Graphic here

Company logo here

****

**Company XXX**

**Flight Operations Manual**

**Revision XX, Date**

**CHANGE MANAGEMENT**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| REV # | DATE | CHANGED SECTIONS | REMARKS | INITIALS |
| 1.0 | 03/11/19 | None | Initial | ZZ |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Table of Contents

[1. Guide to the use of this Flight Operations Manual 6](#_Toc45627409)

[1.1 Preface 6](#_Toc45627410)

[1.2 Authority 6](#_Toc45627411)

[1.3 Acronyms 6](#_Toc45627412)

[1.4 Gender reference 7](#_Toc45627413)

[1.5 Revision control 7](#_Toc45627414)

[1.6 Change indicators 7](#_Toc45627415)

[2. Organizational structure 8](#_Toc45627416)

[2.1 Chief Pilot 8](#_Toc45627417)

[2.2 Head of Training 8](#_Toc45627418)

[2.3 Aviation Safety Officer 8](#_Toc45627419)

[2.4 Remote Pilot Instructors 9](#_Toc45627420)

[2.5 Remote Pilots in Command 9](#_Toc45627421)

[2.6 Visual Observers 9](#_Toc45627422)

[2.7 Air Boss 9](#_Toc45627423)

[3. Operational policies 10](#_Toc45627424)

[3.1 General 10](#_Toc45627425)

[3.1.1 Pilot conduct 10](#_Toc45627426)

[3.1.2 Airmanship principles 10](#_Toc45627427)

[3.2 Categories of flight operations 11](#_Toc45627428)

[3.2.1 Operational missions 11](#_Toc45627429)

[3.2.2 Training 11](#_Toc45627430)

[3.2.3 Recurrency 11](#_Toc45627431)

[3.2.4 Demonstration flights 11](#_Toc45627432)

[3.3 Flight limitations and guidelines 11](#_Toc45627433)

[3.3.1 Airspace considerations 11](#_Toc45627434)

[3.3.2 Flights near aerodromes 12](#_Toc45627435)

[3.3.3 Flights near people and structures 12](#_Toc45627436)

[3.3.4 Dropping of objects 13](#_Toc45627437)

[3.3.5 Negligent or reckless operation 13](#_Toc45627438)

[3.3.6 Right of way 13](#_Toc45627439)

[3.4 First-aid and emergency response equipment 13](#_Toc45627440)

[3.5 Procedures to conduct flight operations 14](#_Toc45627441)

[3.5.1 Document review - aircraft 14](#_Toc45627442)

[3.5.2 Document review – pilot 14](#_Toc45627443)

[3.5.3 Flight plans 15](#_Toc45627444)

[3.5.4 Flight crew 15](#_Toc45627445)

[3.5.5 Radio usage 17](#_Toc45627446)

[3.5.6 Pre-flight activities 18](#_Toc45627447)

[3.5.7 In-flight activities 22](#_Toc45627448)

[3.5.8 Post-flight activities 24](#_Toc45627449)

[4. Risk management 25](#_Toc45627450)

[4.1 Safe flight practice 25](#_Toc45627451)

[4.1.1 Safety management system 26](#_Toc45627452)

[4.1.2 Human factors 26](#_Toc45627453)

[4.2 Risk assessment 27](#_Toc45627454)

[4.3 Non-normal operations and emergencies 28](#_Toc45627455)

[4.3.1 Emergency response plan 28](#_Toc45627456)

[4.3.2 Medical emergencies 28](#_Toc45627457)

[4.3.3 Fires 29](#_Toc45627458)

[4.3.4 Lost communications 29](#_Toc45627459)

[4.3.5 RF interference 30](#_Toc45627460)

[4.4 Incident and accident response 31](#_Toc45627461)

[4.4.1 General 31](#_Toc45627462)

[4.4.2 External reporting and pilot activity 31](#_Toc45627463)

[4.4.3 Internal Incident Reporting 32](#_Toc45627464)

[5. Flight personnel 32](#_Toc45627465)

[5.1 Qualifications and privileges 32](#_Toc45627466)

[5.1.1 Student pilots 32](#_Toc45627467)

[5.1.2 Remote pilot instructors 32](#_Toc45627468)

[5.1.3 Remote pilot in command (RPIC) 32](#_Toc45627469)

[6. Training programs for remote pilots 33](#_Toc45627470)

[7. Aircraft and airworthiness 33](#_Toc45627471)

[7.1 Registration 33](#_Toc45627472)

[7.2 Markings 33](#_Toc45627473)

[7.3 RPA letter of approval 33](#_Toc45627474)

[7.4 Maintenance 33](#_Toc45627475)

[7.4.1 Aircraft maintenance logbooks 34](#_Toc45627476)

[7.4.2 Battery maintenance 34](#_Toc45627477)

[7.4.3 Software and firmware updates 34](#_Toc45627478)

[7.5 Reporting of discrepancies 34](#_Toc45627479)

[8. Flight logging and document management 35](#_Toc45627480)

[8.1 Airman records 35](#_Toc45627481)

[8.1.1 Pilot logbooks 35](#_Toc45627482)

[8.1.2 Certificates 35](#_Toc45627483)

[8.2 Aircraft records 36](#_Toc45627484)

# 1. Guide to the use of this Flight Operations Manual

## 1.1 Preface

This remotely piloted aircraft (RPA) flight operations manual (FOM) represents a safe flight guide to drone operations at Company XX. Material in this document applies to all pilots operating at XX, regardless of their level of achievement or flight training. In addition to this FOM, all pilots and pilots in training will abide by the Safety Management System (SMS) guide and the aircraft-specific Standard Operating Procedures Manual (SOPM). Flight management will be conducted using YYsystem which is used to track pilot and aircraft flight operations, and provide flight-relevant documentation to the pilots and crew on-site as they prepare for and conduct flight missions.

All pilots must review the FOM and other documentation as a part of normal flight activity. The UAS-specific Manufacturer User Manual and the UAS-specific Standard Operating Procedures Manual (SOPM) provides aircraft-specific knowledge for flight operations to safely occur. It is the responsibility of all XX pilots to maintain access to these documents up to and during flight operations so that they may be referenced at any time where flight-critical information is needed. Due to an unreliable internet, these documents will be downloaded prior to flight in the field.

Compliance with the rules and policies of this manual and related documents is mandatory. Failure to comply may result in disciplinary action. Users of the FOM are encouraged to report mistakes and contribute to corrections which will ensure the document is relevant and up-to-date.

## 1.2 Authority

This manual applies to all operators of drones that are flying under the governing authority. Compliance with the policies and procedures in this manual are mandatory and must be followed by all personnel of Company XX.

## 1.3 Acronyms

ADM: Aeronautical Decision Making

Aerodrome: Airport

AIM: Airman’s Information Manual

AIS: Abbreviated Injury Scale

ATSU: Air Traffic Service Unit

CRM: Crew Resource Management

ERC: Emergency Response Coordinator

ERP: Emergency Response Plan

FOM: Flight Operations Manual

FTM: Flight Training Manual

GCS: Ground Control Station

GCSO: Ground Control Station Operator

GMM: General Maintenance Manual

NOTAM: Notice to Airmen

ORF: Operations Request Form

PCS: Pilot Credentialing System

RF: Radio Frequency

RLA: Remotely Piloted Aircraft Letter of Approval

RMT: Remotely Piloted Aircraft Maintenance Technician

ROC: Remotely Piloted Aircraft Operational Certificate

RPA: Remotely Piloted Aircraft

RPI: Remote Pilot Instructor

RPL: Remotely Piloted Aircraft Pilots License

RPIC: Remote Pilot in Command

SMS: Safety Management System

SOPM: Standard Operating Procedures Manual

UAS: Unmanned Aircraft Systems

UASPC: Unmanned Aircraft Systems Pilots Code

VLOS: Visual Line of Sight

VO: Visual Observers

## 1.4 Gender reference

Any reference to persons in this manual are gender-neutral, i.e., statements herein apply equally to all persons.

