



# SUAS MAINTENANCE GUIDE

General sUAS Maintenance

## Routine UAS Maintenance Overview

Unmanned Aerial Systems (UAS) are subject to wear and tear of constant use and require regular maintenance checks to ensure everything is in working order.

This document is designed to support your organizational processes of maintenance of your UAS. High-level maintenance inspections should ideally happen in the field both pre and post flights. Checking for wear and tear on a per-flight basis is efficient as repair requirements are caught earlier. While this document is intended for more thorough maintenance inspections, we do recommend the essentials be attended to in the field post-flight. Essential field inspection points will be highlighted throughout the document.

Ideally, basic UAS maintenance should be scheduled based on the UAS usage. Specific suggestions are after 25 flights and 100 flights. The more the UAS is used, the more frequent maintenance should occur. Over time the UAS will gather layers of dirt and matter from the rigors of flight, transport, and storage. The entire system should be cleaned and inspected regularly. For most organizations, scheduling maintenance twice a year is recommended.

*Please note: Before performing any kind of structural check, make sure all battery packs are disconnected and the UAS is powered down.*

Whatever the case, follow your organizational processes in place to decide how and when to perform maintenance.

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## HARDWARE REQUIRED FOR BASIC MAINTENANCE

We recommend a tool kit consisting of:

- |  |   |
|--|---|
| <input type="checkbox"/> #00 size Phillips screwdriver | <input type="checkbox"/> Bottle of bearing lubricant (Recommend Tri-Flow w/needle applicator) |
| <input type="checkbox"/> #0 size Phillips screwdriver  | <input type="checkbox"/> Microfiber Cleaning cloth  |
| <input type="checkbox"/> #1 size Phillips screwdriver  | <input type="checkbox"/> Antistatic Cloth   |
| <input type="checkbox"/> 1.5mm Hex Driver              | <input type="checkbox"/> Antistatic wristband   |
| <input type="checkbox"/> 2.0mm Hex Driver              | <input type="checkbox"/> Isopropyl alcohol  |
| <input type="checkbox"/> 2.5mm Hex Driver              | <input type="checkbox"/> Can of compressed air Tube of extra-fine graphite lubricant (dry)    |
| <input type="checkbox"/> Small pair of Hemostats       | <input type="checkbox"/> Small Vacuum   |
| <input type="checkbox"/> Magnifying glass              | <input type="checkbox"/> Small bristle brush  |
| <input type="checkbox"/> Lens Cleaning Cloth           |   |

## LOGGING MAINTENANCE INSPECTIONS

We recommend logging every time a thorough maintenance inspection is made on the UAS. In order to keep records consistent, the following details should be captured with every log:

### Record Basic Details

- Technician/Pilot First and Last Name
- Date of maintenance inspection
- UAS model make and model
- UAS ID number (serial & registration information)
- Drone weight (kg)
- Additional comments / noted repairs required
- Repairs made

## ESSENTIAL PRE & POST FIELD INSPECTION CHECKLIST

### PRE-Field Checklist

- Camera / Payload unit is clean**
  - Clean lens of camera / payload
- SOFTWARE & FIRMWARE UPDATES**
  - Ensure UAV, controller and camera have current software/firmware
  - IF software/firmware is updated– **be sure to do a TEST FLIGHT after updates are completed**

### POST-Field Checklist

#### Structural Inspection

- Visually check aircraft for signs of damage and/or excessive wear
- Check propellers for any chips/nicks or other abrasions
- Wipe down UAV of dust/debris

### Camera / Payload

- Check Camera / Payload unit is clean**
  - Clean lens of camera / payload
  - Remove dirt and debris from body/frame

### Battery Check

- Record battery use and level of charge when mission is complete
- Allow to cool before recharging

### Log Flight Details

- LOG FLIGHT DETAILS**
  - Record basic details:
    - Unmanned Pilot Name & FAA Registration Number
    - Date of Flight
    - Site Location
    - UAV Make / Model
    - UAV Serial Number & Registration Information
    - Weather experienced during flight
    - Notable commentary on flight (any issues / unexpected weather etc.)

