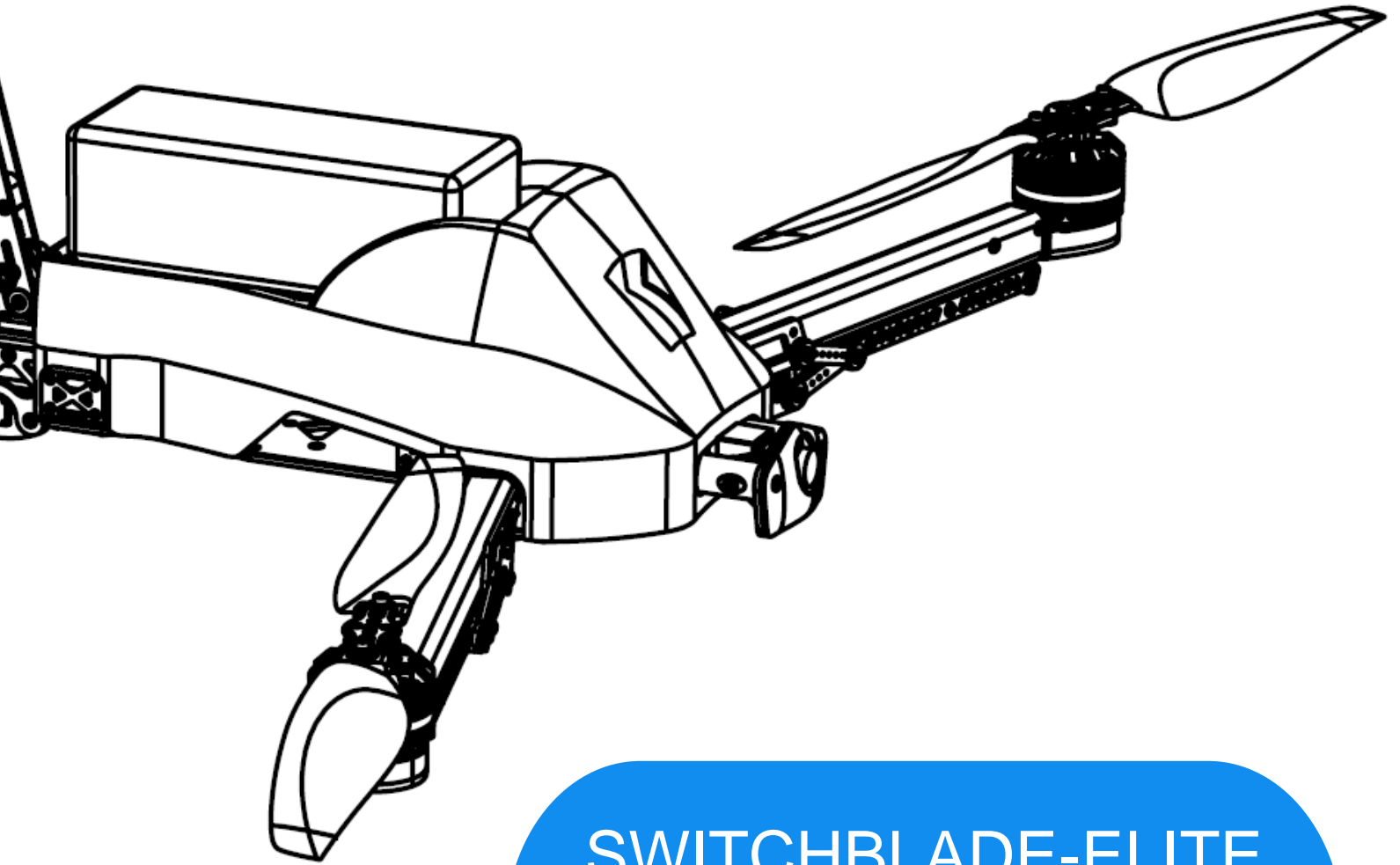


It is important to note that if the flight environment is significantly higher than the launch location the 15m climb altitude may not be adequate. If 15m is not adequate for your flight environment the setting can be easily changed in the parameters section of the Mission Planner software. Additionally, if the launch location itself is moving, say from a moving vessel, it is best to avoid the use of Return to Launch.

Return to Launch mode is also a failsafe protocol, and will be activated automatically should the SwitchBlade-Elite lose communication with the controller.

***NOTE:**

If at any time during a RTL sequence the pilot wishes to retake control, they may do so by simply moving the flight mode switch to another flight mode. If the RTL was executed automatically due to a lost link with the controller, control can be re-established once the transmitter regains the link and a flight mode switch is toggled from any flight current mode to any other flight mode.



