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**Remotely Piloted Aircraft (RPA)**

**Safety Management System (SMS)**

**Revision 1.0 October 29, 2019**

**CHANGE MANAGEMENT**

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| --- | --- | --- | --- | --- |
| REV # | DATE | CHANGED SECTIONS | REMARKS | INITIALS |
| 0 | 12/13/19 | None | Initial |  |
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|  |  |  |  |  |

**Table of Contents**

**List of effective changes 2**

**Contents 3**

[**1. *Safety Policy and Objectives* 6**](#_Toc23771061)

[**1.1 Appointment of ADDA Safety Personnel and Key Safety Groups 6**](#_Toc23771062)

1.1.1 Internal Safety Committee 6

1.1.2 External Safety Review Committee 7

[**1.2 Accident Investigation 7**](#_Toc23771063)

[**1.3 Emergency Response Planning 8**](#_Toc23771064)

[**1.4 RPA Operational Safety 8**](#_Toc23771065)

[**1.5 Occupational Health and Safety 8**](#_Toc23771066)

1.5.1 Fatigue 8

1.5.2 Protection from the Elements 8

1.5.2.1 Dehydration and Heat Related Risks 8

1.5.2.2 Sun 9

1.5.2.3 Thunderstorms 9

1.5.3 Personal Protective Equipment 9

1.5.4 Distractions and Interference 9

[**1.6 Hazard Safety Zones 10**](#_Toc23771067)

**1.7 General Operational Guidance 10**

**1.8 Obtaining Approval to Operate UAS 10**

**1.9 RPA Registration Requirements 11**

**1.10 Pilot Requirements 11**

[**2. *Emergency Response Plan* 11**](#_Toc23771068)

[**2.1 Emergency Preparedness 12**](#_Toc23771069)

[**2.2 Emergency Response Coordinator 12**](#_Toc23771070)

[**2.3 Emergency Procedures Quick Reference Checklist 12**](#_Toc23771071)

[**2.4 Emergency Contact Tree 12**](#_Toc23771072)

[**2.5 Project Manager and/or Head of Training Responsibilities During an Emergency 13**](#_Toc23771073)

[**2.6 Aircraft Crash Procedure Goals 13**](#_Toc23771074)

[**2.7 Loss of NAV/GPS Procedures 14**](#_Toc23771075)

**2.8 Lost Link Procedures 14**

**2.9 Lost Orientation Procedures for VTOL RPA 14**

**2.10 Emergency Response Plan Testing 15**

[**3. *Safety Risk Management* 15**](#_Toc23771076)

[**3.1 Safety Risk Management Process Overview 16**](#_Toc23771077)

[**3.2 Hazard Identification (ID) 16**](#_Toc23771080)

[**3.3 Hazard Assessment / Calcuate Risks 17**](#_Toc23771085)

[**3.4 Analyze Risks / Risk Control Measures 18**](#_Toc23771092)

[**3.5 Mitigate Risks 19**](#_Toc23771093)

**3.6 Recording the Risk Management Process 19**

[**4. *Safety Assurance* 20**](#_Toc23771102)

[**4.1 Safety Performance Monitoring and Measurment 20**](#_Toc23771103)

[4.1.1 Internal Audits 20](#_Toc23771104)

[4.1.2 External Audits 21](#_Toc23771105)

[**4.2 Continuous Improvement of the SMS 21**](#_Toc23771106)

4.2.1 Monitoring, Review, and Continuous Improvement 21

[**4.3 Mandatory Incident / Accident Reporting System 21**](#_Toc23771107)

[**4.4 Open and Anonymous UAS Reporting System 22**](#_Toc23771113)

**4.5 Safety Reviews 22**

[**5. *Safety Promotion* 22**](#_Toc23771117)

[**5.1 Training 22**](#_Toc23771118)

**5.2 Active Safety Communication 23**

[**6. *ADDA Tracking – Document and Record Management* 23**](#_Toc23771122)

**6.1 Policy and Procedure Documents 23**

**6.2 Operation Logs 24**

**6.3 Reports 26**

**Appendix 1: UAS Operation Request Form 29**

**Appendix 2: Initial Risk Assessment 31**

**Appendix 3: Risk Mitigation 33**

**Appendix 4: UAS Incident / Accident Report 34**

**Appendix 5: Flight Risk Assessment Tool 36**

# Safety Policy and Objectives

This Safety Management System (SMS) is founded with the purpose of maintaining an effective safety culture in all operations. This involves complying with local safety regulations as well as upholding our own procedures for safe remotely piloted aircraft (RPA) operation. Our role as an educational organization carries with it the added responsibility of ensuring that proper safety knowledge is imparted to our students through a “just culture.” Just culture refers to an organization that engages in the identification of systematic errors, the implementation of preventative corrective actions, and exhibits an intolerance of undesirable behaviors such as recklessness or willful disregard for established procedures. **All of our staff and students have the responsibility to practice proper RPA safety in all their operations.**

Our safety objectives are as follows:

1. Outline proper RPA safety procedures.
2. Ensure proper RPA safety procedures are adhered to by all personnel.
3. Create a culture of safety within our operations and among our people.
4. Ensure the proper documentation and recording of all flight safety procedures and incident reports.
5. Ensure safety related matters are properly communicated through the personnel framework

Company XXX is dedicated to ensuring all safety issues, including hazards, accidents and incidents can be reported without fear of reprisal. The procedures and this document are liable to change to continue to reflect industry best practices in safe RPA operations.

Specific procedures for training and operations are describing in detail in these documents:

* Flight Training Manual (FTM)
* Flight Operations Manual (FOM)
* Generic and model specific aircraft manuals
* UAS Pilot Code of Conduct (UASPC)
* Airman’s Information Manual (AIM)

## Appointment of Safety Personnel and Key Safety Groups

Company XXX has two committees to oversee the safety of its operations - an internal safety review committee (ISC) made up of senior personnel and an external safety review committee (ESC) consisting of RPA experts.

### 1.1.1 Internal Safety Committee

Company XXX has a number of personnel who oversee all safety matters and form the Internal Safety Committee (ISC). These include:

* Aviation Safety Officer
* Project Manager
* Head of Training
* Local/Site Representative (when applicable)

These personnel are selected by the Chief Pilot and are responsible for maintaining safe operations and mitigate safety-related safety risks by:

* Forming and maintaining a comprehensive and beneficial safety culture;
* Establishing organizational priorities and tasking;
* Outlining procedures on how to perform activities or processes;
* Ensuring accountability to all established safety procedures;
* Maximizing the skills of the organization’s personnel;
* Allocating all necessary resources to address safety concerns, and above all
* Demonstrating proper safety procedures in all operations.