## 1.5 Revision control

Control of this manual is the responsibility of the Chief Pilot. No alterations, changes or deviations are authorized without prior approval from the Chief Pilot. When any changes are made a change notice will be issued.

## 1.6 Change indicators

A heavy vertical line (change bar) in the margin identifies changed, added, or deleted material.

# 2. Organizational structure

Company XX maintains a structure for the governance of flights. An organizational chart for this leadership is shown in Figure 1. Each position is described below.

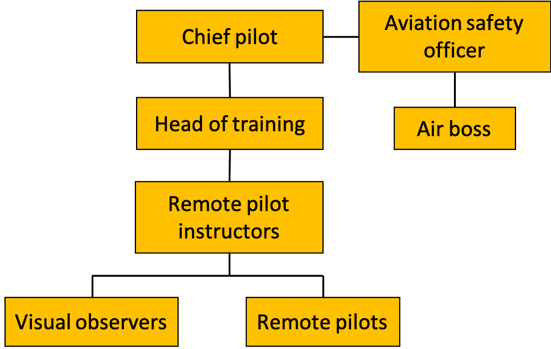


Figure 1. Organizational structure

## 2.1 Chief Pilot

The Chief Pilot is recognized as the key accountable person regarding flight operations and training. This person ensures that flight operations and training are in compliance with Company guidelines as specified in this manual, the SOPM and the SMS. The Chief Pilot will assist UAS instructors and students as needed regarding their questions and concerns about the program. Qualifications for the Chief Pilot include a.), b.), etc.

## 2.2 Head of Training

The Head of Training is the direct representative of the Chief Pilot. Qualifications for the Head of Training include a.), b.), etc.

## 2.3 Aviation Safety Officer

The Aviation Safety Officer is responsible for overseeing safe flight operations with reference to the Safety Management System (SMS) rulebook. This person provides an independent assessment of flight operations from a safety perspective, and will report anomalies directly to the Chief Pilot. Pilots are encouraged to contact the Aviation Safety Officer if there are safety of flight issues that need to be addressed. The qualifications for this person include a.), b.), etc.

It is the job of the Aviation Safety Officer to designate an Emergency Response Coordinator (ERC) for each flight activity. This person is notified at the beginning and end of flight activities and will be contacted if an incident or accident occurs that results in injuries.

## 2.4 Remote Pilot Instructors

The Remote Pilot Instructors (RPI) are responsible for delivering a training curriculum. A Remote Pilot Instructor is responsible for the safety of their students while demonstrating flight maneuvers and supervising flight operations of their students in the practical portion of the course. Instructors engage with their students directly to demonstrate and teach the safe operation of unmanned aircraft, and they are critical evaluators of the students’ abilities with reference to the assessments of their performance. Qualifications for the remote pilot instructor include a.), b.), etc.

## 2.5 Remote Pilots in Command

There are two categories of Remote Pilots: a.) Student pilots (SP), and b.) Remote pilots in command (RPIC). The student pilots have a responsibility to operate under the privileges presented in §5.1.1. The SPs fly under direct supervision by the RPI. These pilots will be recognized in a pilot registry described in §8.1.2.

It is important to recognize that the RPIC is the single point responsible person for the flight operation – any questions or concerns about the flight activity should be brought to the RPIC. The RPIC ensures the flight operation is safe and progresses to achieve the mission outcome. In the event that any anomalous behavior occurs during the mission, the RPIC will mitigate the effects of that anomaly by altering flight operations accordingly to reduce risk. All flight operational decisions must be either made by and/or approved by the RPIC before they are executed.

## 2.6 Visual Observers

Visual Observers (VO) are responsible for communicating operational hazards and air traffic conflicts during flight activities. Visual Observers are familiar with this FOM, the SMS, UAS-specific SOPMs, checklists, and applicable aircraft user manuals. To qualify as a Visual Observer, the person must a.), b.), etc.

## 2.7 Air Boss

The Air Boss is responsible for deconfliction of UAS during multi-aircraft operations. Standard terminology among the pilots and air boss allows efficient deconfliction to minimize collision risk. The Air Boss is optional but may be required if the number of simultaneous operations exceeds Z.

# 3. Operational policies

## 3.1 General

### 3.1.1 Pilot conduct

Company XX strives to maintain the highest standard of flight operations conduct. Pilots will reference the UAS Pilots Code (UASPC) V1.0 that was developed by a team of aviation and UAS professionals to enhance the quality and safety of UAS flight operations. Pilot conduct and professionalism affect the entire aviation community, including its safety culture. The UASPC provides a set of guidelines and recommended practices towards pilot proficiency and operational safety which will directly benefit the flying community. Pilots will be given the abbreviated UAS Pilots Code in hard copy which they will be encouraged to study prior to flights as a refresher of their conduct. In summary, the UASPC addresses:

* General responsibilities of UAS pilots
* Risk mitigation, to consider both manned aircraft and people on the ground
* Training and proficiency, including informal methods of staying current
* Security and privacy measures

### 3.1.2 Airmanship principles

The RPIC must certify that airmanship principles for each mission are met using the standard briefing checklist (SB01) which is conducted with the flight crew prior to flight. The certification is accomplished by checking that these items have been addressed prior to flight:

1. Know your aircraft, the capabilities and limitations in normal and non-normal scenarios – review the aircraft-specific SOPM
2. Know yourself, your limitations and personal habits that effect safety.
3. Know your environment, the airspace, the weather, the operation.
4. Know your team, conduct briefings, use your observers, communicate, be positive and resolve conflicts quickly and fairly.
5. Know the Risks, always conduct a thorough risk assessment.
6. Stay Proficient, practice and conduct ‘dry runs’ of complex operations, and scenario based training for emergencies.
7. Have the discipline to keep up to date on the latest safety and operational knowledge, including technical information regarding your platform.

***Do this to improve your situational awareness on every operation***

## 3.2 Categories of flight operations

### 3.2.1 Operational missions

Most flights conducted by Company XX would be categorized as operational flight missions that are performed as a service through a sponsor contractual agreement. For each flight activity, a crew requirement is defined and personnel are allocated as necessary to meet the obligations defined in this FOM. Visual observers are optional but will be used for risk mitigation when operations are conducted in areas of denser population and/or near structures.

### 3.2.2 Training

Company XX trains new UAS operators as needed in response to demands for drone services. For this reason, a flight training manual (FTM) has been created to guide the flight training program. The FTM includes a syllabus and the lesson plans for every flight training experience.

### 3.2.3 Recurrency

Pilots who need to renew a license or have a flight review conducted will be eligible to fly with an instructor who will provide the skills assessment. In the event an incident or accident occurred and the event report contained a recommendation for recurrency training, the pilot would need to complete that training before proceeding to pilot in command flight operations.

### 3.2.4 Demonstration flights

At certain times, an RPIC will need to demonstrate flight operations to a potential sponsor and these flights would be conducted under more controlled conditions but with more persons present. Risk mitiation methods will be used to ensure the level of safety has not been impacted.

## 3.3 Flight limitations and guidelines

### 3.3.1 Airspace considerations

Before flight operations occur, it is important to consider the airspace that will be used by the drone, and how use of this airspace may affect other air traffic in the vicinity of flight operations. While it is always necessary to use see and avoid techniques to ensure the airspace is deconflicted, most RPA flight activity today is in non-segregated airspace and an analysis of aeronautical charts and the consultation with local air traffic control authorities is necessary to ensure the flights are authorized. Temporary flight restrictions, or limitations to RPA flights that are not reflected in aeronautical charts may occur without obvious notification, and so an airspace review and confirmation is required as part of the airspace review that occurs prior to operations.