SWITCHBLADE-ELITE
OPERATING
PROCEDURES

PREFLIGHT CHECKLIST

- The first step for any flight is to choose the correct flight environment and conditions.

Don't fly the SwitchBlade-Elite indoors. Always fly outside in clear, open areas at a safe distance from yourself, other people, power lines, animals, vehicles, trees, and buildings. When flying in areas with potential hazards, maintain adequate distance from any people, vehicles, or structures. As the pilot, you are responsible for navigating the SwitchBlade-Elite to avoid obstacles.

Don't fly within 5 miles of an airport or within any airspace restricted by your local, state, or national airspace authority. 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).

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

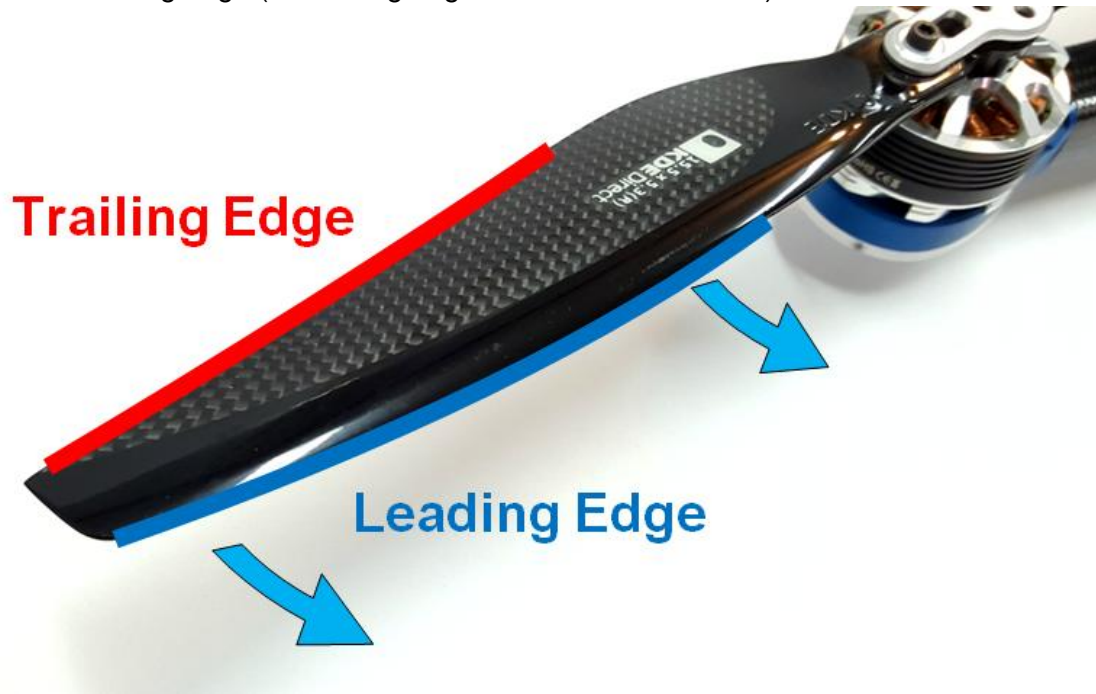
Before flying, determine the boundaries of the safe flying area at your location. Be aware of any risks, including bodies of water, structures, trees, power lines, etc, and designate a few areas where you can land the SwitchBlade-Elite in case of an unsafe situation. Throughout your flight, be prepared 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.
- Remove the SwitchBlade-Elite from the transport case.
- Unfold the arms and propellers as described above.
 - ***NOTE: Do NOT manually raise or lower the retractable landing gear.**
(This can cause permanent damage to the servos.)
- Always check propeller hub tightness by moving the prop back and forth, should be just tight enough to hold itself straight if motor axis is held parallel to the ground.
- Raise and secure the GPS mast.

- Check the battery voltage with the supplied voltage checker (4.20V/cell = fully charged).
- Check that the battery is properly secured.
 - Position the battery pack so that the center of mass is in the center of the aircraft.
 - Battery Velcro is in contact with the battery plate Velcro.
 - Velcro strap is securely tightened and well adhered.
- Visually survey all electrical & mechanical connections
- Before powering the transmitter be sure all the switches are in their default positions.
- Power up the transmitter, select “On” on the touch screen menu to activate the radio and check transmitter battery level.
- 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).
- Confirm the radio link is active by changing the flight mode (an audible tone will sound).
- Deploy the landing gear by lifting the aircraft off the ground by hand and flip the gear switch on the transmitter to the deployed position. Once deployed set the aircraft back on the ground.
- If flying with a payload, attach it to the airframe now.
- If applicable ground test the payload and associated equipment (i.e. monitor).
- If using tablet or PC, launch mission planning app and connect to the aircraft.
- Check battery level of connected telemetry device (tablet, phone, PC).