## 25 FLIGHTS CHECK LIST

### Aircraft

- Update Firmware
- Inspect chassis for cracks (even the smallest crack can cause flight issues if left unnoticed)
- Clean gimbal vibration dampers of dust/debris
- Check arm locks for positive operation
- Clean motors of debris, dust, using compressed air can. Manually spin to assure no grit is inside, and all props spin freely and identically verify all screws are secure. Hand tighten if necessary
- Wipe arms/legs of dust
- Check arm swivels for stress cracks
- Clean sonar inputs clean of debris, dust, and fingerprints
- Wipe Optical Flow Camera clean of dust and fingerprints
- Inspect antennae (fitting properly, no damage)
- Calibrate the Compass
- Calibrate Accelerometer
- Calibrate Gimbal

### Propellers

- Replace propeller set with new props (even if original props appear clean/sound)
- Check propellers are free spinning

## Remote

- Update Firmware
- Verify mobile display mount screws are secure. Hand tighten if necessary
- Check vents for debris/dust. Vacuum if necessary. ***We do not recommend blowing compressed air into these vents.***
- Check antennae mounts for stress cracks
- Check joystick wells for dust/debris
- Check antennae mounts for solid movement, no cracks nor looseness
- Perform inspection flight

## Logging

- Log inspection/maintenance
  - Technician/Pilot First and Last Name
  - Date of maintenance inspection
  - UAS model make and model
  - UAS ID number (serial & registration information)
  - Drone weight (kg)
  - Additional comments / noted repairs required
  - Repairs made

# 100 FLIGHTS CHECK LIST

## Aircraft

Using an air duster in combination with a microfiber cloth and a little water, remove most of the dirt and build-up.

- Update Firmware
- Inspect chassis for cracks (even the smallest crack can cause flight issues if left unnoticed)
- Check venting areas for debris/dust/cobwebs
- Brush, Blow, or vacuum dirt from actuators, motors, cooling fan
- Clean gimbal vibration dampers
- Check gimbal arms for smooth rotation
- Check landing gear feet for wear and replace if necessary
- Check all screws and hand tighten if necessary
- Lightly brush battery contacts with pencil eraser to clean. Alternatively, use alcohol wipes to clean contact points
- Inspect antennae (fitting properly, no damage)

## Motors

- Inspect play of motors by lifting each motor and adding some pressure to the side. If any motor is showing signs of play, note the issue and contact the manufacturer of your UAS (or service repair organization) for replacement

- Clean motors of debris, dust, manually spin to assure no grit, imbalanced grind, all props spin identically

### Propellers

- Check the propellers for any cracking, stress marks, or pitting
- Replace propeller set with new props (even if original props appear clean/sound)
- Rotate each propeller in succession to assess whether there are additional obstructions that inhibit the full range of motion.
  - Ideally, the propeller will spin smoothly and without resistance
- Consult the UAS manual on propeller disassembly and perform a thorough cleaning of each component in the motor-propeller module
- If wear is noticed, replace the propeller lock and springs

### Remote

- Update Firmware
- Remove battery and check connections for any grime
- Clean Joystick pivot points with small brush
- Check gimbal control for tightness and adjust if necessary
- Check throttle control for tightness and adjust if necessary
- Calibrate joysticks
- Check handle screws
- Check antennas for tightness
- Perform post-inspection flight

### Logging

- Log inspection/maintenance
  - Technician/Pilot First and Last Name
  - Date of maintenance inspection
  - UAS model make and model
  - UAS ID number (serial & registration information)
  - Drone weight (kg)
  - Additional comments / noted repairs required

# ANNUAL FLIGHT MAINTENANCE

## Aircraft

Using an air duster in combination with a microfiber cloth and a little water, remove most of the dirt and build-up.

Tougher stains may require more extensive cleaning solutions, but make sure that you take care when dealing with sensitive electronic components.

- Update Firmware
- Open shell, generally clean dust, debris
- Inspect chassis for cracks (even the smallest crack can cause flight issues if left unnoticed)
- Check venting areas for debris/dust/cobwebs
- Brush, Blow, or vacuum dirt from actuators, motors, cooling fan
- Clean gimbal vibration dampers
- Check gimbal arms for smooth rotation
- Check landing gear feet for wear and replace if necessary
- Check all screws and Hand Tighten if necessary
- Lightly brush battery contacts with pencil eraser to clean. Alternatively, use alcohol wipes to clean contact points
- Check motherboard for cracks/breaks
- Inspect all legs and connectors for cracks and tight connection
- Check all connections for integrity
- Clear dust/debris from GPS module
- Check all solder joints for integrity
- Replace battery connection board
- Replace landing pads on legs
- Replace gimbal vibration dampers
- Lubricate gimbal attachment points
- Thread lock any metal to metal screw points
- Clear lens board of dust/debris
- Check attachment points for integrity
- Replace arm locks and springs
- Remove and re-tighten all hex screws
- Remove and re-tighten all other fasteners
- Verify all sensors are optimized and functioning properly
- Calibrate Compass
- Calibrate GPS (if available)
- Calibrate Accelerometer (dynamically)
- Calibrate Gimbal (if available)