RPA flights that are intended to be operated in any given airspace must comply with the requirements of that airspace, e.g., certifications, approvals and equipment. Irrespective of these certifications, approvals or equipment requirements, RPA may be prohibited from operating in certain areas for reasons of safety or due to political boundaries.

### 3.3.2 Flights near aerodromes

Flights of an RPA are not allowed within a fixed distance of an aerodrome (airport) as designated by the authority, and may also be restricted a.) around approach and takeoff paths, b.) within the vicinity of navigational aids, c.) within an aerodrome traffic zone, and d.) within terminal traffic holding patterns.

With permission from the controlling authority, flights near aerodromes may be approved, provided that consideration is given to imposing operating restrictions in the interest of safety.

If operations are to be conducted within the 3 nautical miles boundary of an aerodrome, except for R-VLoS operations, no RPA shall be operated unless the pilot has a functioning air-band radio in his possession, tuned to the frequency or frequencies applicable to the Air Traffic Service Unit (ATSU) providing services or controlling such area or airspace or to aircraft in such area or airspace.

### 3.3.3 Flights near people and structures

The use of RPA over people who are not considered to be active participants in the flight operation is prohibited. In many cases, controlling authorities have restrictions on RPA flight over people, and while in some cases aircraft below a certain weight are allowed to operate over people, this policy prohibits all flights over non-participants. Table 1 shows the parameters by which flight operations will be allowed.

**Table 1. Safe operational distances in flight ops (distances are absolute)**

|  |  |  |
| --- | --- | --- |
| **Aircraft** | **Obstacle** | **Safe distance** |
| < 30 kts top speed | People (non-participating) | zz m, no overflight |
|  | People (participating) or non-participating inside structures | z m (< 0.5 kg aircraft)  y m (>1 kg aircraft) |
|  | Vehicles, structures and trees | qq m |
| > 30 kts top speed | People (non-participating) | pp m, no overflight |
|  | People (participating) or non-participating inside structures | rr m |
|  | Vehicles, structures and trees | ss m |

### 3.3.4 Dropping of objects

No RPIC shall allow any object to be dropped from an aircraft in flight that creates a hazard to persons or property. However, this section does not prohibit the dropping of any object if reasonable precautions are taken to avoid injury or damage to persons or property.

### 3.3.5 Negligent or reckless operation

No person shall operate an RPA in a negligent or reckless manner so as to endanger the safety of any person, property or other RPA / aircraft in the air or on the ground.

### 3.3.6 Right of way

The RPA shall avoid passing over, under or in front of manned aircraft, unless it passes well clear and takes into account the effect of aircraft wake turbulence.

When two RPAs are approaching head-on or approximately in a way that there is danger of collision, each RPA shall alter its heading to the right.

When two RPAs are converging at approximately the same level, the RPA which has the other RPA on its right, shall give way.

## 3.4 First-aid and emergency response equipment

As part of routine flight activity, the Aviation Safety Officer will designate a person who is present on the flying field to be the emergency response coordinator. This person is responsible for placing emergency response equipment in a designated position on the field where it will be accessible to all flight crew personnel. The equipment will include, at a minimum, the following items:

* + - 1. First aid kit that includes enough supplies to address the most common injuries (cuts, minor lacerations, burns, dehydration)
      2. A phone number of the nearest emergency response unit for transportation to a hospital
      3. 2l of drinking water
      4. Clean patient space to administer first aid
      5. A bucket of sand for putting out fires

An emergency response plan (ERP) will also be available for use on the field in the event that an emergency occurs and a time-limited response must be initiated. The ERP is fully described in the safety management system (SMS) handbook.

## 3.5 Procedures to conduct flight operations

### 3.5.1 Document review - aircraft

All pilots must review the RPA FOM and supplemental documents as a matter of normal RPA operational activity. An RPA-Specific Standard Operating Procedures Manual (SOPM), developed for use while operating the aircraft, provides information necessary for flight and must be accessible while operating the RPA. It is the responsibility of the Chief Pilot to keep these publications current and to incorporate changes as they occur.

Aircraft specific documentation should be checked to ensure the aircraft has no maintenance issues, it has passed required inspections (where applicable), and its certificates are up to date. The following documentation is included in a pre-flight operational review:

* RPA operational certificate (ROC) or letter of approval (RLA), where applicable
* Aircraft operations manual, where applicable, including operational limitations
* Standard operating procedures manual (SOPM)
* Maintenance manual, where applicable
* Aircraft and battery logbooks
* Certificate of registration, where applicable
* Certificate of airworthiness, where applicable

In reviewing the aircraft logbook, any safety of flight issue or deviation from normal flight operation should be noted and considered for the current flight activity. Likewise, flight anomalies that occur during the current flight should be noted in the aircraft logbook, and the pilot should make the determination as to whether or not the condition is severe enough to ground the aircraft. If it is, then a red tag should be attached to the aircraft indicating it is not airworthy and must be repaired before flight activity can continue.

Batteries that are associated with the aircraft also have logbooks to track their ability to take a full charge and function at an acceptable capacity. The number of charge cycles is recorded and any tracking of degradation should be noted to allow spent batteries to be pulled out of service when necessary. The battery cell balance should also be checked to verify that no cells are going bad.

### 3.5.2 Document review – pilot

It is important for the remote pilot in command (RPIC) to verify that his/her certifications are accurate and up to date. This includes certifications specific to the pilot only, and certifications that pertain to the pilot operating a particular aircraft (equipment restrictions). The RPIC should review the following documents for currency and accuracy:

* Remotely piloted aircraft pilot’s license (RPL), where applicable
* Student pilot license, where applicable
* Logbook review for flight currency, if applicable
* Medical certificate, if applicable

### 3.5.3 Flight plans

All flights begin with a flight plan, no matter how simple the flight may be. Flight planning takes into account site-specific information and environmental factors that can impact the safety of the flight operation. Examples of data collected include aircraft and pilot information (document review, currency), weather, airspace analysis, and crew role review. A flight ID number is issued by the Chief Pilot to approve a submitted plan. No flights should occur without the issuance of authorization from the Chief Pilot.

Flight planning will also take into account any waivers, approvals and permissions that allow flight operations as an exception to normal operational parameters. These are checked in a stand-alone document on the tablets or computers used in the field for flight operations.

### 3.5.4 Flight crew

#### 3.5.4.1 Definition

The flight crew for RPA operations must consist of a minimum of one person if there is no ground control station (GCS), and two people if there is a GCS. A visual observer is optional but is recommended if there are simultaneous flight operations occurring. There is no strict requirement for an Air Boss. In lieu of an Air Boss, RPICs shall use effective communications, Crew Resource Management (CRM), and sound principles of Aeronautical Decision Making (ADM) to deconflict between multiple aircraft.

#### 3.5.4.2 Remote Pilot in Command (RPIC) duties

An RPIC must be designated before or during the flight. The RPIC is directly responsible for and is the final authority as to the operation of the small unmanned aircraft system. This person must ensure that the RPA will pose no undue hazard to other people, other aircraft, or other property in the event of a loss of control of the aircraft for any reason.

The RPIC must ensure that the RPA operation complies with all applicable regulations.

The RPIC must have the ability to direct the RPA aircraft to ensure compliance with the applicable provisions of this chapter.

The RPIC must contact the Emergency Response Coordinator (ERC) at the beginning and end of the flight operations.

#### 3.5.4.3 Remote Pilot Instructor (RPI) duties

In training, an RPI will be guide and supervise the student pilot on how to properly execute maneuvers, and to convey a safe flying culture. The RPI will use voice commands to assist the student in accomplishing a lesson objective. After a lesson is completed, the instructor provides a critique of the student’s technique and these comments are recorded in the student’s flight logbook. All logbook entries resulting from training are made in concurrence and acknowledged by both the instructor and student.