### 1.1.2 External Safety Review Committee

Company XXX has a panel of RPA experts that serve on the Advisory Board (AB). An External Safety Review Committee (ESC) is comprised of three members of the AB and will oversee and review operations from an outside perspective. The ESC will convene approximately three times per year coincident with the AB meetings, and may also meet immediately following an incident/accident that results in significant injury or property damage. The committee is tasked with ensuring that the SMS and other safety procedures comply with RPA best practices and industry standards. The aim of this committee is to ensure that a safety culture is held accountable by people outside the organization.

## Accident/Incident Investigation

The Internal Safety Committee (ISC) is also tasked with conducting accident/incident investigations. In the event that an RPIC files an accident/incident report, an email is sent to the Aviation Safety Officer (ASO) notifying that a report has been filed. The ASO will assess the severity of the incident/accident and at their discretion may convene the ISC to find the root cause of the accident/incident. The ISC is also tasked to determine if any action is taken against the RPIC, including recurrency training or suspension of flight privileges. The ISC will analyze the incident/accident and suggest any changes in the flight operation that would enhance safety and prevent the event from reoccurring.

To maintain impartiality, it is critical that members of the ISC have no affiliation with individuals under investigation or otherwise involved in the accident. In the event that such affiliation is found, another member will temporarily replace the affiliated person on the ISC for the extent of the accident investigation. The results of all investigations will be reviewed by the External Safety Review Committee (ESC). The ESC may also recommend changes to policy and procedures as they see necessary to prevent recurrence of incidents.

## Emergency Response Planning

All ADDA entities operating RPA must follow the Emergency Response Plan in the event of an incident or accident. It is the responsibility of the Person in Charge if the Remote Pilot in Command (RPIC) is not on site to initiate the Emergency Response Plan. The duties and responsibilities of personnel in the event of an accident or incident are described in the Emergency Response Plan (Section 2 of this document).

## RPA Operational Safety

Safe operation of each aircraft is guided by the Flight Operations Manual (FOM) and aircraft manuals: the user manual and Standard Operating Procedures Manual (SOPM). These documents fully describe the procedures, equipment, and documentation required to operate each RPA.

## Occupational Health and Safety

Company XXX has policies to protect the well-being of the flight crew (pilots, visual observers, and others). This section provides an overview - additional information is included in the Flight Operations Manual.

### 1.5.1 Fatigue

Crew fatigue is a significant risk factor to successful mission completion and overall safety. Hours of pilot rest is a factor in the preflight planning risk assessment. The fatigue requirements for pilots are:

1. Maximum duty time - 12 hours per day (this includes any required meetings, standardization flights, ground labs, classes or any other assignment)
2. Maximum duty time - 70 hours per week
3. Minimum of 10 consecutive hours of rest during the 24-hour period that precedes the completion of the last activity.

### 1.5.2 Protection From the Elements

In addition the consideration of how the weather impacts the safety of flying an RPA, the elements also impact the safety of the crew.

#### 1.5.2.1 Dehydration and Heat Related Risks

Dehydration is a significant risk factor during operations of UAS. This is often related to heat, but can still be a factor even when the weather is cooler. The flight crew needs to ensure they have an adequate supply of water and breaks during operation to drink it. The crew should watch for signs of dehydration in themselves and their fellow crew members. Beyond thirst, these include: headache, fatigue, cramps, sleepiness, and dizziness. Un-remedied dehydration can lead to even more serious conditions such as heat exhaustion or heat stroke. The symptoms of heat exhaustion are similar to dehydration with the addition of possible low blood pressure, nausea, and a low fever. Heat stroke is even more severe and includes symptoms like rapid heartbeat and breathing and possible stroke-like symptoms like confusion, hallucinations, seizures, and loss of consciousness. In addition to getting fluids and cooling, the person with possible heat exhaustion or heat stroke should get immediate medical attention.

#### 1.5.2.2 Sun

Sun exposure is a risk in two ways - it impacts a pilot's vision and can also cause sunburn. Each crew member should have sunglasses and/or brimmed hat to protect their eyes when it is sunny, so they can clearly see the UAS and any potential hazards. Individuals at risk of sunburn should either wear clothing preventing sun exposure or sunscreen to protect themselves.

#### 1.5.2.3 Thunderstorms

Thunderstorms bring the potential hazard of lightning which is a risk to the crew and their hardware. The crew should check the weather reports as part of flight planning the day before and the day of the planned flight and avoid operations if the risk of thunderstorm is high. If there is thunder in the area operations should be suspended until 30 minutes after the last instance of thunder. The crew should also review the weather radar when available to help make the decision on whether it is safe to proceed.

### 1.5.3 Personal Protective Equipment

Personal Protective Equipment (PPE) is used to reduce the risk to the crew related to UAS-specific hazards and is required for all operations of UAS with the ADDA program. The minimum requirements are:

* Safety glasses
* Sleeved shirt (short or long)
* Closed-toe shoes

Additional PPE may be required based on the risk assessments/mitigation plans for specific mission plans. Fluorescent orange, green or yellow vests are highly recommended for the flight crew to identify responsible parties of the operation, and to indicate to observers that an operation of elevated risk is taking place.

### 1.5.4 Distractions and Interference

Care should be taken to minimize the possible distractions of the crew and opportunities for interference. When operating in the proximity of any people other than the flight crew (bystanders, spectators, or other flight crews) the measures to reduce distraction and interference should be included in the mission plan. Common measures may include controls such as:

* Barrier or marker separating the flight crew from others
* Signage explaining operations (to reduce questions addressed to the flight crew while they try to set up, operate, etc.)
* Pre-flight briefing for crowd
* Additional crew for crowd control
* Crew clearly identified by clothing

The measures used should be specific to the operation. The flight crew must also be prepared to suspend operations by landing the UAS if the measures do not seem sufficient.

## Hazard Safety Zones

Any multi-rotor platform regardless of its size will have a minimum hazard area of 3 feet. At no time shall any person or property enter the hazard area during operations including launching, flight, and landing (unless required during an emergency situation). Hazard areas will vary in size based on individual aircraft characteristics and are defined in the aircraft SOP (listed as launch and recovery areas). Hand launch and recovery of multi-rotor platforms can be performed to meet specific objectives but these procedures must be specifically addressed in the risk analysis prior to flight. Hand launch and recovery is limited to multi-rotor systems weighing less than 2 pounds or if the manufacturers’ procedures allow for hand launch and recovery.

## General Operational Guidance

The Aviation Safety Officer will review requests for RPA activities to ensure compliance with applicable national and local laws and regulations and policy requirements. The Pilot in Command or Head of Training will evaluate requests for use of an RPA to determine if use of the equipment is within acceptable safety parameters. If the risk or process presented is acceptable, and/or control measures can be employed to satisfactorily mitigate the risk(s) associated with the proposed operations, they will close out the request for further risk assessment and approve the flight and issue a flight ID number. They will also perform a general risk assessment for each site of operations to use as a baseline for site risk for each flight plan.

National and local laws, and applicable policies must be followed in conjunction with any RPA activities. Any RPA operating in violation of any national or local laws or company policies will be grounded.

