

Standard Operating Procedures for UAV or Drone based Monitoring of Wildlife

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Abstract:

This paper summarises a Standard Operating Procedure (SOP) and recommended practices for the use of UAVs or Drones for wildlife monitoring. These include some of the technological changes required to minimise impact, as well as operational considerations when deploying, surveying and recovering the UAV.

Introduction - UAVs for Wildlife Monitoring

There is an increased application of UAVs (or drones) for wildlife oriented missions, (Anderson & Gaston, 2013; Chabot & Bird, 2015; Gonzalez et al. 2016; Linchant et al., 2015; Watts et al., 2010) UAVs are particularly useful for wildlife observation and monitoring as they can capture data with high spatial and temporal resolution. Wildlife may respond idiosyncratically to a UAV in proximity depending on a variety of factors, including the species, environmental and historical context, as well as the type of UAV and its method of operation (Hodgson and Koh, 2016). Having the necessary procedures in place is a *delicate balance* between ethical considerations, health and safety of people, animals and property, and the objectives of the mission. Observation of wildlife using UAVs needs to adhere to the rules and regulations of local aviation safety authorities (e.g. FAA, CASA, CAA) which include among others *restrictions* on flying beyond visual line of sight, above a defined altitude, at night and near people or in the vicinity of important infrastructure and prohibited areas. Flight missions should not be undertaken without *permits* from the government, national parks, local councils or indigenous communities. Moreover, even though it is not a legal requirement, it is advisable to notify properties and other interested parties in close proximity to the flight area, of the purpose and timing of the flight missions. Therefore there is an urgent need to have standard procedures and practices in place to ensure that not only the target species, but also any unintended target species, are not adversely impacted by operating the UAV. The procedure provides *a suite of recommended procedures* regarding the use of UAVs for the purpose of observation or surveys of wildlife.

STANDARD OPERATING PROCEDURE

1. Title

Observation and surveying of Wildlife using Unmanned Aerial Vehicles (UAVs) or Drones.

2. Purpose

This SOP details several recommended procedures to follow for observation of wildlife using Unmanned Aerial Vehicles (UAVs) (or drones).

3. Scope

This procedure applies to personnel involved in the observation of wildlife using UAVs (or drones) for the purpose of conservation and environmental inventory assessments. Although these standards operating procedures (SOPs) are to be adhered to by all commercial applications of drones, they are strongly recommended for use in recreational, research, and conservation management drone operations being conducted in close proximity to wildlife.

4. Abbreviations

AEC	Animal Ethics Committee
B-VLOS	Beyond visual line of sight
CAA	Civil Aviation Authority
CASA	Civil Aviation Safety Authority
CI	Chief investigator
FAA	Federal Aviation Administration
FOV	Field of view
FPV	First person view
MTOW	Maximum takeoff weight
nm	Nautical miles
RePL	Remote pilot licence
RPM	Revolutions per minute
SOP	Standard Operating Procedure
UAV	Unmanned aerial vehicle
UOC	Unmanned Operator Certificate
VLOS	Visual line of sight

5. Definitions

5.1 Code refers to a code such as The Australian Code for the Care and Use of Animals for Scientific Purposes (National Health and Medical Research Council, 2013) or codes in other nations such as the Canadian CCAC guidelines on the Care and use of Wildlife (Canadian CCAC guidelines on the Care and use of Wildlife, 2003) or the UK's Wildlife and Countryside Act (Wildlife and Countryside Act, 1981)

5.2 Competent means, as defined in the Code, the consistent application of knowledge and skill to the standard of performance required regarding the care and use of animals. It embodies the ability to transfer and apply knowledge and skill to new situations and environments (the Code);

5.3 Investigator means, as defined in most codes for the care and use of animals, any person who uses animals for scientific purposes. This includes, for the purpose of this SOP, personnel such as researchers, teachers, UAV controllers, undergraduate and post-graduate students involved in research projects, and people involved in product testing, environmental testing, and wildlife surveys using UAVs or Drones.

5.4 Ground station is the centre of operations, where the UAV (or drone) is prepared for the flight, where the UAV operators are and the systems are in place to track the flight of the UAV.

5.5 Visual line of sight (VLOS) is a term used in aviation with respect to the person's ability to see a UAV or drone.

6. Training and Competency

6.1 All personnel need to be competent for the procedure they perform, or be under the direct *supervision* of a person who is competent to perform the procedure.