#### 3.5.4.4 Visual Observer (VO) duties

The use of a VO is optional. The RPIC may choose to use a VO to supplement situational awareness and visual line of sight (VLOS). Although the RPIC and person manipulating the controls must maintain the capability to see the RPA, using one or more VOs allows the PIC and person manipulating the controls to conduct other mission-critical duties (such as checking displays) while still ensuring situational awareness of the RPA. The VO must be able to effectively communicate:

1. The RPA location, attitude, altitude, and direction of flight;
2. The position of other aircraft or hazards in the airspace; and
3. The determination that the RPA does not endanger the life or property of another.

To ensure that the VO can carry out his or her duties, the RPIC must ensure that the VO is positioned in a location where he or she is able to see the RPA sufficiently to maintain VLOS. The RPIC can do this by specifying the location of the VO. The RPIC and VO must also:

1. Scan the airspace where the RPA is operating for any potential collision hazard,
2. Maintain awareness of the position of the RPA through direct visual observation.

This would be accomplished by the VO maintaining visual contact with the RPA and the surrounding airspace, and then communicating to the RPIC (or person manipulating the controls) the flight status of the UAS and any hazards which may enter the area of operation, so that the RPIC or person manipulating the controls can take appropriate action.

#### Requirements of the RPIC and VO

RPICs must have completed xxx training and passed xxx exam(s) to fly for Company XX. Company XX maintains a record of approved pilots. This record includes pilot certificates, medical certificates and other pilot information that will be accessible to the Chief Pilot, Head of Training and the RPIs.

Visual observers (VOs) are not required to have a remote pilot certificate but they are required to pass a knowledge test. A list of eligible VOs is also kept on file.

RPICs and VOs must complete a practical flight evaluation requirement annually, conducted by the Head of Training. The pilot’s performance is noted in their logbook.

#### Currency

To be considered current, an RPIC must perform every 30 consecutive days, one launch and recovery and 15 minutes of flight time for each type of RPA qualified to operate (e.g. multirotor or fixed-wing).

Any crewmember whose currency has lapsed for more than 30 days will enter a 30-day probationary period in which they must accomplish two launch and recoveries and 30 minutes of flight in each type of RPA qualified to operate. RPICs who fail to complete the probationary requirements or allow more than 60 days since their currency had lapsed will enter suspension and must complete a proficiency flight evaluation.

#### 3.5.4.7 Alcohol and drug use

1. No remote pilot or VO shallconsume alcohol less than 8 hours prior to reporting for duty
2. Commence a duty period while the concentration of alcohol in any specimen of blood taken from any part of his or her body is more than 0.02 grams per 100 millilitres;
3. Consume alcohol or any psychoactive substance during the duty period or whilst on standby for duty; and
4. Commence duty period while under the influence of alcohol or any psychoactive substance having a narcotic effect

#### 3.5.4.8 Clothing restrictions

All personnel, including students, staff, faculty, maintenance personnel, and visitor/guest observers while engaged in the activities involving flying, or observing an aircraft will, as a minimum, wear the following:

1. Shoes (closed-toe)
2. Sleeved shirts made of conventional fabric so that the torso remains fully covered. Unusually thin or open weave fabric is acceptable.

Pilots and observers must wear fluorescent orange or green vests to indicate their participation as essential flight crew.

### Radio usage

Radio usage in RPA flight is dominated by the use of telemetry links for command and control, but voice communications via radio link is also necessary to facilitate deconfliction with manned aircraft. When operations occur on or near an aerodrome, it is necessary to possess a handheld radio to communicate with manned aircraft and flight control authorities. A radio operator’s permit may be required, depending on the State authority that regulates communications.

Air-band radio shall have a required output and shall be configured in such a way that the range, strength of transmission and quality of communication extends beyond the furthest likely position of the RPA from the pilot.

Using proper radio phraseology and procedures contribute to a pilot’s ability to operate safely and efficiently in the airspace system. A review of the Pilot/Control Glossary contained in the FAA-published Airman’s Information Manual (AIM) assists a pilot in the use and understanding of standard terminology. The ICAO phonetic alphabet should also be substituted when the letters of the alphabet need to be spoken.

### Pre-flight activities

#### 3.5.6.1 Checklists

The use of checklists is a critical component to any flight operation; in manned aviation it is commonly understood that every item on a checklist can be traced to a provable accident or incident. Likewise in drone flight, checklists are created to prevent the most common accidents from happening, and it is expected that only under rare circumstances would an accident occur after a pre-flight checklist is strictly used.

Checklists will be used in a disciplined and rote manner. The read-point method will be used, where the pilot reads an item on the checklist and then points to the item they are inspecting on the checklist. If the item applies to a computer setting, then students will also point at the computer screen acknowledging they have entered the correct settings for the flight. This method that requires a physical hand motion to verify checklist items has been used in other high risk situations to reduce operator error.

Normal checklists are routine checklists that will be aircraft specific and specified in the SOPM. They are conducted pre- and post-flight. Emergency checklists will also be available in the SOPM but are short and intended to be memorized so that they can be implemented in the event of a departure from normal flight operations. In executing an emergency checklist, mnemonics will be used to aid in the rote learning of a procedure that needs to be executed in the event that, for instance, the aircraft loses radio contact with the ground station and begins to fly-away. Events such as this are time critical and do not allow for a pilot to find and read an emergency procedure.

#### 3.5.6.2 Airspace and site survey analysis

The first check that the RPIC will conduct prior to flight activity is directed at the airspace to ensure the flight operations are in compliance with the aviation regulatory system. This includes a check of the airspace for Notices to Airmen (NOTAM), temporary flight restrictions and other flight operation activity that is published and of interest to the flight crew.

A site survey is also required to ensure the flying site is generally acceptable for the drone operations. Site requirements can vary depending on the size of the aircraft being flown, but these general rules apply.

* + **VTOL**
    1. Area is mostly level (low slope, minimal bumps)
    2. Open area with at least *4m* radius around the UAV
    3. Minimal loose debris to be kicked up during take-off or landing (place heavy blanket or plywood on ground if this is an issue)
    4. No vertical obstacles *above 5m* of flying altitude within *15m* radius of take-off location
    5. Pilot and observer location is at least *8m* feet from take-off point and have room to move from that location away from the UAV
    6. Pilot and observer have clear line of sight to UAV at take-off and can safely move to a position to maintain line of sight through entire flight. Beyond visual line of sight (BVLOS) flights are not allowed unless the operator has written permission from the agency controlling the airspace.
    7. Ground station is at least *8m* from take-off point
  + **Fixed Wing**
    1. Area is mostly level (low slope, minimal bumps)
    2. Runway is long enough and wide enough for UAV takeoff and landing operations
    3. No vertical obstacles greater than *5m* high within a *35m* perimeter of runway
    4. Operator location is at least *8m* from take-off point (start)
    5. Operator has clear line-of-sight of UAV at take-off and can safely move to a position to maintain line of sight through entire flight. Beyond visual line of sight (BVLOS) flights are not allowed unless the operator has written permission from the agency controlling agency the airspace.
    6. Ground station is at least *16m* from take-off point

An alternative landing site should also be identified to allow for a plan of action in case an emergency landing is needed. Emergency landings can be triggered by a variety of factors, such as: low battery, mechanical issues, intrusions into airspace, etc.

Each flight location brings with it certain hazards unique to the location. These can include fixed hazards (trees, buildings, power lines, etc) as well as moving hazards (pedestrians, vehicles, etc). It is recommended to choose a site that has fewer risks present, but this is not always possible. It is the responsibility of the RPIC to determine potential risks before takeoff, and alert other team members to the risks. In the instance that there are moving hazards, it may be necessary to manage the traffic with some combination of barriers and personnel.