## Obtaining Approval to Operate UAS

A new risk assessment must be submitted for new flight operations areas at least two weeks in advance. Routine flight operations are approved by the Chief Pilot after a request is made for flight authorization within 24 hours of flight activity.

## RPA Registration Requirements

RPA are registered through the appropriate local and national authorities.

## Pilot Requirements

Pilots operating under this SMS must meet the following qualifications:

* Be at least 18 years old.
* Be able to read, speak, write, and understand English (exceptions may be made if the person is unable to meet one of these requirements for a medical reason, such as hearing impairment).
* Be in a physical and mental condition to safely operate a small RPA.

# Emergency Response Plan

When an emergency occurs, it is crucial that the pilot maintains focus on flying the aircraft. This means quickly forming 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. It is the pilot’s primary responsibility to: maintain aircraft control, analyze the situation, take corrective action, and land the aircraft as soon as conditions permit.

The sole person who makes final flight decisions during an emergency is the Remote Pilot in Command. 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 the available information. An emergency response plan (ERP) should guide the flight team through the appropriate procedures.

## 2.1 Emergency Preparedness

As part of all operations proper precautions need to be made to maximize readiness to respond to an emergency. These preparations include:

1. All Flight Planning forms and Aircraft Checklist are properly completed before operations begin.
2. Under no circumstances should UAS operation begin without a Flight ID number issued.
3. Ensure flight crew has first aid supplies, 2 liters of water, a communication device, and sand before they proceed to site.
4. The flight crew should have the current emergency contact list available at the site.
5. All crew should have the appropriate PPE.
6. Identify alternative landing locations prior to takeoff so the RPIC can make a quick decision about emergency landings if needed during flight.

## Emergency Response Coordinator

An Emergency Response Coordinator (ERC) will be designated for each flight site. They will be on-site and are expected to take the lead in executing the ERP. The flight crew should check with the ERC before beginning any flight operations. The ERC prepares a “base” of operations in the event of an emergency. This location is chosen to be close to the flight area will consist of the following provisions:

* An open and clean space to attend to the injured
* A first aid kit to administer aid for the most common injuries (cuts, minor lacerations, burns, dehydration)
* A phone number for the nearest emergency response unit for transportation to a hospital
* 2l of drinking water
* A bucket of sand for putting out fires

## Emergency Procedures Quick Reference Checklist

1. If necessary, call emergency services.
2. Render first aid as necessary.
3. Contact the Project Manager via the call out list.
4. Preserve accident/incident site to ensure aircraft wreckage is not tampered with.
5. Secure the Ground Control Station.
6. Once the flight crew and scene are secure/safe take pictures and begin documentation of the incident.

## Emergency Contact Tree

The emergency contact list (ECL) document is maintained within electronic records and loaded on each of the program tablets used at the flying site.

The following personnel roles are listed below in order of ability to address the situation. In the event of an emergency, call people in the listed order.

1. Emergency Response Coordinator: The ERC is the first point of contact for all emergencies. Contact them immediately in the case of an incident. The ERC should be at the location of the accident or close proximity.
2. Project Manager: The Project Manager is based locally and is attached to the operation. Contact them immediately in the case of an incident.
3. Chief Pilot: The Chief Pilot is not based locally. Contact if the prior personnel cannot be reached.

## Project Manager and/or Chief Pilot Responsibilities during an Emergency

1. Contact local aviation authorities as required.
2. Ensure that precautions are taken to protect all investigators and preserve all evidence.
3. Restrict access to the aircraft until the emergency investigation has concluded.
4. Interview appropriate personnel and witnesses. This could take the form of written or recorded statements. Personnel and witness contact information should be recorded in case follow-up interviews are required.
5. Ensure all necessary data for developing an investigation is obtained. This includes photographs and sensor measurements collected.
6. If applicable, coordinate post-accident drug testing for all involved crewmembers within 12 hours. Ensure that crewmembers are informed of this requirement and report for testing.
7. Ensure completion of the appropriate incident report section of the flight log form.
8. Ensure that any media questions are directed to the Project Manager, the Head of Training, or the Programmatic Lead. These are the only personnel allowed to engage with the media for legal purposes. The Programmatic Lead should be made aware of any media involvement as soon as possible.
9. Complete the Incident Response Report

## Aircraft Crash Procedure Goals

The crew and accompanying personnel following an aircraft crash are to:

1. Protect themselves and others first
2. Make sure that the situation is dealt with in order to prevent further injury and damage
3. Get help from surrounding personnel and bystanders
4. Control the damage caused by the incident and prevent it from spreading
5. Record as much information about the aircraft crash as possible to identify the point of failure, learn from the incident, and avoid similar incidents in the future.

## Loss of NAV/GPS Procedures

Upon first indication of GPS Loss, maintain visual contact with the RPA. If the RPA exceeds visual range, note the system range and bearing to the RPA.

1. Select an attitude stabilized control mode.
2. Set/confirm safe altitude for area between RPA position and GCS.
3. Direct RPA to GCS by visual guidance.
4. If RPA has exceeded visual range, direct RPA to GCS using back azimuth of last known position.
5. Recover RPA.

## Lost Link Procedures

Upon first indication of Lost Link (LL), check the antenna orientation, GCS link status, and cables and connections.

1. Often one of the aforementioned items is the culprit of a lost link. If all connections and links are secure and there is still no link, typically the RPA will continue its current operation until a predefined LL timeout is exceeded then execute LL procedures.
2. Notify flight crew about lost link.
3. Clear lost link landing area.

Most RPA programs will automatically execute a predetermined flight profile when the LL timeout is exceeded. When an RPA is at distant range and executes a Return-to-Home (RTH) LL procedure, link may be re-established and the operator may have the option of regaining control and resuming the operation (mode control switch). Care should be taken when setting the minimum safe altitude (MSA) for the Return-to Home LL procedure. The MSA should be chosen to address the highest obstacle within the flight area.

## Lost Orientation Procedures for VTOL RPA

1. Release sticks, allowing aircraft to stop.
2. Climb to a safe altitude above nearby obstacles.
3. Move stick forward, note apparent direction of flight.
4. If apparent sideways movement:
   1. Yaw the aircraft for a second. Aim to change the aircraft’s heading by ~45 degrees.
   2. Continue until aircraft performs no apparent sideways movement.
5. Move the stick forward, staying at constant altitude (no altitude input change).
   1. If aircraft appears to climb it is returning to to Ground Control Station.
   2. If aircraft appears to descend, it is departing away from the Ground Control Station. Stop and repeat process until returning to Ground Control Station.
6. If the pilot cannot reestablish orientation a Return-to-Home command should be issued.

## Emergency Response Plan Testing

It is important to periodically test the emergency response plan through simulation of an actual emergency. Emergency response assignments will be made and personnel will be coached on how to provide support during an emergency.