6.2 When supervision is required the chief investigator or project lead will nominate a person competent in the procedure to be the supervisor.

6.3 People who are considered not yet to be competent will be under the direct supervision of a person who is competent and a monitoring strategy will be in place until competency is attained.

6.4 *Training records* will be maintained by the chief investigator and be available for inspection by an Animal Ethics Committee (AEC) or civil aviation authority on request.

6.5 The following training and certificates suggested and in most cases required for this SOP are:

Apply and obtain a remote pilot licence (RePL), Operator Controller certificate, or similar certification issued by a civil aviation safety authority (e.g. FAA, CASA), and if the UAV maximum take-off weight (MTOW) > 2.0kgs (Australia) operate under an Unmanned Operator Certificate (e.g. CASA.UOC).

All personnel involved in the observational study should complete an Animal Ethics course such as "Animal Ethics: The care and use of animals for scientific purposes" (National Health and Medical Research Council, 2013).

7. Materials and equipment

The equipment stated below are an indication of some of the technology systems that have been used for wildlife surveying.

- UAV; e.g. a DJI Mavic Pro, a DJI S800, a Phantom Pro, etc.
- Thermal camera; e.g. a Flir Vue Pro m a Tau 650, etc.
- Digital camera; e.g. a 4K Digital Camera with 30fps Video, etc.
- Flight Controller; e.g. a DJI Mavic Remote Controller, etc.

8. Safety Instructions

8.1 It is recommended to obtain a *RePL, Operator Controller certificate or similar certification issued by a civil aviation safety authority (e.g. FAA, CASA, CAA)* and if the UAV MTOW > 2.0kgs (CASA) operate under an Unmanned Operator Certificate (e.g. CASA.UOC).

8.2 The UAV operators must *adhere to aviation rules* (e.g. CASA, FAA, CAA) for the area being overflown, which may include restrictions on flying beyond visual line of sight, above a defined altitude, at night and near people or in the vicinity of important infrastructure and prohibited areas.

8.3 Other personnel involved in the observation of wildlife from a UAV must *adhere to any instructions given by the UAV controller* to ensure the safe operation of the UAV at all times, and the minimisation of disturbance to the resident wildlife species.

8.4 The UAV ground station to be **located at a reasonable distance from the survey area** to minimise any wildlife disturbance, and if possible out of sight of the target species and other resident species that may be adversely affected or disturbed by UAV or human activity at the ground station.

8.5 Similarly the UAV launch and recovery site must be **chosen away from the wildlife species being observed** and if possible out of sight of other resident species that may be adversely affected or disturbed by drone or human activity at the launch and recovery site.

8.6 The UAV controller must have the **ability to intervene to take manual** control of the UAV during the flight.

8.7 It is recommended that at least one participant in the observational study **observe the visual and thermal footage from the UAV received** at the ground station during the flight using FPV goggles to ensure that any signs of distress or unusual behaviour by the target or other species are identified as early as possible so that aerial operations can immediately be suspended and appropriate action taken to minimise any stress to the animal.

9. Procedure

This section details the procedure when planning a flight mission. It is recommended to describe the pre-flight checklist and mission requirement in a concise table.

9.1 Define a site for UAV operations as per below

- Confirm site is > 3 nm from a towered aerodrome or obtain necessary approvals or obtain necessary approvals from relevant aviation safety authorities (e.g. CASA, CAA, FAA)
- Confirm Visual Line of Sight (VLOS) with the UAV can be maintained at all times or obtain necessary approvals (e.g. B-VLOS, night operations)

9.2 Select an appropriate UAV and adjust for the observational study as follows:

- **Reduce the weight** of the UAV to a minimum so that the amount of **power required is reduced** therefore requiring less thrust during operation.
- Select **an appropriate sensor resolution and lens FOV** which enables the accomplishment of the mission objectives while flying as far as possible from the target and not-target species.

9.3 Define a flight path for the UAV using the ground station ensuring the UAV is < 400 ft (CASA) and that visual line of sight and if available, video telemetry (used for observing the target wildlife species) can be maintained at all times. Approvals may be given by applying to the relevant aviation safety authority that allows use without such visual restrictions as stated.