ARMING / TAKEOFF

- Arm aircraft by holding the throttle at zero and full right yaw for 5 seconds (be sure not to hold more than 15sec or the aircraft will enter 'AutoTrim' mode).
- check that the propellers are turning in the correct directions. The leading rotor edge is smoother and thicker (shown in blue below). The trailing edge is thinner and sharper than the leading edge (the trailing edge is shown in red below).



- Gently bring up the throttle and initiate take-off

FLIGHT

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

LANDING / DISARMING

- Prior to landing the aircraft, check the landing site environment (power lines, people, animals, etc).
- If landing manually, deploy the landing gear.
- Land the aircraft (ideally on a level surface).
- Disarm by holding zero throttle and full left yaw.
- If carrying a payload, remove it.
- By hand, lift the aircraft off the ground and use the transmitter to retract the landing gear.
***NOTE: Do not manually raise or lower the retractable landing gear.**
(This can cause permanent damage to the servos.)
- If using telemetry disconnect it from the tablet, phone or PC.
- Disconnect the battery.
- Power down the transmitter.
- Return transmitter switches to default positions.
- If using payload accessories (i.e. monitor) power them down.
- Visually survey all electrical & mechanical connections.
- Pull red pull-pins down and fold the arms in.
- Unsecure and lower the GPS mast, and then fold the tail propeller inward against the GPS mast.
- Check the battery voltage with the supplied voltage checker and note the flight time.
***NOTE:** 3.60V/cell is lowest recommended discharge level if lower than 3.60V/cell reduce flight time on future flights.
- Place aircraft in hard travel case and secure latches.

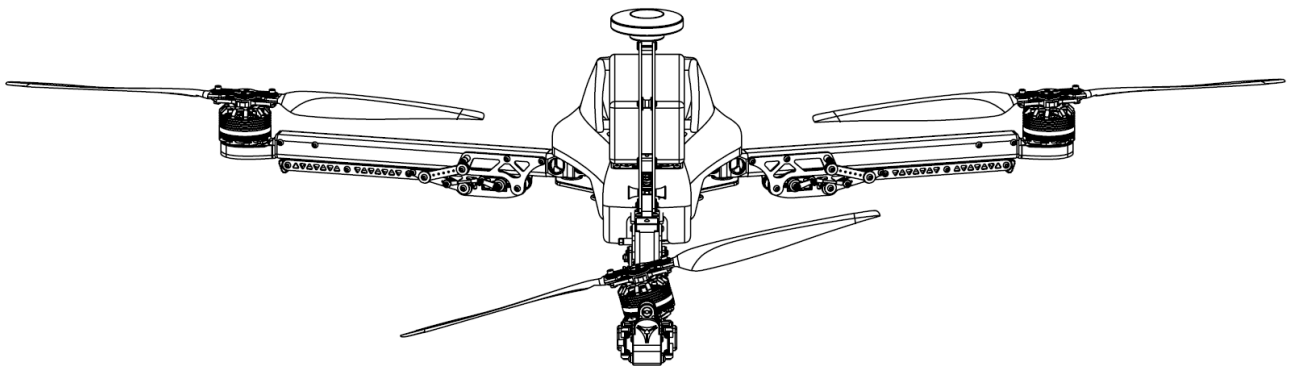
CONTROLS

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

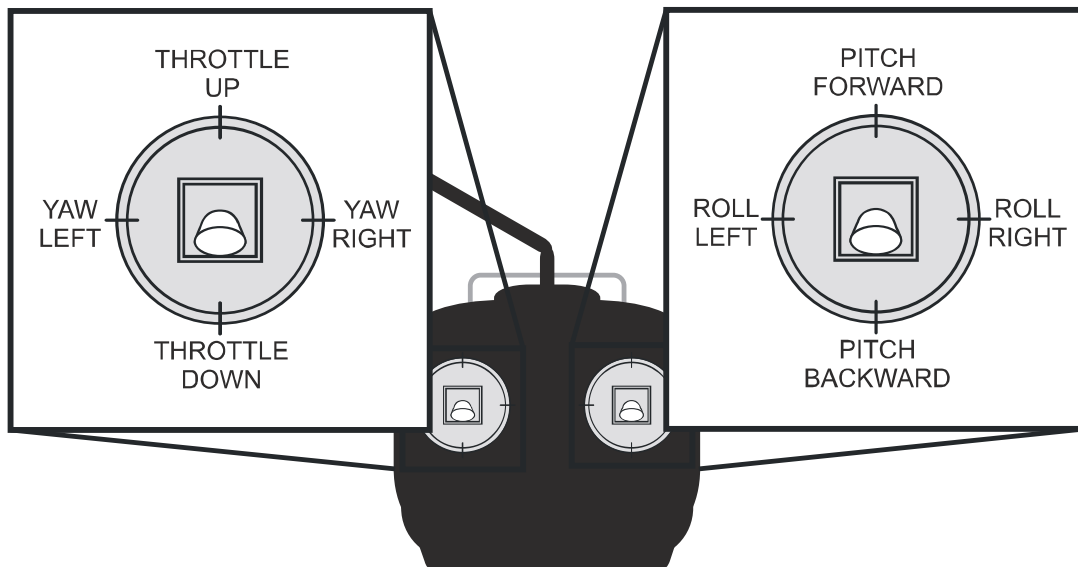
***IMPORTANT:** The SwitchBlade-Elite is a precision machine designed to be controlled with very gentle and smooth inputs.