## Motors

- Inspect play of motors by lifting each motor and adding some pressure to the side. If any motor is showing signs of play, note the issue and contact the manufacturer of your UAS (or service repair organization) for replacement
- Clean motors of debris, dust, manually spin to assure no grit, imbalanced grind, all props spin identically
- Inspect bearings for lubrication and wear

## Propellers

- Check the propellers for any cracking, stress marks, or pitting
  - Replace propeller set if needed
- Rotate each propeller in succession to assess whether there are additional obstructions that inhibit the full range of motion.
  - Ideally, the propeller will spin smoothly and without resistance
- Consult the UAS manual on propeller disassembly and perform a thorough cleaning of each component in the motor-propeller module
- Check propeller locks for integrity, wear, and operation. If wear is noticed, replace the propeller lock and springs

## Remote / Control Station

- Update Firmware
- Update all software applications
- Remove battery
- Remove screws on back panel
  - Clean Joystick connection points with Contact Cleaning spray
  - Remove and clean gimbal control potentiometer with Contact Cleaning spray
  - Remove and clean throttle control potentiometer with Contact Cleaning spray
  - Re-install gimbal and throttle control potentiometers
  - Check gimbal control for tightness
  - Check throttle control for tightness
  - Clear electronic components of dust/debris
  - Check stand/handle screws
  - Check all connectors for integrity
  - Clean battery connector points with Contact Cleaning spray
  - Check toggle mount threads for tightness
- Check extended range transmitter/receiver (if applicable)
- Check Smart Phone / Tablet connections/software
- Check laptop /control station

## Logging

- Log inspection/maintenance
  - Technician/Pilot First and Last Name
  - Date of maintenance inspection
  - UAS model make and model
  - UAS ID number (serial & registration information)
  - Drone weight (kg)
  - Additional comments / noted repairs required
  - Repairs made

## ADDITIONAL CONSIDERATIONS FOR MAINTENANCE INSPECTIONS

### Batteries

*Batteries need to be replaced every 250-350 cycles*

Batteries are the fuel that keep the sUAS flying. If using batteries outside manufacturer brands, be certain that any batteries used are authorized by the manufacturer. Calculate flight times per battery at 75% of the total battery life. Never fly beyond equipment warning points. Most systems and batteries are designed to warn at approximately 30% and return to home (RTH) at approximately 20%, leaving time for a safe descent and landing.

- Be certain that all batteries are **numbered**, and each **charge cycle is logged** (this is a FAR).
- Batteries need to be replaced every 250-350 cycles (Manufacturers have recommendations, so knowing how many charges have been placed on each battery is valuable information and may be needed in the event of an FAA ramp check.
  - Again, the type of charger used may impact the lifecycle of batteries.

### Battery Charger

A vital piece of the UAS package is the charging station for batteries and it is often overlooked. It too needs to be serviced bi-annually to avoid common battery-charging-related issues.

As well as a visual check, ensure the voltage specified by the dock is compliant with that of the battery.

- Inspect charger for visible damage
- Take voltage reading
- Record comments on charger damage

### Battery Inspections

- Double check all batteries for numbering (sometimes stickers or ink wear off)
- Inspect drone batteries for damage
- Inspect battery packs for bulges or leakage

- Inspect controller batteries for damage
- Replace damaged batteries (if necessary)

## Propellers

Propellers are some of the more delicate parts of the UAS and they need to be inspected closely for cracks before every flight.

*Propeller replacements are recommended after every 20 hours (~25 flights)*

This should be self-evident, yet it seems that many pilots don't consider the many reasons for carrying at least a full set of propellers plus two.

Even if your last flight went off without a hitch, you should be extremely thorough with your examination. Propeller damage can go unnoticed until it proves critical, and the last thing you want is your unit failing mid-flight due to a small crack you didn't notice during field maintenance.

Props are easily chipped/damaged during landings when small rocks may be flipped due to propwash, dirt or foreign objects on window ledges, trees, or other objects in the flight area, handling of props during installation or removal from the aircraft, or simply from bouncing around in the storage compartment of the drone case.

Most professional sUAS have maintenance recommendations of prop replacement every 20 hours/25 flights or similar. Absent this manufacturer recommendation, all props should be replaced in accordance with above recommendations. Immediately replace any chipped or damaged prop.

## Camera / Payload

Typically, UAS carry cameras (or similar payloads). It's important to do a full maintenance inspection of the UAS camera/payload as well.

- Check Camera / Payload unit is clean**
  - Clean lens of camera / payload
  - Remove dirt and debris from body/frame
- SOFTWARE & FIRMWARE UPDATES**
- Check filters for cameras – clean or replace if scratched