9.4 Exercise minimum wildlife disturbance flight practices.

- Select a **launch and recovery site away from animals** (out of sight if possible) and maintain a reasonable distance from animals.
- **Minimise the noise** produced by the UAV during operation by lowering RPM through adjusting the diameter and pitch of the propeller to achieve the same thrust.
- **Minimise the visual stimulus** of the UAV by avoiding threatening trajectories and erratic flight movements.

- ***Avoid nesting sites (birds), pregnant or young individuals (wildlife)*** by obtaining as much prior information about the area being overflown as possible, especially with respect to any known individuals which may be at greater risk, such as sick animals, pregnant females, and nesting sites. Particular attention can then be given to these animals and birds to be alert to unusual behaviour or visible signs of distress.
- 9.5 If practical and available use video relay or FPV goggles to observe animal responses and abort flight if unusual behaviour or ***evidence of distress*** such as noise produced by animal or abrupt movement is observed.
- 9.6 The UAV specifications and flight practices must be reported accurately and in full.
- 9.7 Notes of target species responses should be included to generate an evidence base for refined SOP.
- 9.8 Include both ***positive and negative observations***, accidents during operations and incidents of excessive disturbances to the target species, or other species observed in the area being surveyed.
- 9.9 If a negative response is observed on more than 2 occasions or it causes the animal to be at risk (e.g. a koala descends tree and stays on ground, or a bird attacks the UAV) then this should be ***reported in an adverse event notification to the Animal Ethics committee*** in a timely manner. It is highly recommended to either have a wildlife veterinarian, or suitably qualified wildlife carer, in attendance, or have their contact details and assurance of availability during the flight missions.
- 9.10 Once the flight path is completed, ***land the aircraft at a recovery site away from the target wildlife species*** (out of sight if possible) and maintaining a reasonable distance from the wildlife.

10. Responsibilities

- 10.1 The project supervisor, or chief investigator (CI), is the person with ultimate responsibility; however other participants have a responsibility to ***complete the procedure(s) with due care of the animal(s) while following all instructions detailed in the SOP.***
- 10.2 Methods for minimising distress are as outlined in 9.1-9.10 above, and include the minimisation of noise, maintaining as large a distance as possible from the species being observed, establishing the ground station, and launch and recovery site in such a way that they minimise potential distress to the animals. Prompt action shall be taken if signs of distress are observed, and this behaviour shall be documented.
- 10.3 The project supervisor or chief investigator is responsible for ensuring that staff operating the UAV is trained adequately in UAV flight operations, before they can carry out the wildlife observational flight mission.
- 10.4 The person/s carrying out the procedure are need to consider the welfare of the target and non-target wildlife species, and it is their responsibility to ensure correct procedures are followed, as outlined in this SOP.

11. Records

11.1 The project lead or chief investigator will ensure all records associated with the SOPs are maintained.

11.2 Details of the date, location, area surveyed and the target species observed shall be recorded for each flight mission.

11.3 The footage from the digital and thermal cameras shall also serve as records of the observational wildlife study.

12. Ethics Authority

In this section, the ethics authority and approvals shall be listed. The document ID, authority, approval and expiry dates shall be indicated in the header.

13. Risk Assessment

In addition to the SOP it is recommended, and in many cases required, to create a compressive list of identified hazards and controls and the risk assessment before controls, the type of control implemented and the risk assessment after control is implemented..

14. Conclusions and Recommendations

This SOP lists recommended practises and guidelines for the observation of wildlife using a UAV (or drone).

Some techniques, such as *video relay, if available shall be used to ensure that prompt action is taken* and the UAV is either immediately landed, if safe to do so, or returned to the launch or recovery site, should any unusual animal responses indicative of distress, are observed during UAV or drone operations.

The presence of a veterinarian or suitably qualified wildlife carer may also be required, and is highly recommended, depending on the species inhabiting the target area, or any known challenges such as pregnant females, or young and vulnerable individuals.

In many cases it is sufficient that a veterinarian is aware of the UAV mission and has agreed to be contactable and able to assist in any emergency.

We *encourage researches to use and expand on this SOP through their experiences* and case studies and learnings for the purpose of improving the use of UAV or drones for wildlife monitoring whilst minimising the impact to the species we seek to monitor and protect.

15. References

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