***IMPORTANT:** Take care, especially when familiarizing oneself with the aircraft, to make VERY small, smooth, and gentle control inputs.

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



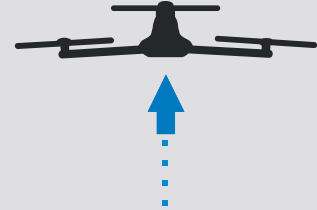
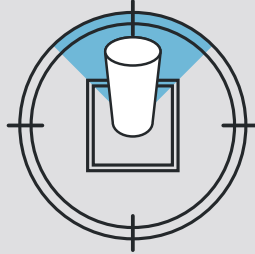
The controller features and control inputs are shown below.



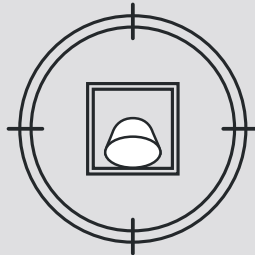
Move the left stick vertically to control the SwitchBlade-Elite's altitude and acceleration.

THROTTLE

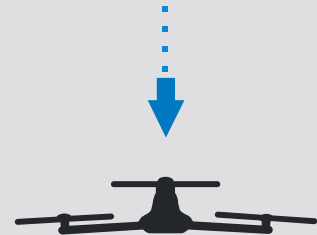
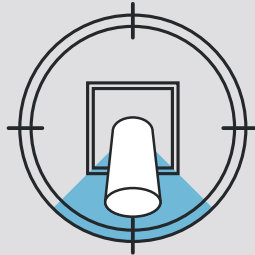
To take off and to gain altitude, move the throttle slightly past the center position.



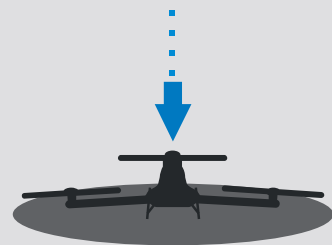
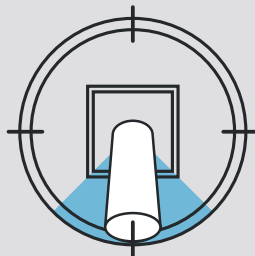
Set the throttle to center to maintain the current altitude.



Move the throttle back from center to decrease altitude.



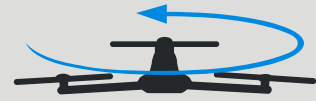
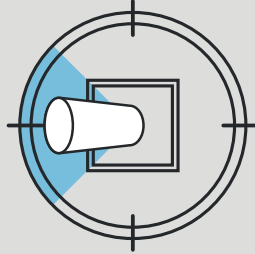
Set the throttle fully back to land once the SwitchBlade-Elite is near the ground.



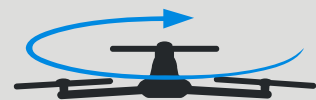
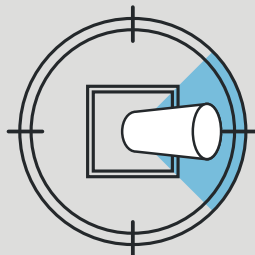
Move the left stick horizontally to rotate or "yaw" the SwitchBlade-Elite and control orientation.

YAW

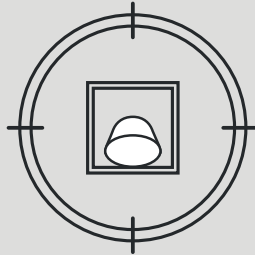
Move the stick to the left to rotate counterclockwise.



Move the stick to the right to rotate clockwise.



Release the stick to stop rotating and maintain the current orientation.

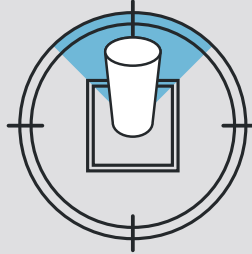


Use the right stick to fly SwitchBlade-Elite forward, back, left, and right. These movements are relative to the SwitchBlade-Elite's current orientation, so always maintain awareness of SwitchBlade-Elite's forward-facing direction before using right-stick controls.