#### 3.5.6.3 Weather analysis

A weather briefing is also obtained both to ensure that the flights will be in compliance with the governing authority (ceiling and visibility restrictions), but also to assess the overall safety of the mission by examining forecast and observed winds, precipitation and cloud conditions. Weather is checked the day before the flight in a forecast product, and it is checked again just before flight operations. Demonstrated wind and gust capabilities of the aircraft are referenced from the SOPM and used in the checksheet to ensure that a flight is feasible. If the steady or gusting wind conditions exceed the limits stated in the SOPM then the flight is canceled.

#### 3.5.6.4 Document check

All documentation related to the flight operations should be reviewed and checked off as acceptable prior to flight activities. The document review is also covered in the flight planning activity on the day before the flight. A document review includes:

* Pilot certification and privileges
* Logbook review for flight currency, if applicable
* Medical certificate, if applicable
* RPA operational certificate (ROC) or letter of approval (RLA), where applicable
* Aircraft user’s manual, where applicable, including operational limitations
* Standard operating procedures manual (SOPM)
* Maintenance manual, where applicable
* Aircraft logbook
* Certificate of registration, where applicable
* Certificate of airworthiness, where applicable
* Operations authorization letter from the controlling authority, where applicable
* Waivers of operation, to include aircraft, operations and pilot

#### Aircraft airworthiness

The aircraft airworthiness is verified in a preflight inspection procedure that is scripted for the RPIC to follow easily while in the field. These checklists have been designed to catch any issues that would result in an unsafe condition and for that reason, must be followed without exception.

#### Completing the flight plan

The flight plan is submitted for approval to the Chief Pilot who will authorize the mission to proceed. Etc.

#### Pilot and flight crew readiness

Before every flight, the IMSAFE Checklist should be run through by all crew members to self-evaluate whether they are in good condition for the flight operation. The checklist is as follows:

**I** *Illness,* Do I have any symptoms?

**M** *Medication,* Have I been taking any prescription or over-the-counter drugs that might affect my performance?

**S**  *Stress,* Am I under psychological pressure from the job? Am I worried about financial matters, health problems, or family discord?

**A**  *Alcohol,* Have I been drinking within the past 8 hours?

**F** *Fatigue,* Am I tired and not adequately rested?

**E**  *Emotion,* Am I emotionally upset?

#### Pre-flight briefing

Briefings are conducted by the RPIC to ensure the flight crewmembers are aware of the current state of the flight and what intended actions are going to take place in the future. Briefings also ensure pertinent information is shared between flight crewmembers so the pilots can correctly and safely fly the airplane and make appropriate aeronautical decisions. At the end of the briefing, a go/no-go decision about the flight will be made by the crew, with the RPIC having the authority to make all final decisions.

The first step in ensuring that flight operations are safe and conducted in accordance with the governing authority is to confirm that required documentation is available and acceptable. In the document check, the RPIC verifies that all applicable documents have been downloaded to a device (laptop or tablet) that is immediately available to the pilot and crew. Required operational approvals, exemptions, privileges, and supporting flight documents are contained in the download. In the protocol, the documents are checked and verified using the pointing system (mentioned above) to confirm they exist.

Next, the RPIC should brief everyone on the airspace conditions as provided in an earlier briefing with the controlling authority. The current and forecast weather conditions, and any weather factors that are critical to safe flight operations are noted at this time. The RPIC will use best judgement in assessing the operational risk given airspace, weather and flight mission information.

Flights will be categorized as one of the following possible options: a.) training/recurrency, b.) non-training flight, or c.) initial (shakedown) flight.

It is important to designate accurately the responsibilities of the flight crew so their authority is not questioned during critical phases of flight. The Remote Pilot in Command (RPIC) has the ultimate authority to initiate and terminate the flight, for any reason.

The RPIC is responsible for determining that the flight operations will not interfere with persons and property in the vicinity of the flight area. This requires that an operational boundary (buffer) be defined for the flight area that will maintain a safe distance from the aircraft to people, vehicles, structures and trees, as defined in Table 1 (repeated below):

**Table 1. Safe operational distances in flight ops (distances are absolute)**

|  |  |  |
| --- | --- | --- |
| **Aircraft** | **Obstacle** | **Safe distance** |
| < 30 kts top speed | People (non-participating) | zz m, no overflight |
|  | People (participating) or non-participating inside structures | z m (< 0.5 kg aircraft)  y m (>1 kg aircraft) |
|  | Vehicles, structures and trees | qq m |
| > 30 kts top speed | People (non-participating) | pp m, no overflight |
|  | People (participating) or non-participating inside structures | rr m |
|  | Vehicles, structures and trees | ss m |

The RPIC has unlimited authority to terminate the flight at any time if an anomaly to the normal flight operation is detected. This could be an aircraft problem, a changing situation on the ground, or a flight crew-related problem.

If a student pilot is receiving instruction, then that person is instructed by the RPI on the flight training maneuvers that will be completed during a particular lesson. It is necessary for the SP to comply closely to the requests to gain the most benefit from the lesson, and lesson plans will generally be available prior to the flight activity. Students are expected to review the lesson plan prior to flight to maintain a high operational tempo of flight training activity.

If a ground control station has been set up, then a Ground Control Station Operator (GCSO) will be assigned to load and activate mission plans, and also to report flight status to the RPIC and SP. The GCSO may need to communicate flight critical information, and this will be accomplished using standard terminology agreed upon by the crew.

A Visual Observer (VO) may be assigned to the flight crew, and their assignment will be to look for flight traffic in the vicinity of the present flight operations. The VO is optional as the RPIC can also serve as the VO for the purposes of running a flight training program.

### 3.5.7 In-flight activities

#### 3.5.7.1 Situational awareness / crew resource management

During flight operations, the flight crew is expected to assume their assigned duties and not deviate from preassigned tasks. The minimum flight crew would consist of only the RPIC. The RPIC and other flight team members (as needed) would use effective communications, crew resource management (CRM) principles, and sound principles of aeronautical decision making to sustain safe flight operations.

#### 3.5.7.2 Sterile cockpit

Students are taught the principles of the sterile cockpit used in manned aviation, where the flight crew is trained to focus on flight tasks exclusive of all other activity. The origin of the sterile cockpit is from studies of aviation accidents that revealed a pattern of flight crew distraction causing preventable accidents. A flight crew that is sharing casual conversation or is focused on a non-critical activity has a much greater chance of missing a critical step in flight operations and allowing the aircraft to depart from its intended plan. Similarly, in unmanned aircraft operations it is important for the flight crew to be focused on the flight activity only in order to prevent unintended outcomes. The sterile cockpit philosophy will be employed from the beginning to end of flight operations, with students demonstrating their knowledge of the importance of this heightened attention during flight activity.

In general, sterile cockpit procedures will be used a.) during assembly of the aircraft, b.) during all preflight checks and execution of checklists, c.) during flight, and d.) during the post-flight debrief. Sterile cockpit will be reinforced by ensuring pilots and crew comply with the following rules and procedures:

1. No conversation that is not related to the flight activity
2. No picture taking or video recording outside of what is included in the mission profile
3. No cell phone use allowed accept for that required by the flight activity

Students are reminded that if they see a potential violation of the sterile cockpit policy that they should bring that to the attention of their crewmates to correct the condition immediately.

#### 3.5.7.3 Transfer of control

Transfer of control between RPICs and/ or operators at the controls is permitted.

When operating a UAS exocentrically, a two-tier system can be used, with one transmitter operating as the master controller while a second transmitter is linked or slaved to it allowing dual control of an aircraft. Movement of sticks on the Remote Pilot Instructor’s remote controller provides instantaneous transfer of control from one transmitter to the other. This system is a means of achieving a position transfer of control from one pilot to another. A verbal command of “I have the aircraft” will be used when taking control from a student and “You have the aircraft” when giving control to a student. The student will confirm control and announce “Roger, I have the aircraft”.

#### Communications / terminology

The crew needs to be able to clearly communicate critical information rapidly during flight operations. This will typically be accomplished person-to-person when operating small RPA where the entire crew is located a few meters away from each other. A standard set of commands is used to eliminate confusion during operation. Commands should be acknowledged by repeating the command back to the person initiating the voice command.