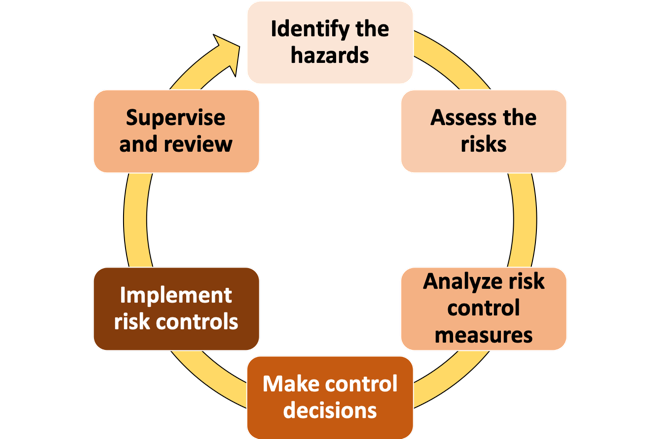
# Operational Risk Management

### Operational Risk Management Overview

This SMS component provides a decision-making process for identifying hazards and mitigating risks based on a thorough understanding of ADDA procedures and the operating environment. Operational risk management (ORM) is pre-emptive rather than reactive. The approach is based on the philosophy that it is irresponsible and wasteful to wait for an accident to happen, then figuring out how to prevent it from happening again. ORM provides the decision-making tool that helps to systematically identify risks and benefits, and determine the best courses of action for any situation.

Risk is defined as the probability and severity of accident and loss from exposure to various hazards, including injury to people and loss of resources. Decision making commonly weighs risk and benefits, and ORM provides a six-step process for identifying hazards and taking reasonable measures to reduce risk to personnel, equipment and the mission. Figure 1 shows the ORM process which is guided by the four principles of ORM:

1. **Accept no unnecessary risk:** Unnecessary risk carries no commensurate return in terms of benefits or opportunities, and only “necessary risk” should be accepted.
2. **Make risk decisions at the appropriate level:** Anyone can make a decision involving risk, however the person that should be making these decisions needs to be authorized and empowered to implement the necessary changes.
3. **Accept risk when benefits outweigh the costs:** This is important to understand – that risk is frequently present and if the benefit gained is significant, then a higher level of risk may be assumed.
4. **Integrate ORM into planning at all levels:** Risks are more easily assessed and managed in the planning stages of an operation. As such, risk should be considered from the very beginning to minimize impact throughout an operation.



*Figure 1: Operational Risk Management (ORM) Process, based on the FAA ORM process, FAA System Safety Handbook, Chr. 15, Operational Risk Management, Dec. 2000.*

The ORM process is thoroughly explained below:

1. **Identify the hazard:** Defined as a real or potential condition that causes degradation, injury, illness, death or damage to or loss of equipment or property.
2. **Assess the risk:** The assessment step is the application of quantitative and qualitative measures to determine the level of risk associated with specific hazards.
3. **Analyze risk control measures:** Investigate specific strategies and tools that reduce, mitigate or eliminate the risk. The three components of risk that are considered include: a.) probability of occurrence, b.) severity of the hazard, and c.) exposure of people and equipment to the risk.
4. **Make control decisions:** Identify the appropriate decision maker. That person chooses the best control or combination of controls based on 3.), above.
5. **Implement risk controls:** Management must formulate a plan for applying the controls that have been selected, then provide the time, materials and personnel needed to put those measures in place.
6. **Supervise and review:** Once controls are in place, the process must be periodically reevaluated for effectiveness. The process continues throughout the life cycle of the system, mission or activity.

### Operational Risk Management Practice

The ORM process outlined in Figure 1 is best utilized for substantial RPA undertakings that involved new missions or airframes. Examples of such undertakings include:

* New mission types (like RPA in support of Search and Rescue or Crop Surveying)
* New airframe types (like the inclusion of Fixed-Wing RPA in a mission set that is established for Rotary-Wing RPA)
* RPA sustained operations in a uniquely different environment (like a month long RPA surveying in another country outside preexisting ADDA operations)
* New styles of RPA flying (like Beyond Visual Line of Sight (BVLOS))

Project leadership will analyze all new operational risks for each significant new operation scenario (new RPA, new site, new type of mission). The Internal Safety Committee will request the appropriate mission proposal and risk assessment forms from the proposed RPA operator (applicant) through the Operations Request Form (ORF). The Internal Safety Committee will then evaluate that documentation for completeness and quality and either: 1) approve the proposed RPA operation, 2) send the request back to the RPA operations applicant with recommendations to improve/substantiate the product further, or 3) reject the product and the proposed RPA operation as being too hazardous to the Accepted Level of Safety (ALoS). This approval allows the proposed operations to proceed to flight planning. Flight Planning includes a risk score based on prior assessments done through the Operations Request Form.

## 3.1 Hazard Identification (ID)

The ORM process begins with Hazard Identification (ID). A Hazard is a perceived item or condition that will potentially jeopardize the mission or cause injury (or death) to any person, or damage any property (including the aircraft). Hazard identification is often the most critical step in the ORM process because it generates most of the risk management process. Hazard ID should be performed by a team whenever possible. Multiple people (and thus multiple perspectives) helps further the thoroughness of the Hazard ID process and thus encourage safer practice.

Hazard ID should be performed by the RPA operator(s) after the initial site survey of the operating area is complete. The RPA operator(s) should also be familiar with the aircraft and the planned mission objectives before beginning Hazard ID. The most effective initial way to identify hazards is to envision the entire mission plan in chronological order (including preflight/planning, flight operation, and post-operation activities). This makes it easier to point out hazards that can emerge at any point of the mission. Additional hazards can be identified through the division of larger tasks into subtasks, thus granting greater resolution to mission procedures. Prior operating experience also significantly aids in appropriate hazard ID.

Once the hazards have been listed, each hazard should be assessed for possible causes and those subsequent causes listed with the hazard. The causes will be the most important component when the time comes for the Safety Committee to list potential control measures.

## Assess the Risks

The next step after hazards have been identified and their associated causes listed is an initial assessment of each hazard for its Severity and Likelihood. This hazard assessment is conducted by evaluating each hazard against the categories in the RPA Risk Assessment Matrix (see Figure 2). To better understand the classification of risk, severity and likelihood can be addressed separately in a systematic evaluation.

*Severity: The worst thing that can result due to an individual hazard.*

* Example: If the worst result of a hazard was death, its severity is “A-catastrophic”.
* Example: IF the worst result of a hazard was a mild delay, its severity is “E-Negligible”.

*Likelihood: The degree to which the hazard is probable to occur.*

* Example: If the occurrences are common, then the likelihood is “5-frequent.”
* Example: If the occurrences are non-existent, then the likelihood is 1-extremely improbable.”