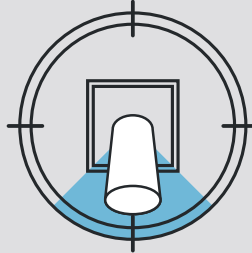
Move the right stick vertically to control pitch.

PITCH

Move the right stick forward to fly forward.



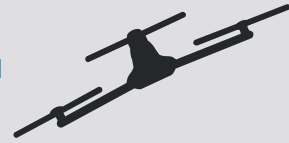
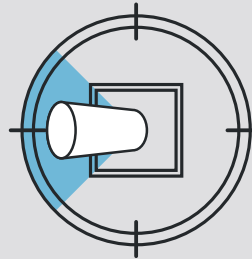
Move the right stick back to fly backward.



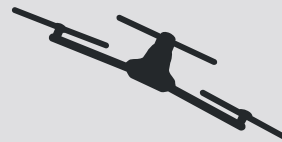
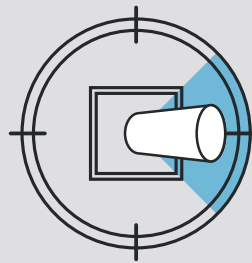
Move the right stick horizontally to control roll.

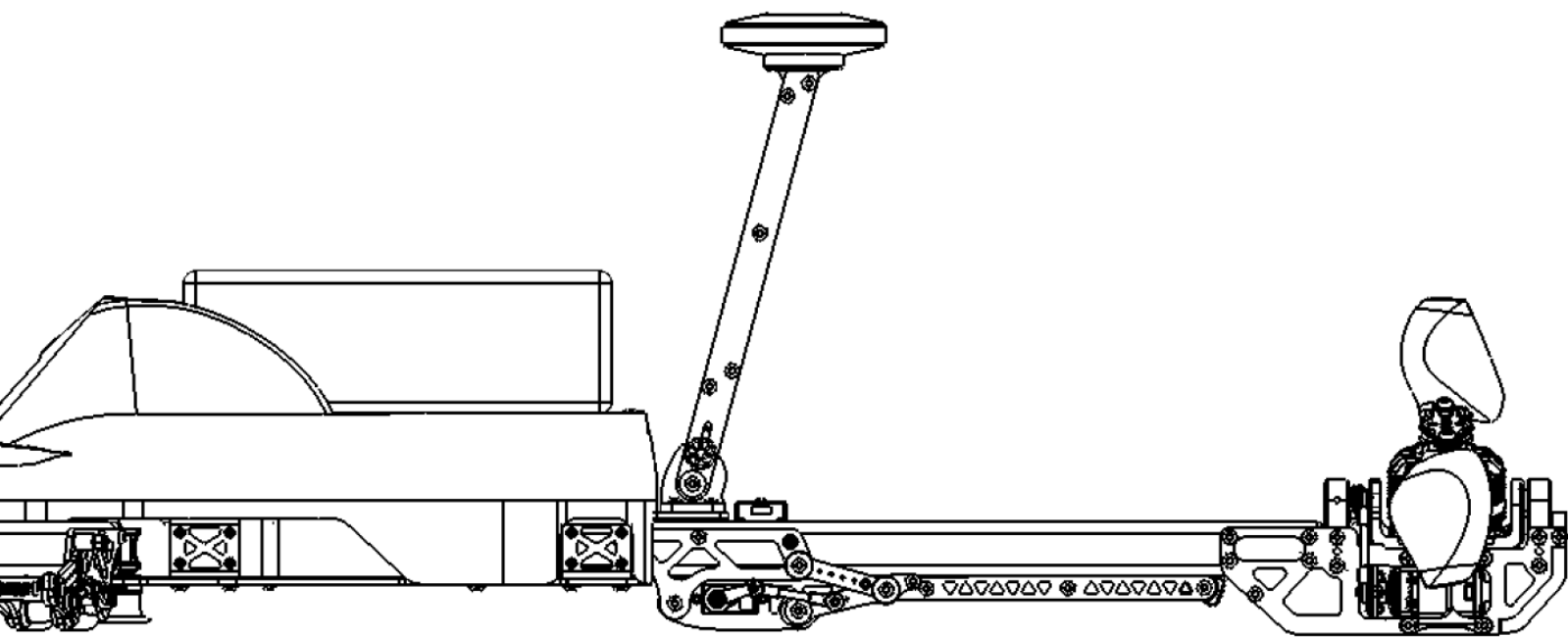
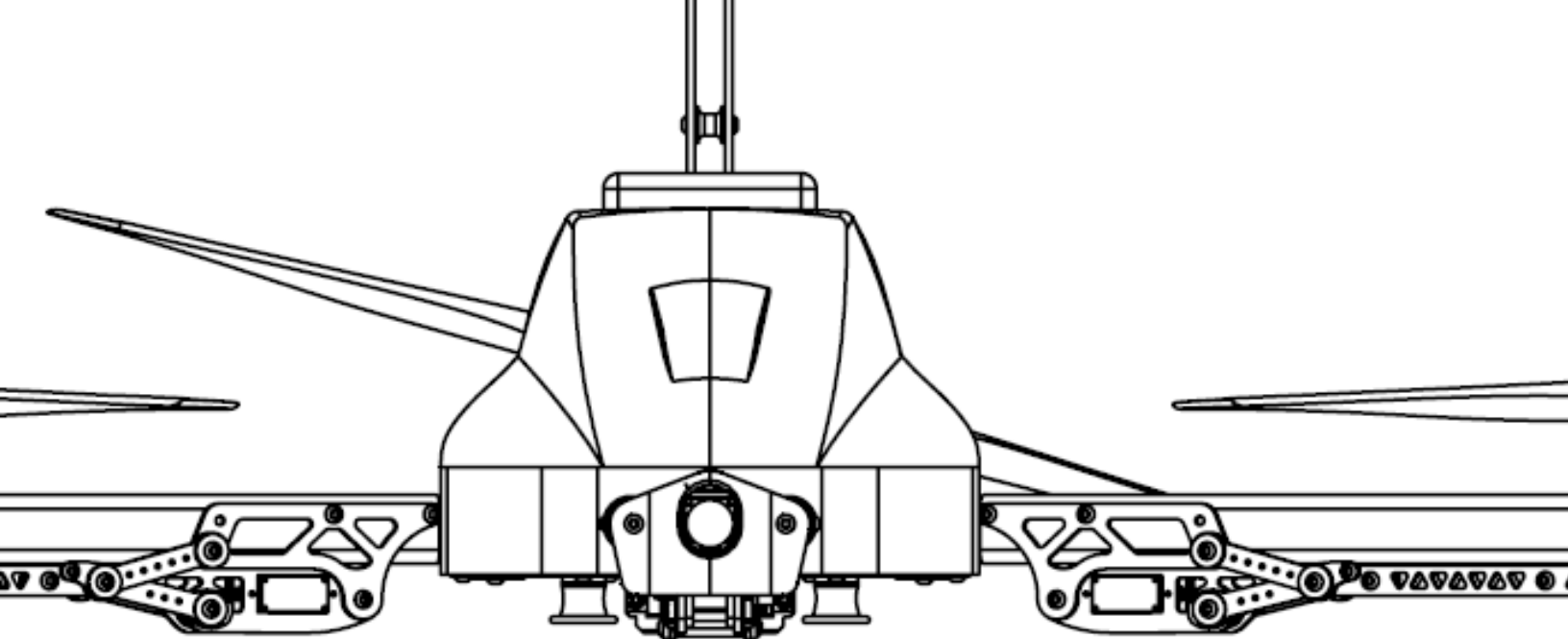
ROLL