1. **Take-off** - the pilot is clear to start flight
2. **Start Mission** - the pilot is clear to start the mission (flip into auto or start the planned manual flight)
3. **Mode *New Mode*** - when the UAV changes flight modes the ground station communicated the current mode
4. **Battery** - Battery status update in minutes of flight and current voltage
5. **RTK State** - current GPS mode on UAV
6. Turns/waypoints are announced by ground station operator
7. **Abort** - stop the mission and fly home
8. **Pause** - switch to loiter or stabilize and remain at the current location until abort or resume is commanded
9. **Resume** - restart the mission after a pause
10. **Land** - land at the closest safe location without delay
11. **No comms** - communication is lost (should switch to RTL so a mode change will also be announced)
12. **Off track** - not following mission, be ready to abort or land
13. **Aircraft** – Another aircraft detected in the vicinity of flight operations

#### 3.5.7.5 See and avoid

When visual meteorological conditions prevail during a visual line-of-sight flight, it is the responsibility of the RPIC and VO (if present) to maintain vigilance over other aircraft in the vicinity, and call the traffic out to the crew when spotted. Usually, no deviations from the planned flight paths will be necessary, however if deviations are needed then the RPIC has the responsibility to position the aircraft safely away from other air traffic. Aggressive maneuvering may be necessary to provide safe operational boundaries between the aircraft.

### Post-flight activities

After the flight activity has terminated, the crew has the responsibility to continue operating in a professional manner until final documentation has been finished.

#### 3.5.8.1 Securing the aircraft

After landing, the aircraft should be secured and powered down. If it is windy, it will be necessary to secure the aircraft to ensure it is not damaged in a gust of wind. Airborne dust may affect the electronics also, and so protection from the wind is always a good idea. Likewise, if a flight is terminated due to rain moving into the area, then the aircraft should be covered to prevent damage due to water.

#### 3.5.8.2 Post-flight inspection and checklist

Once the aircraft is secured, batteries can be disconnected and the aircraft is inspected for any anomalies to its structure that may have occurred during flight. Any abnormal sounds during flight may be a good reason to inspect the airframe and propulsion system carefully for possible damage.

#### 3.5.8.3 Debrief on flight

The final activity after flying has commenced is for the RPIC to ask the flight crew for any feedback from the flight, and make notes about the procedures that were followed and concerns about the flight that need to be addressed. Any and all comments and concerns should be evaluated, with notes taken by the RPIC. These should be shared with the Head of Training.

#### Logbooks

The RPIC will be responsible for updating all logbooks after the flight. Aircraft flight logs will record aircraft operational cycles, total flight time, battery information (charge/discharge cycles and current charge status), and any anomalies observed during the flight. Pilot logbooks will record flight time, a description of the flight activity, and any safety of flight issues that need to be addressed in a follow-on training session.

Due to the fact that LiPo batteries become less efficient with each charge, it is crucial that their cycles are recorded to avoid a failure in flight. In order to do so, each battery must also be specially identified so that proper recordings of their life cycles can be made.

**Table 3. Logbooks kept on electronic document system**

|  |  |  |
| --- | --- | --- |
| **Logbook** | **For what?** | **Who maintains?** |
| Maint\_S500\_SNXX | Maintenance logging | RPI or designee |
| Flightlog\_S500\_SNXX | Aircraft logbook | RPIC |
| Bat\_SNXX | Battery logbook | RPIC |
| Pilot <Name> Logbook | Pilot logbook | RPIC or SP |

# 4. Risk management

## 4.1 Safe flight practice

An overall assessment of risk is computed based on airspace and flight operations parameters. The risk matrix is reviewed prior to flight with the flight crew present, so that everyone is aware of the risk level associated with the current flight.

### 4.1.1 Safety management system

The ADDA Safety Management System (SMS) outlines the safety policy and procedures.  The SMS outlines the safety procedures put into place to prevent incidents/emergency, the procedures to respond to incidents/emergencies, and methods to ensure the policies are promoted and followed by all operators.  The most important part of safety is that **everyone** is responsible for it.

### 4.1.2 Human factors

It is important for the PIC and all crew members to be aware of their own limitations in regards to flying. Several factors can negatively affect the performance of the flight crew and precautions must be taken to avoid such performance inhibitors to best guarantee safe flights.

#### 4.1.2.1 Fatigue

Fatigue is one of the biggest contributors to pilot error. Fatigue can hurt a pilot’s concentration, affect coordination, and decrease the pilot’s ability to properly communicate. There are two types of fatigue; mental and physical. Mental fatigue can arise from stress or prolong cognitive work while physical fatigue can result from exercise and sleep loss.

A pilot should never fly while suffering from acute fatigue for all of the reasons listed above. No matter the experience level of any pilot can overcome the detrimental effects of fatigue. It is important to consult the IMSAFE checklist to evaluate whether or not a pilot is fit for flight at that time.

#### 4.1.2.2 Dehydration

Dehydration is another commonly seen ailment seen in pilots, particularly due to the fact that most pilots will be flying in warm, sunny conditions as these are also some of the best flight times. It is important that everyone is drinking water liberally to avoid the side effects of dehydration.

Signs of dehydration include, but are not limited to:

* Headaches
* Fatigue
* Cramps
* Sleepiness
* Dizziness

It is recommended that crew members should drink two to four liters of water every 24 hours while working. It is best to have water at the flight site, carry a container for easy intake tracking, and making sure to drink preventively, not reactively, to avoid the worst of dehydration.

#### 4.1.2.3 Distractions

Distractions are another form of human factors that can affect the pilot’s ability to do their job. One of the best ways to avoid distractions is through proper mission planning. By ensuring that all crew members are aware of the mission and environment, any form of unwanted distractions are best avoided. It is also advised that crew members wear bright vests or clothing for the purposes of identification as well as a means of advising against distraction for pedestrians not involved in the flight operations. The sterile cockpit policy is designed to minimize the opportunity for distraction.

## 4.2 Risk assessment

Each flight location brings with it certain hazards unique to the location. These can include fixed hazards (trees, buildings, power lines, etc) as well as moving hazards (pedestrians, vehicles, etc). It is recommended to choose a site that has fewer risks present, but this is not always possible. It is the responsibility of the PIC to determine potential risks before takeoff, and alert other team members to the risks. In the instance that there are moving hazards, it may be necessary to manage the traffic with some combination of barriers and personnel.

The Operations Request Form (ORF) is completed for each new flight operation to formally identify the potential hazards and their consequences.  They are then evaluated for their risk level based on severity and likelihood based on the risk code matrix shown in Figure 2. A risk mitigation plan is developed for all hazards that are at any risk level other than green.  The goal is to reduce the risk level by at least one color level.

A requirement of completing the flight planning is to also complete a risk evaluation for the flight activity. Appendix 5 in the SMS presents a flight risk assessment tool that is used to compute a risk value used to determine if the mission can proceed. This risk computation occurs during flight planning, where risk values are assigned to components of the flight operation. The risk level is determined with concurrence from the flight crew.  The flight risk assessment includes the risk levels from the ORF for the site, aircraft, mission profile, and the operational, crew, and environmental factors. Each level higher of flight risk requires additional oversight and approval before proceeding.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Risk Likelihood** | **Risk Severity** | | | | |
| **Catastrophic A** | **Critical B** | **Moderate C** | **Minor D** | **Negligible E** |
| **5 - Frequent** | 5A | 5B | 5C | 5D | **5E** |
| **4 – Likely** | 4A | 4B | 4C | 4D | 4E |
| **3 – Occasional** | 3A | 3B | 3C | 3D | 3E |
| **2 – Seldom** | 2A | 2B | 2C | 2D | 2E |
| **1 – Improbable** | 1A | 1B | 1C | 1D | 1E |

**Figure 2. Risk matrix codes**

## 4.3 Non-normal operations and emergencies

In all flight activity, it is crucially important to plan for the unexpected. While the front-end planning that takes place is intended to cover the most obvious root causes of failure, accidents still happen and we must be prepared for them. Note that aircraft-specific emergency response plans and procedures published in the aircraft user’s manual or the SOPM still take precedence over the plans and procedures outlined in this section.