Grading scales for severity and probability include brackets such as the ones defined in the ICAO Safety Management Manual, 3rd Ed, 2013, shown in Tables 1 and 2:

**Table 1. Safety risk severity table**

|  |  |  |
| --- | --- | --- |
| **Severity** | **Meaning** | **Value** |
| Catastrophic | Equipment destroyed, death | A |
| Hazardous | Large reduction in safety margins, physical distress, serious injury, major equipment damage | B |
| Major | Significant reduction in safety margins, reduction in ability to cope with adverse conditions, serious incident, injury to persons | C |
| Minor | Nuisance, operating limitations, use of emergency procedures, minor incident | D |
| Negligible | Few consequences | E |

**Table 2. Safety risk probability table**

|  |  |  |
| --- | --- | --- |
| **Likelihood** | **Meaning** | **Value** |
| Frequent | Likely to occur many times (has occurred frequently) | 5 |
| Occasional | Likely to occur sometimes (has occurred infrequently) | 4 |
| Remote | Unlikely to occur, but possible (has occurred rarely) | 3 |
| Improbable | Very unlikely to occur (not known to have occurred) | 2 |
| Extremely improbable | Almost inconceivable that the event will occur | 1 |

Expressing these risk assessment values into a safety risk assessment matrix provides an overall risk calculation to evaluate system-level risk (Figure 2):

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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: RPA Risk Assessment Matrix*

After each hazard (with its associated causes) is evaluated for severity and probability, the term Risk can then be applied. A Risk is the expression of a hazard in terms of combined possible likelihood and severity (e.g. – “Loss of mission due to bad batteries, caused by lack of adequate number of batteries available - 2B [orange]: Seldom/Critical).

## Analyze Risk Control Measures

Safety risk management encompasses the assessment and mitigation of potential hazards. This is done by considering risk control measures for each hazard and then selecting an appropriate control. Safety risk management is therefore a key component of the safety management process. Risks that are intolerable must be mitigated, while tolerable risks may be passed through without mitigation (although mitigation is still preferred when feasible).

Each risk without any interventions is analyzed to seek countermeasures that will decrease its level by at least one color in the RPA Assessment Matrix (such as from orange to yellow). Reducing the level/color is done by: 1) decreasing severity, 2) decreasing likelihood, or 3) decreasing both. These interventions are called Risk Controls, Control Measures, or Risk Mitigators. The goal is to reduce the risk level as much as practically possible. The Safety Committee should pay attention to the alphanumeric Raw Risk score to see what effect a control measure will have. In the battery example in section 3.2 where the risk is categorized as 2B [orange], the RPA operation applicant can lower the level of risk to yellow by either decreasing Severity by one level to Moderate (C), or by decreasing Likelihood by one level to Improbable (1). The odds are that decreasing severity in this case may be easier than decreasing likelihood from Seldom to Improbable, but there is no set rule when determining such Control Measures. It should be done to the UAS operator’s best judgement.

A raw risk that is reassessed for control measures to be implemented becomes a mitigated risk. A good mitigated risk is decreased by at least one level/color from the unmitigated raw risk. A risk that is mitigated becomes a fully assessed risk. After all risks are fully assessed they are combined into a master table and charted by color as seen in Figure 3. The Safety Committee will analyze all the assessed risks to determine any further course of action. Once the appropriate decision level is identified, the Safety Committee will take the risk to the appropriate accountable personnel for approval. In most cases, the accountable person is already a member of the Safety Committee.

|  |  |  |
| --- | --- | --- |
| **Assessment Risk Index** | **Criteria** | **Accountability** |
| 5A, 5B, 5C, 4A, 4B, 3A | Unacceptable under existing circumstances, requires immediate action. | Program Lead, Project Manager, Aviation Safety Officer, & Head of Training |
| 5D, 5E, 4C, 3B, 3C, 2A, 2B | Manageable under risk control & mitigation. Requires authorized decision. | Project Manager, Aviation Safety Officer, & Head of Training |
| 4D, 4E, 3D, 2C, 1A, 1B | Acceptable after review of the operation. Requires continued tracking and recorded action plans. | Project Manager or Aviation Safety Officer |
| 3E, 2D, 2E, 1C, 1D, 1E | Acceptable with continued data collection and trending for continuous monitoring. | RPIC |

*Figure 3: Assessed Risk Table - Includes associated accountable people for each index.*

## Make Control Decisions

The RPA operator(s) will decide the appropriate risk controls for each hazard identified. These controls are outlined in the Operations Request Form (ORF) that formally documents the risk assessment. The Safety Committee may propose further risk mitigation recommendations and expand the ADDA Safety Procedures (if so required) after the Risk Analysis. These recommendations must mention which (if any) risk control measures must be implemented prior to approval. Recommendations from the Safety Committee should be made within a simple cost versus benefit framework that assesses the value of each risk control measure, both individually as well as within the larger system of proposed measures. The goal is to select the most effective mixture of risk control measures that balances benefit and cost. The Safety Committee’s recommendations can include different implementation tactics such as risk deferral, risk transference, risk avoidance, risk acceptance, and/or risk rejection.

Upon conclusion of the Safety Committee’s analysis and proposal of recommendations, the accountable people (outlined in Figure 3) can make one of several decisions that include (but are limited to):

1. Approval
2. Approval with caveats
3. Rejection
4. Referral to another member of the Safety Committee.

In all cases, the accountable person will relay to the operation applicant his/her decision. The RPA operation proponent(s), upon receiving accountable person approval or approval with caveats is then responsible to monitor the implementation of the risk control measures that are specified in the accountable person’s decision and ensure that they are carried out by the RPIC. The RPIC is then responsible for the operational (i.e., flight-related) implementation of risk controls within the team. Though the RPIC is responsible for the overall implementation of risk controls, the implementation of individual controls can be assigned to individual flight team members.

## Implement Risk Controls

Once the risk controls are selected they must be put into practice – identifying hazards and planning to mitigate them has no value if this planning is not put into use. The RPIC is responsible for ensuring that all controls are followed for each mission. For higher risk levels this implementation will also include actions by the ADDA staff. This may take many forms – direct oversight of a high risk operation, updating operating procedures and documentation, and/or providing additional training to the RPA operators involved with a potential hazard. The ADDA staff will also do post mission follow up to assess if the new controls are working as planned and to confirm the risk level assessments (are Severity and Likelihood correctly scored for a hazard).

The risk controls should be clearly included in the mission plan description that is submitted in flight planning. If the risk controls impact common operating procedures, then the documentation should be updated to reflect the implemented control.

## Supervise and Review – Recording the Risk Management Process

All Risk Management activities are archived in an electronic tracking system. This tracking system is used to formally document the risk assessment and mitigation and provide a means to check the effectiveness of the identification, assessment, mitigation planning, and mitigation implementation. Every flight, aircraft, site, and operation risk assessment is kept on file and in an up-to-date centralized spot. Proper record keeping is crucial to the safety management process. Such records provide important safety trend information that can be used to avert potential future accidents and drives the continued improvement of safety methods and policies.