Move the right stick left to fly left.



Move the right stick right to fly right.





SWITCHBLADE-ELITE
EMERGENCY
PROCEDURES

The emergency procedures listed in this section are the recommended practices for handling the aircraft in the event of an aircraft 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. In general, if an emergency occurs, three basic actions can be applied to most situations:

- Maintain aircraft control
 - Small emergencies can quickly escalate if the pilot is distracted attempting to determine or troubleshoot the problem. Always maintain visual contact with the aircraft during an emergency to reduce the likelihood of losing orientation.
- Analyze the situation
 - Once the aircraft is stabilized, begin to assess the cause of the emergency if practical.
- 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

AIRCRAFT ERROR

If for any reason there seems to be an aircraft error, the following steps should be taken:

- **Neutralize Controls**
 - Bring both control sticks to center (especially the throttle stick).
- **Analyze Situation**
 - Using gentle, deliberate control inputs bring the aircraft back to the launch site.
 - Deploy landing gear.
 - Land and disarm.

UNCONTROLLABLE ENVIRONMENTAL CHANGE

For a slight uncontrollable environmental adjustment such as a pilot distraction or heightened weather conditions, the following steps should be taken:

- **Neutralize Controls**
 - Bring both control sticks to center (especially the throttle).
- **Switch to Position Hold mode**
 - Allow the aircraft control to hover the aircraft in place until the environmental adjustment is properly addressed and normal flight can resume.