### 4.3.1 Emergency response plan

When an emergency occurs, it is crucial that the pilot, first and foremost, flies the aircraft. This means focusing attention on a safe trajectory plan of the aircraft so that it is brought under control, or landed at the earliest possible opportunity. Unmanned aircraft systems are more complex than manned aircraft in that the control may be distributed, and the root cause of failure may not have any prior indicators. In these cases, it is always necessary for the pilot to recognize the problem as early as possible and take manual control to stabilize and/or land the aircraft. In general, the process to follow when an emergency occurs is summarized here:

1. Maintain aircraft control
2. Analyze the situation and take corrective action
3. Land as soon as conditions permit

The sole person who makes final flight decisions during an emergency is the RPIC. As the person who is flying the aircraft, they should recognize that information may be presented to them from other crewmembers, however they are ultimately responsible for making flight control decisions after evaluating all available information.

The specific Emergency Response Plan (ERP) is found in the SMS, Section 2. The ERP is accessible by all crewmembers so that whoever can retrieve it first will be able to share with the entire crew. It is written so that no prior knowledge of the flight mission is needed to execute the response, allowing outside help to intervene if the crew is incapacitated. The Emergency Response Coordinator (ERC) on-site is expected to take the lead in executing an ERP.

### 4.3.2 Medical emergencies

The crew conducts a self-assessment of their health prior to flight, however a medical emergency is rarely a foreseen event. The crew is briefed on the location of a first aid kit during the preflight briefing so that in the event of an emergency, a rapid response can be made. The first aid kit will be positioned conveniently for all flight crews during a particular training event.

### 4.3.3 Fires

While the incident of fires is rare, preparation and planning should occur so that in the event of a fire, a proper response can be initiated. In general, drone fires are usually limited to the Lithium Polymer batteries that power them. These batteries need to be properly charged, discharged and stored to maximize their life and reduce the likelihood of a runaway thermal event. Some important recommendations to minimize fire potential are:

1. Use a balancer when charging the battery so that all cells are charged equally, preventing an unstable power distribution across the cells.
2. Batteries should never be charged unattended – always have someone nearby to avert a fire event if the battery becomes overheated and/or starts to smoke.
3. If a battery becomes “puffy,” it most likely has been damaged during charging or discharging which will result in the cells expanding. The battery should be taken out of service unless it is only slightly distorted. More than a 5% dimensional change from its original shape indicates the battery needs to be removed from service.
4. Batteries should always be stored in fireproof containers (boxes or bags). Although rare, batteries can spontaneously overheat but are more likely to do so when being charged or discharged.
5. Battery charging should occur on and near surfaces that are not flammable, such as concrete floors and walls.
6. A container of sand should be kept in the room where batteries are generally charged and stored; it is to be applied over the burning battery.

### 4.3.4 Lost communications

Failure of communications from ground to air can result in loss of control of the aircraft, and this requires the RPIC to follow procedures designed to either regain control of the aircraft or reduce its likelihood of crashing. There are a few categories of wireless failure that should be considered, discussed below.

Additionally, the SOPM covers more detailed information about lost communications procedures which are aircraft-specific.

#### 4.3.4.1 Loss of GPS

Since most flight control systems rely on GPS to stabilize the aircraft, the loss of GPS can degrade the ability of the aircraft to hold position and attitude. If this is the case, the aircraft may start to drift or act unpredictably. Some flight controllers may initiate a return to launch (RTL) mode upon detection of the loss of GPS, but without the absolute navigation provided by GPS the aircraft will rely on magnetometer and inertial sensors resulting in an inaccurate trajectory back to the home waypoint. It is best for the pilot to take manual control of the aircraft and fly it to a safe landing point, realizing that the aircraft stabilization may be degraded.

#### 4.3.4.2 Lost radio link

The transmitter or telemetry link is a low-bandwidth link that is sometimes broken as the flight distances increase between the ground station and the aircraft. Similar to loss of GPS, the aircraft may initiate an RTL mode after a selectable time period has elapsed without the link being regained. A typical RTL mode will first command the aircraft to climb to a preset altitude that is determined to be a safe altitude for flight back to the home waypoint. Once this altitude is achieved, the aircraft flies to the home waypoint and then descends to a landing. Note that in setting up the aircraft for an autonomous flight, the RTL cruise altitude is an important parameter to set and should not be overlooked prior to mission.

**Lost radio link procedure:**

* Pilot or GCS operator announce “Lost link!”
* Pilot takes manual control when the link is re-established and brings the aircraft to a safe landing

During an RTL mode if the pilot is able to regain the link then the aircraft can be flown manually either to continue the mission or to land. In any case, the loss link problem should be investigated and corrected so that the planned missions can proceed without interruption.

#### 4.3.4.3 Fly-away

Aircraft that fail to respond to any flight control input and appear to be flying on a steady heading and altitude would be classified as fly-away aircraft. In these cases, it may be necessary to contact the appropriate air traffic control authority to inform them of the situation by describing a.) the aircraft, b.) its heading and c.) its airspeed. Additionally, the authority will want to know d.) the endurance of the aircraft to compute its maximum range, and e.) if there is any telemetry data that can be relayed to facilitate in tracking the aircraft.

**Fly-away procedure:**

* Pilot or GCS operator announce “Fly-away!”
* Nearest available personnel with phone contact the air traffic control authority and inform them about the situation, with points a.) – e.) covered in the description.

### 4.3.5 RF interference

Anytime a wireless system is operated, it may be subject to interference from other radio signals in the area. An important consideration for drone flight is to carefully analyze all possible sources of radio frequency (RF) interference since directional antennas can have very localized effects on the wireless environment. If a spectrum analyzer is available, it is always helpful to analyze the frequency environment before flights begin to ensure that the aircraft frequencies are not overpowered by other signals in the area. If an analyzer is not available, an inspection of the antennas in the area may provide information about the frequencies that will be encountered, and the power of those signals. High power source or repeater dish antennas that pass a signal directly through a flight path are particularly dangerous since the power density is high enough to overcome an aircraft receiver even if there is frequency separation. It is very important to adjust flight paths so that an aircraft avoids these areas. The radio channel should also be chosen to avoid conflict with any other radios in operation on other RPA in the area even if they are not in the air at the same time.

## 4.4 Incident and accident response

### 4.4.1 General

While it is in everyone’s interest to avoid accidents, they sometimes occur and there needs to be a policy for addressing these events.

### 4.4.2 External reporting and pilot activity

Reportable incidents involving unmanned aircraft are defined as:

* 1. In-flight fire
  2. “Fly-away” events that result in the aircraft leaving the immediate flight operations area with no ability of the remote pilot to regain control of the aircraft.
  3. Mid-air collision
  4. Serious injury which falls into one of five categories: *(1)* *Requires hospitalization for more than 48 hours, commencing within 7 days from the date of the injury was received; (2) results in a fracture of any bone (except simple fractures of fingers, toes, or nose); (3) causes severe hemorrhages, nerve, muscle, or tendon damage; (4) involves any internal organ; or (5) involves second- or third-degree burns, or any burns affecting more than 5 percent of the body surface.*

Reportable accidents include:

* 1. Serious injury – classified as an abbreviated injury scale (AIS) level 3 injury, which corresponds to, as an example, an open fracture of the humerus, or an 8 – 10% chance of death
  2. More than $500 (MK400,000) worth of damage on the ground, other than the aircraft

Pilots who have an incident or accident shall notify a.) the Emergency Response Coordinator if anyone has been injured, and c.) the Chief Pilot who is always available to take the incident/accident report. An email should be sent as soon as possible but not more than 24 hours after the incident or accident to [xxx@xxx.xxx](mailto:xxx@xxx.xxx) describing the incident or accident. Please use the incident report section that is included. Flight operations should be terminated immediately until a review of the accident or incident has been conducted and the pilot in command has been notified that operations can continue.