The following forms and documents linked in the Appendix will be used to document RPA Safety Risk Management:

Specific Flight

* Flight Planning Form
* Site Risk Assessment Summary
* Drone Specific Risk Assessment Summary
* New operations type

An anonymous safety report form (ASR) that is used to document any safety concerns. Information from these reports can be useful in identifying cases where risk assessment may have been insufficient or when risk mitigation was not effective or was not properly followed.

# Safety Assurance

Safety policy and procedures are only effective if they are actually followed. This requires ADDA to monitor the safety performance for all aspects of the program.

## 4.1 Safety Performance Monitoring and Measurement

Routine monitoring of safety procedures and operational practice will occur. This will take the form of internal audits conducted by members of the Internal Safety Committee, and external audits conducted by members of the External Safety Review Committee. The audits are designed to improve the safety and quality of all operations by ensuring compliance with all safety procedures/standards and improving these procedures.

### 4.1.1 Internal Audits

The internal audit plan verifies that flight operations, maintenance, training, and standards respond to organizational policy, developments, and change. Additionally, the audit plan ensures that the company policies and standards serve to promote a rigorous and thorough safety culture. Finally, the audit ensures that all aspects of RPA operations are appropriately evaluated to ensure maximum compliance with safety procedures.

The internal audit plan includes three key components:

* Documentation review - periodic checks of the records management system are performed with the Flight Summary Reports (FSR) to ensure that program activities are being properly logged.
* Participant questionnaire – Pilots participate in periodic anonymous surveys about safety to receive honest feedback about how safety procedures are working in practice.
* Incident review - all incident reports and anonymous safety reports will be reviewed weekly and monthly to detect if there are any patterns in the incidents that need to be addressed with changes to policy, operating procedures, or hardware/software. These reviews are in addition to the review conducted at the time of the event done to complete an Incident and Hazard Response Report (IHR).

The Chief Pilot is responsible for the internal audit completion. They may complete it themselves or select a designee for each task. The results of the internal audit will be compiled in the Internal Safety Review Report (ISR) and be available to the External Safety Review Committee.

### 4.1.2 External Audits

The External Safety Review Committee (ESRC) conducts external audits during the convening of the Advisory Board meetings. The purpose of these external audits is to seek out any gaps in the SMS that may have been missed in internal review, possibly due to a lack of outside perspective. These reviews provide an additional level of oversight to ensure a comprehensive and up-to-date safety framework. The ESRC will be provided with the incident list, all incident response reports, access to a tracking system, and the results from internal audits. Historical records are available since data for each cohort is archived and retained indefinitely by the Aviation Safety Officer.

## Continuous Improvement of the SMS

Reviewing and updating the SMS is a critical step towards maintaining a high-quality program. The External Safety Review Committee (ESRC) and the Aviation Safety Officer are sensitive to the need for continuous improvement and they have the authority to update the SMS whenever necessary due to changing industry standards, the result of an incident, or some other compelling circumstance. Regular surveillance of all RPA operations are necessary in order to:

* Identify emerging or existing risks.
* Obtain further information to improve risk assessment and mitigation.
* Ensure that risk controls are effective and efficient in both design and operation.
* Analyze and learn from events, changes, trends, successes, and failures.
* Ensure that all affiliates are implementing best safety practice.

To facilitate monitoring and improvement to the safety programs, all reports (aircraft and pilot logbooks, maintenance, incident/accident, anonymous safety reports) for a given cohort are archived and available for reference by the reviewers. Monitoring is the responsibility of all affiliated people, and any safety issues should be directly communicated to the Aviation Safety Officer, or indirectly through the Anonymous Safety Reporting System.

## Mandatory Incident/Accident Reporting System

All RPA operators are required to submit a complete and detailed incident/accident report (included in Flight Logbook form in tracking) if any of the following occur during operations:

***Incidents***

* Near miss with an object or person
* Airspace violations
* Traffic conflict in flight
* Procedure errors
* Human Factor Error including fatigue
* Crash with any amount of damage beyond normal wear and tear (includes Prop Strike/Tipover and Hard Landings)
* Fuel/Energy Event
* Altitude Deviations
* Loss of data links
* Reputation conflict

***Accidents***

* Property damage of any type/cost
* Injury of any type

The submission of a report triggers a notification to the Aviation Safety Officer. The ASO has the discretion to trigger an investigation of the incident/accident by the internal safety committee (ISC), and based on their findings, recurrency training or disciplinary action may be taken against the pilot.

Additional reporting managed by the Aviation Safety Officer (or their designee) to the proper authorities and the program director is required for more serious incidents and accidents including:

* In-flight fire
* “Fly-away” event that result in the aircraft leaving the immediate flight operations area with no ability of the remote pilot to regain control of the aircraft
* Mid-air collision
* 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
* 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
* More than $500 (MK400,000) worth of damage on the ground, other than the aircraft

Company personnel will complete the Incident and Hazard Response Report (IHR) for each incident reported in a flight log. The IHR includes a summary of the documentation related to the incident or hazard (flight logbook, anonymous safety reports, etc.), an initial risk assessment, a likely root cause, and a recommended action or response. The risk assessment is based on the product of the severity score (1-10) and likelihood score (1-5) and is used to prioritize the analysis and response. Any risk score of 10 or higher should have an immediate response and no operations similar to the one the incident occurred during should be done until the response is determined. The response to incidents with lower scores can be deferred to be included as part of the next Internal Safety Review (ISR).

## Hazard Reporting

Company XXX documents all potential hazards to its operations. Potential hazards are first documented through the Operations Request Form (ORF). This form guides the operator(s) through identification, assessment, and mitigation of risks. The ORF is completed whenever new operation types are to begin (new sites, aircraft, mission profiles, or payloads). Hazards are also potentially reported through both the Tracking Flight Logbook or the Anonymous Safety Report. In these cases, the new hazard will be evaluated through the Incident and Hazard Response Report (IHR). In many instances, part of the recommended response in the IHR will include a revision of the ORF that would include the hazard.

## Open and Anonymous UAS Reporting System

The ADDA will provide both open and anonymous safety reporting features for all affiliated people (staff, students, guests, etc.) The purpose of these safety reporting features is the reporting of unsafe RPA operations free from the fear of repercussion or reprimand. All submissions are equally investigated, assessed, and addressed immediately upon receipt by the Safety Committee. These submissions are handled with the Anonymous Safety Report form (ASR). The Incident and Hazard Response Report (IHR) will be completed for each ASR submitted (may be combined with another IHR if they are based on the same event/concern).

## Safety Reviews

The administration will conduct a semi-annual review of all of its safety procedures, subsystems, form submissions, and relevant safety data. This review is intended to address any possible failings of the SMS in performing its duty. If failings are discovered, they will be addressed through updates and policy changes.

The RPA incident reporting system must also be tested at least once annually to ensure that it is working as intended. If a calendar year has not had an actual RPA incident reported, the staff will enact an incident reporting exercise.