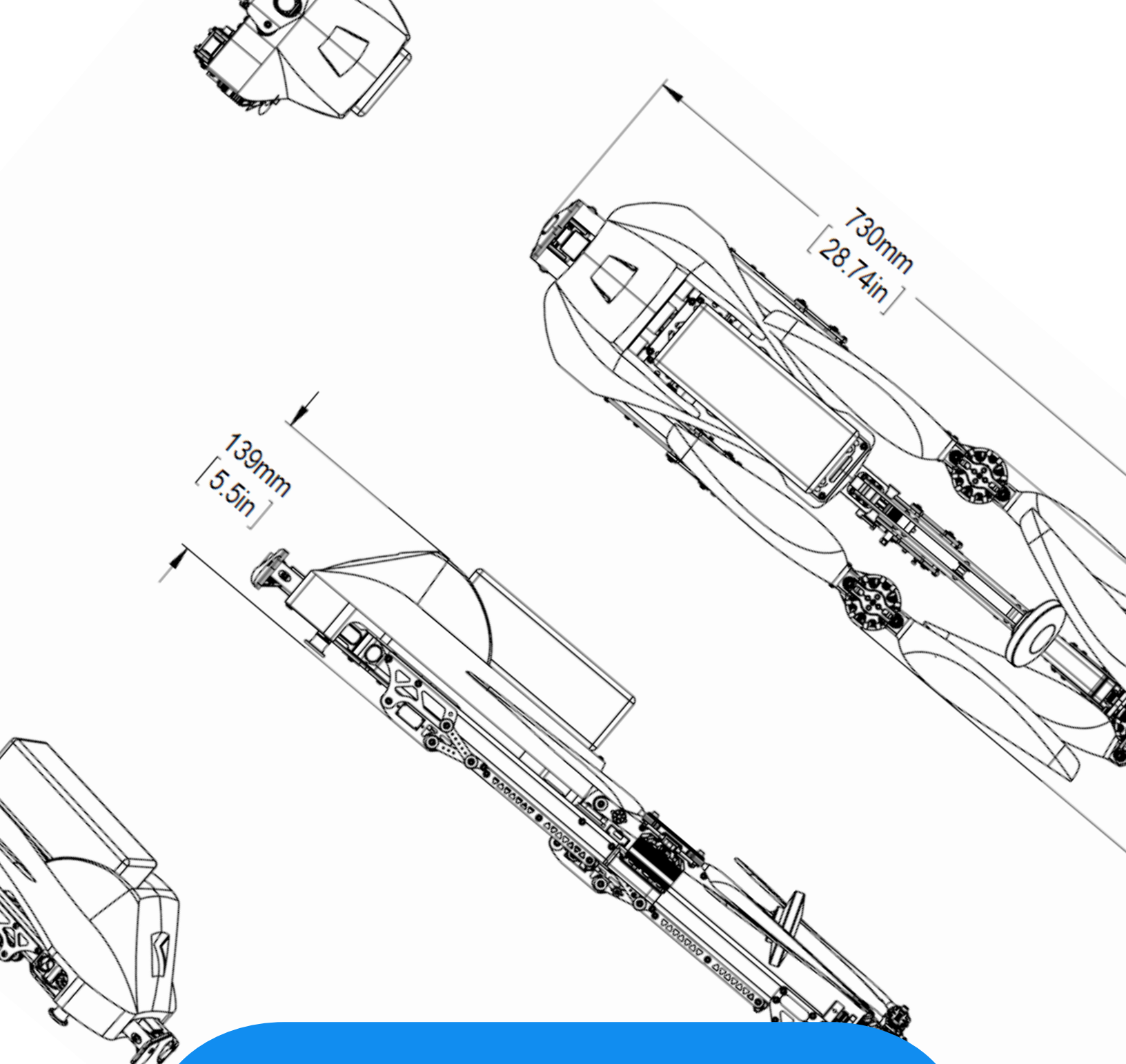
For more drastic uncontrollable environmental adjustments such as pilot incapacitation, the following steps should be taken:

- **Switch to Return To Launch mode**

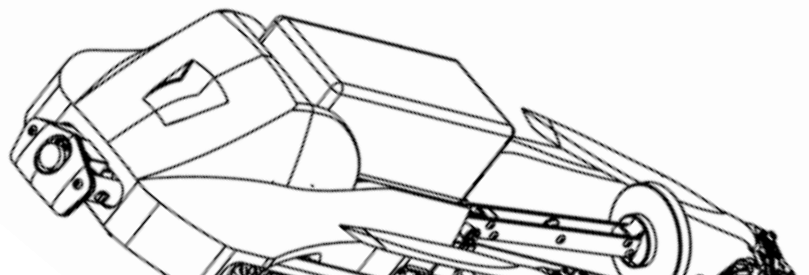
For more information on Position Hold mode, please see the associated section on page 36. For more information on Return to Launch mode, please see the associated sections on page 39.