### 4.4.3 Internal Incident Reporting

Less serious incidents and accidents should be recorded internally. The expectation is that for every serious incident that requires an external report there will be several less severe incidents such as near misses in flight, hard landings, tip overs, etc. that do not need to be reported, but do need to be recorded.  **Any deviation from the planned flight should be recorded in the flight log with no exceptions.**

# 5. Flight personnel

## 5.1 Qualifications and privileges

This section outlines the privileges for each pilot category.

### 5.1.1 Student pilots

Student pilots (SP) receive flight instruction when being trained by a remote pilot instructor (RPI). Training activities are either specified in a lesson plan with objectives to be accomplished, or they may occur on an as-needed basis depending on how much flight time a particular student needs to become proficient. Student pilots become qualified to fly aircraft after reviewing several documents that are available on Google Drive. Students pilots must complete the Student Document Review Form which verifies they have read required reading material to begin flight training. Once this form is complete the student’s contact information, medical history and other important information is recorded in the Pilot Credentialing system.

### 5.1.2 Remote pilot instructors

The Remote pilot instructors (RPI) have the authority to conduct flight operations and provide flight instruction to student pilots. They can provide logbook endorsements to give student pilots the privilege to conduct flights in pairs during day VFR conditions.

In addition to practical flight activities, RPIs provide classroom instruction that covers all topics in this FOM as well as the SOPM, SMS and the governing flight rules for pilots operating in Malawi airspace.

### 5.1.3 Remote pilot in command (RPIC)

The RPIC is always the person who is in direct command of the flight operation. This person may not be physically on the flight controls while giving instruction, but will be proximally close enough to the student operator to intervene if necessary. The RPIC has the responsibility to ensure a safe flight operation occurs, and for that reason they will ultimately be responsible for the flight planning and flight execution even if a student pilot is in control of the aircraft. In many cases, the student pilot will be filling out forms that are submitted in the course of a flight operation; it is expected that the RPI (RPIC) will review those forms for accuracy and ultimately have responsibility for the content.

# 6. Training programs for remote pilots

Discuss your training program here.

# 7. Aircraft and airworthiness

## 7.1 Registration

Aircraft must be registered as required by the controlling authority guidelines. Registered aircraft information is archived in the electronic documents system, which also contains information about expiration of registration. In the event that an RPA Letter of Approval (RLA) is required, then those letters are also archived in the electronic records system.

## 7.2 Markings

Markings as required by the controlling authority will be applied to all registered aircraft in the manner specified by the referring documents.

## RPA letter of approval

If a letter of approval is needed, it would be archived in the electronics document system (add text here).

## 7.4 Maintenance

Maintenance on training aircraft is not prescribed, however a maintenance manual has been included in electronic documents for the xxx aircraft that outlines a procedure for the disassembly, inspection and reassembly of components. Additionally, a general maintenance manual (GMM) is available in electronic documents that specifies the types of maintenance that can be performed on RPA, and who is authorized to conduct that maintenance. Additionally, aircraft inspections are addressed.

All actions taken on the aircraft related to repair, replacement or modification of the aircraft are guided by the policy in the GMM and should be logged in the aircraft maintenance logbook.

Remote pilots are authorized to perform maintenance on any aircraft. This includes major repair to an aircraft, etc.

### 7.4.1 Aircraft maintenance logbooks

Maintenance logbooks are found in the electronic document system. The file designation for these logbooks is Maint\_YYY\_SNXX, where YYY refers to the particular aircraft. All flying aircraft will have an initial entry in the logbook that states the following: “This aircraft was assembled by \_\_\_\_\_\_\_\_\_\_\_\_. Quality assurance was maintained throughout the assembly process with intermediate checks on the mechanical system and electrical/electronic function. I certify that the aircraft was built to xxx standards.” Signed \_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

### 7.4.2 Battery maintenance

Batteries require charging, and this is classified as regular maintenance. The battery logbook is accessed through the electronic documents. More information on battery maintenance is found in the GMM.

### 7.4.3 Software and firmware updates

Software and firmware updates are also considered to be maintenance items that need to be logged, and this is supported through the log file SWL01 that is accessed in electronic documents. Version control of software and firmware should be checked at regular intervals to ensure that all aircraft are up to date with software and firmware versions.

## Reporting of discrepancies

It is important that all operators of unmanned aircraft take an active approach to find anomalies and/or discrepancies in aircraft that may result in the departure/loss of an aircraft. Company XXX maintains an anonymous reporting channel that will allow students, staff and bystanders to report observed anomalies which they consider to be safety of flight issues requiring corrective action. The chief pilot will have access to these reports and will be able to take corrective action when needed. The form for discrepancy reporting is found in electronic documentsas the Anonymous Safety Report form, or ASR.

# 8. Flight logging and document management

## 8.1 Airman records

### 8.1.1 Pilot logbooks

All pilots will keep personal flight logs which may be requested by the Head of Training or Chief Pilot at any time. The logbooks will reflect both air and ground instruction received, with the instructor providing comments about the student’s performance where applicable. At a minimum, the date, aircraft, location, flight activity, and total time (including the category of flight) should be recorded

### 8.1.2 Certificates

Pilots are individually responsible for uploading certificates and documentation that is required for compliance in flight operations.. Certificates that document eligibility are as follows:

#### 8.1.2.1 Student pilot certificate

Issued to students who are engaged in a training program. The student pilot (SP) certificate allows the student to operate training aircraft under the supervision of an RPI. Students are credentialed to operate aircraft using the pilot credentialing system (PCS) which verifies the following:

1. The student is at least 18 years of age
2. The student is medically fit to perform the duties of a remote pilot
3. The student has read and understands the following ADDA documents:
   1. Flight operations manual (FOM – this document)
   2. Safety management system (SMS)
   3. Standard operating procedures manual (SOPM)
   4. XXX aircraft users manual
   5. UASPC – Pilots code of conduct

Students that are credentialed are authorized to fly training aircraft at sites approved by the Chief Pilot. The Operations Request Form (ORF) is used to designate new flight training areas.

#### 8.1.2.2 Medical self-certification

Students will be asked to submit a self-certification of their health and well-being, where they state they have no known medical deficiencies that would prevent them from performing the duties of the remote pilot. This medical certificate will be signed, dated and uploaded to the electronic forms system.

#### 8.1.2.3 Remote pilot license

Students who successfully pass the written and practical tests given by a governing authority are designated as remote pilots.

#### Visual observer certificate

Eligible visual observers must pass the visual observer knowledge test and receive a passing score (75%) to qualify as an active visual observer.

## 8.2 Aircraft records

Aircraft condition for safe flight operation is tracked in the aircraft logbooks, both in the maintenance logs and the flight logs. These logs will note the amount of time that a particular aircraft flew, and if there were any discrepancies in performance that appeared during the flight or in a post-flight examination. Where possible, corrective action should be taken immediately to fix/repair items on the aircraft that show signs of degradation. If a correction action is taken, then that work should be recorded in the maintenance logbook for the aircraft (Maint\_YYY\_SNXX). It is important for the student pilots to learn to be proactive on maintenance that will be conducted as soon as a problem is discovered, and this most likely would be found during a preflight inspection or a post-flight inspection. Note that the general maintenance manual (GMM) should be referenced to gain further information on performing maintenance and inspections on aircraft. Whenever maintenance is performed, the aircraft logbooks should be updated with aircraft total time, and what the maintenance issue was and how it was addressed.