# Safety Promotion

Company XXX is committed to promoting safety at all levels of operation, from the curriculum taught to our students, to the procedures incorporated into our flight missions. As such, proper training of students and staff and the proper spread of safety knowledge are key pillars of our culture of safety.

## 5.1 Training

Company XXX teaches the principles of RPA and RPA operations. Safety is a key component of this field and thus it is incorporated into our student curriculum and training. Our training ensures that pilots and staff are familiar with the procedures and documentation requirements outlined within the SMS. Safety is an element of all flight training lessons.

## Active Safety Communication

Proper safety communication is key to ensuring that proper dissemination of all safety procedures, requirements, and knowledge occurs. It is the responsibility of Company XXX to:

1. Ensure all staff, students, and guests are aware of the SMS in accordance with their active/inactive roles within the SMS.
2. Convey Safety Critical Information.
3. Explain why certain safety actions have been taken.
4. Explain updated or modified safety procedures, policies, equipment, forms, or documents.

These responsibilities can be accomplished through the proper dissemination of all safety material in a prompt and institutionalized manner. The SMS is made readily available to all affiliated people and is supplemented by Safety Processes and/or Procedures in other documents (such as the ADDA Flight Operations Manual (FOM)), Posters, Notices, and Bulletins. These supplementary methods of safety knowledge conveyance ensure that all affiliates are up-to-date on the most recent safety knowledge and ready to participate in our culture of safety.

# 6. Tracking: Document and Record Management

All aspects of perations are logged in its record management system. This system is used to store all policy and procedure documents, maintain logs of all operations (planning, flights, maintenance, etc.), and keep reports on all personnel and hardware. This system is based around Google Drive and an online/offline forms system called Formplus

## 6.1 Policy and Procedure Documents

All reference documents are located on Google Drive and will be accessible through shortcuts that are installed on field portable devices – usally laptops and tablets. Tables 3 and 4 summarize the documents that are available.

**Table 3. General list of documents**

|  |  |  |
| --- | --- | --- |
| **Name** | **Document ID** | **Description** |
| Safety Management System | XXX\_SMS | This document |
| Change Notices | YYY | Tracks the changes to all documents |
| Flight Operations Manual | ZZZ\_FOM | Guide that governs best practice for the ADDA and pilots |
| General Maintenance Manual | QQQ\_GMM | Maintenance procedures for RPA |
| Pilot’s Code of Conduct | UASPC | UAS Pilot’s Code of Conduct |
| Airman’s Information Manual | AIM | Pilot/Control glossary for communication |
| Flight Training Manual | FTM | Detailed schedule for flight days in ADDA course |
| Syllabus | Syllabus | ADDA Module 1 and 2 Syllabuses |

**Table 4. Aircraft specific documents**

|  |  |  |
| --- | --- | --- |
| **Name** | **Document ID** | **Description** |
| S-500 Aircraft Manual | Manual\_S500 | User’s manual for the S-500 |
| S-500 Standard Operating Procedure | SOPM\_S500 | Procedures for S-500 that builds off FOM |
| Bixler Aircraft Manual | Manual\_Bixler | User’s manual for the Bixler |
| Parrot Disco Aircraft Manual | Manual\_Disco | User’s manual for the Parrot Disco |
| DJI Enterprise Aircraft Manual | Manual\_Enterprise | User’s manual for the DJI Enterprise |

## 6.2 Operation Logs

Each operation related to flight and instruction is logged. This includes all flight planning, maintenance, flights, and student results. The forms used in trackingprovide a convenient portal to enter data – first during the flight planning phase, and then after the flight is complete when logs must be filled out. Pilots are provided shortcuts to links on the laptops and tablets used by staff and students. The shortcuts are sequentially accessed to record flight data. Table 5 summarizes the data entry forms.

**Table 5. Fillable forms in *tracking***

|  |  |  |
| --- | --- | --- |
| **Name** | **Document ID** | **Description** |
| Flight Log | Flight\_Log | Complete log of all information about a flight operation (crew info, hardware info, flight times, mission info). This includes any incident report if necessary. The flight log is also used to record the results of student performance in flight lessons. |
| Maintenance Log | Maintenance Log | Each maintenance operation is recorded. This includes all hardware AND software work done. |
| Battery Log | Battery\_Log | Each charging cycle of a battery is recorded. |
| Flight Request Form | FR01 | This form is used to get approval for a non-routine mission plan (new site, new aircraft, new payload or mission type). Form includes a detailed risk assessment and mitigation plan for the new operation. Should be submitted at least 48 hours before FP01 is filed. |
| Flight Planning Form | FP01 | Description of planned operations filed the day before flight. Flight ID is issued if flight plan is approved. |
| Aircraft Checklist - day before | AC01 | Preparations for flight the next day have been completed |
| Aircraft Checklist - day of | AC02 | Final aircraft preflight checklist |
| Aircraft Checklist - post-flight | AC03 | Post-flight checklist |
| Standard Briefing | SB01 | This checklist is used to conduct a briefing between the RPIC and the flight crew |
| Flight Control Log File Submission | LFS | This form is used to submit the flight controller log file whenever there is an incident report included in a flight log. |
| Anonymous Safety Report | ASR | This form is used to allow any personnel or bystander to report safety concerns. This form is confidential. A link to the form is posted at operation sites. All ASR are logged. |
| Pilot Credentialing System | PCS | The PCS is used to record information about pilot authorizations and related results. |

## 6.3 Reports

Reports consist of compiled data from the entries that are made through the forms listed above.

The reports are what would normally be reviewed instead of looking at the logs that are used to record information. Table 6 shows the reports generated from the operation logs.

**Table 6. Generated reports**

|  |  |  |
| --- | --- | --- |
| **Name** | **Document ID** | **Description** |
| Emergency Contact List | ECL | List of contact information for ADDA personnel and local emergency services |
| Pilot Logbook | Pilot\_Log | This report list all endorsements, assessments, flight hours, and the incident history for a pilot. |
| Aircraft Logbook | Aircraft\_Log | This report lists all flights and maintenance for a specific RPA. |
| Battery Logbook | Battery\_Log | This report lists all charge cycles and flights (with times) for a battery. |
| Ground Control Logbook | GC\_Log | This report tracks the hardware and software for each Ground Control Station (laptop, radios) |
| Flight Summary | FSR | This report consolidates the information from all of the forms (FR01, FP01, FP02, AC01, AC02, AC03, SB01, Flight Log, LFS, ASR) related to a single flight. This is commonly used as part of the review for any flight incident. |
| Incident Response Report | IR01 | This report summarizes the findings and actions from an incident. The flight summary is an appendix in this document. |
| Incident List | IL\_Year | This report lists all flight incidents from a calendar year. The list is based on incident reports included in Flight Logs and the Anonymous Safety Reports. |
| Pilot and Visual Observer List | PL01 | List of all pilots and visual observers with their endorsements |
| Aircraft List | AR01 | List of all aircraft with their ID  number and start of service date |
| Site List | S01 | List of all sites and related approvals/waivers |