MOTOR SHUTOFF / DISARM

Once landed, bringing the throttle to zero will reduce the prop speed to minimum. Additionally, holding the throttle at zero and full left yaw will disarm the SwitchBlade-Elite completely. In the event of a RTL or Land mode protocol completion, the SwitchBlade-Elite will automatically disarm once on the ground after a brief moment. Lastly if the SwitchBlade-Elite is armed and sits for more than fifteen seconds it will 'time out' and automatically disarm.



SWITCHBLADE-ELITE SUPPORT & MAINTENANCE



SUPPORT

Vision Aerial Support 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 or give us a call at 1 (406) 333-1795. To submit a support request through our website, visit visionaerial.com/contact/.

MAINTENANCE

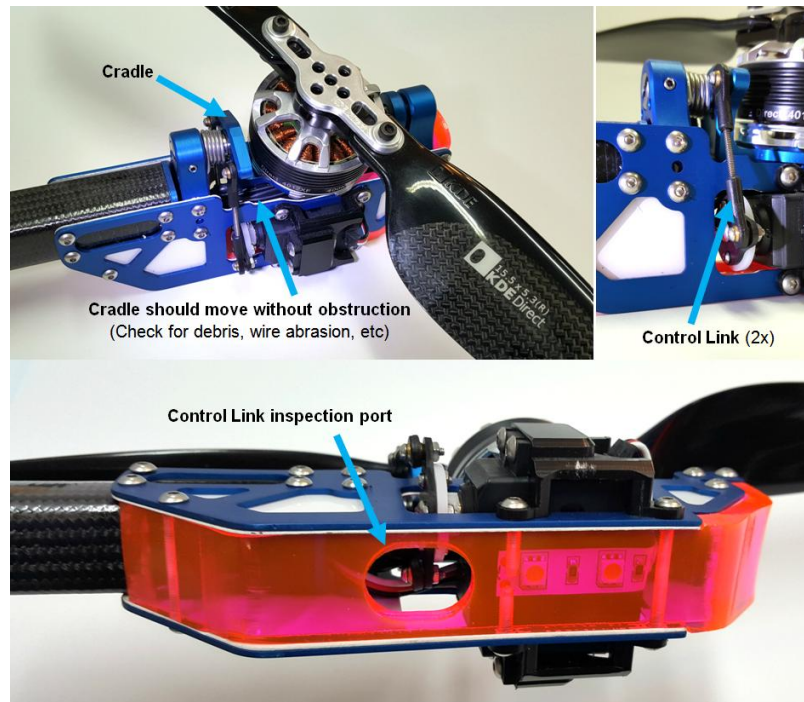
BEFORE EVERY FLIGHT

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. Propellers:

- Inspect for chips, typically on leading edge, if greater than 1.5mm it is recommended the propeller be replaced.
- Inspect for cracks and excessive flexibility. If significantly more flexibility in the propeller is detected, replace the propeller.
- Inspect for proper hub tension. To test, unfold the propeller and hold the aircraft on its side. The propeller should be clamped just tightly enough ensure adequate friction such that gravity does not cause the propeller to rotate on its hub, but loose enough to be comfortably rotated by hand. (For more information see the Propeller section on page 30). An example of a healthy rotor is shown below.



- Once preflight checks are complete, use the throttle to gently rotate the propellers and check that each prop is rotating in the correct direction.

EVERY 25 FLIGHTS

Remove Bodywork.

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

1. Wire Connection:

- Carefully inspect that all wire connections are secure and free of corrosion, abrasion and any debris.

2. 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.

3. Retractable Landing Gear:

- With the landing gear in the retracted position make note of the position of the servo horn relative to the servo body and remove it with the Phillips head screw driver. This will free the retract leg and allow for the inspection. The leg should move freely without any binding. The system is designed to work without the use of lubricants, as they attract dust and can cause fouling. If binding is present compressed air may be used to clear the joints of any debris. When reattaching the servo horn, be sure to move the leg to the retracted position and match the servo horn to the noted orientation. Then apply Threadlocker to the servo horn screw ****DO NOT SKIP THIS STEP**** and reassemble the servo horn (Blue #243 Loctite is recommended).

4. 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 30mV (0.03V) recycle the pack.

5. 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 A - CONTROLLER MANUAL

The following attachment is the controller manual for the included Graupner MZ-18 controller.

APPENDIX B - BATTERY CHARGER MANUAL

The following attachment is the manual for the included IMAX-B6AC battery charger.

APPENDIX C - REFERENCES

PixHawk flight controller:

<https://pixhawk.org/>

Mission Planner site:

<http://ardupilot.org/planner/index.html>

Tower App site:

<https://play.google.com/store/apps/details?id=org.droidplanner.android&hl=en>