**Appendix 1: UAS Operation Request and Initial Risk Assessment Form (ORF)**

**UAS Operation Request Form**

(Completed for all new operations in Flight Request Form or for routine operations in First Flight Planning Form)

|  |
| --- |
| **Submitter Information** |
| Name: E-mail: |
| Personnel category (staff, student, guest, etc.): |
| Date of Request: Proposed location: |
| **Event Information** |
| Aircraft make/model: Aircraft weight (pounds): |
| FAA registration number (if applicable): |
| Date of Event:  UAS Pilot in Command (name): |
| Name of Event: |
| Detailed Description of Event: |
| Date Sent to Risk Manager: |
| **Safety Committee** |
| Does a Safety Committee need to be convened? |
| **Aviation Safety Officer** |
| Comments:  Date: |
| By submitting this UAS Operation Request, the applicant acknowledges they have read, understand and agree to comply with all local air regulations and ADDA policies related to UAS operations. |

\*Requests must be submitted no later than two weeks before the event

# Appendix 2: Initial Risk Assessment

(Completed for all new operations in Flight Request Form)

|  |  |  |
| --- | --- | --- |
| **Initial Operations Risk Assessment Documentation** | | |
| Risk Assessment For: Organization & Location Today’s Date: | | |
| Reason for Risk Assessment (select all that apply): | | |
| ☐ New System Design | | ☐ Modification to an Existing Operation or Procedure |
| ☐ Change to Existing System Design | | ☐ Operational Environmental Change |
| ☐ New Operational Procedure | | ☐ Ineffective Risk Control |
| ☐ Other: | | |
| **Process/System Analysis** | | |
| Brief description of process of system to be assessed: | | |
| **Risk Analysis / Hazard Identification** | | |
|  | **Hazard** | **Potential Consequences** |
| **H1** |  |  |
| **H2** |  |  |
| **H3** |  |  |
| **H4** |  |  |
| **H5** |  |  |
| **(Initial) Risk Assessment** | | |
| Initial Risk Assessment Code: | | |
| **Proposed Risk Controls** | | |
| **H1** |  | |
| **H2** |  | |
| **H3** |  | |
| **H4** |  | |
| **H5** |  | |
| **(Final) Risk Assessment** | | |
| **Final Risk Assessment Code:**   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **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** | | | |

# Appendix 3: Risk Mitigation

(Done for all new operations in Flight Request Form)

|  |  |  |  |
| --- | --- | --- | --- |
| **System/Project:** | | | |
| **Responsible Manager:** | | | |
| **Hazard** | **Control** | **Substitute Risk** | **Residual Risk** |
| H1 |  |  |  |
| H2 |  |  |  |
| H3 |  |  |  |
| H4 |  |  |  |
| H5 |  |  |  |
| H6 |  |  |  |
| H7 |  |  |  |
| H8 |  |  |  |
| H9 |  |  |  |
| H10 |  |  |  |

# Appendix 4: UAS Incident/Accident Report

(Implemented in Flight Log)

|  |  |
| --- | --- |
| **Name:** | **Campus:** |
| **Email:** | **Department/Club:** |
| **Phone:** | **Aircraft Registration #:** |
| **Accident Date/Time:** | **Type of Aircraft:** |

**Location**- Provide address and description

|  |
| --- |
|  |

**The Incident/Accident Involved**- Check all that apply.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Injury |  | Prop Strike/Tipover |  | Loss of Data Downlink |
|  | Death |  | Foreign Object Damage |  | Airspace Violations |
|  | Property Damage |  | Wildlife |  | Procedure Error |
|  | Traffic Conflict in Flight |  | Near Midair Collision |  | Human Factor Error |
|  | Fatigue |  | Hard Landing |  | Other |
|  | Fuel/Energy Event |  | Loss of Command Uplink |  |  |
|  | Altitude Deviations |  | Loss of Telemetry Downlink |  |  |

**Classification –** Check all appropriate responses.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Damage to Aircraft (salvageable) |  | Injury to Person (no hospital) |  | Damage to Property (<$500) |
|  | Damage to Aircraft (hull loss) |  | Injury to Person (hospitalized) |  | Damage to Property (>$500) |
|  | Lost Aircraft (unrecoverable) |  | Death of Person |  |  |

**Weather**- Please describe the weather condition at the time of the accident

|  |
| --- |
|  |

**Description of Incident/Accident**

# 

# Appendix 5: Flight Risk Assessment Tool

(Implemented in Flight Request and Flight Planning Forms)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **1** | **2** | **3** | **4** | **5** | **Rating** |
| Operational Factors | Type of Operation | Normal | Demo | Training/ Recurrency | Initial Flight | Test Flight |  |
| Duration of Operation | < 1 hour | 1-2 hours | 2-4 hours | 4-6 hours | >6 hours |  |
| Simultaneous Operations | 1 UA |  | 2 UAs |  | >2 UAs |  |
| Crew Factors (any member) | Hours of Rest in Last 24 Hours | >8 | 7-8 | 5-6 | 3-5 | <3  (No Fly) |  |
| # of Flights in Type | >20 | 10-20 | 5-10 | 1-5 | 0 |  |
| # of Flights in Last 90 Days | >20 | 15-20 | 10-14 | 5-9 | <5 |  |
| Total UAS Hours | >20 | 10-20 | 5-10 | 1-5 | 0 |  |
| Environmental Factors | Current Wind or Max Gust | <8 kts | 9-12 kts | 13-15 kts | 16-18 kts | >18 kts  (No Fly) |  |
| Forecast Wind for Landing Time | <8 kts | 9-12 kts | 13-15 kts | 15-20 kts | >20 kts |  |
| Weather Forecast for Operation | Clear | Reducing Visibility | Precip |  | T-Storm |  |
| Surrounding Area | Open Field or *Indoor - no spectators* | Vegetation | Mountainous, Confined Outdoor, *Indoor with spectators* | Urban | Crowds/ Assemblies |  |
| Total Risk Score→ | | | | | | |  |
| No unusual hazards. Use normal flight planning and operating procedures. Requires PIC signoff. | | | | | | | 10-20 |
| Elevated risk. Conduct flight planning with extra care. Review personal minimums and operating procedures to ensure that all standards are being met. Consider alternatives to reduce risk. Requires ADDA Program Manager or Aviation Safety Officer signoff. | | | | | | | 21-35 |
| Elevated risk. Conduct flight planning with extra care. Review personal minimums and operating procedures to ensure that all standards are being met. Consider alternatives to reduce risk. Requires ADDA Program Manager and Aviation Safety Officer signoff and inform members of Safety Committee. | | | | | | | 21-30 (or any 2 single scores of 4) |