PDRA01 Operations Manual Template

CAP 2606

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You can copy and use this text but please ensure you always use the most up to date version and use it in context so as not to be misleading, and credit the CAA.

Revision History

|  |  |  |
| --- | --- | --- |
| Edition | Date | Summary |
| First Edition | April 5th 2024 | First Edition |
| First Edition - Amendment 1 | April 10th 2024 | Changes to clarify sections of the PDRA01 template and bring into alignment with CAP 722H Version 3. |
| First Edition - Amendment 2 | August 02nd 2024 | Split operations manual into volume 1, volume 2 and annexes to aid CAA oversight.  Added direct references to CAP 722 and the UAS Regulation in Publications.  Added clarity regarding required UAS operator information on the operations manual front cover and within 1.2 and 1.5.2.  Added reference to airspace managers in 2.16.7.  Added UAS operator ID field to Annex 1- Feasibility study form.  Added flyer ID information field to Annex 2 – Site survey form.  Expanded upon airspace considerations in Annex 3 - Pre-flight briefing form.  Added MAMC information to section 2.6 and contact details to section 2.6.1.5.  Added information to 2.6.2 regarding trespass and nuisance.  Added details to 2.11.2 regarding battery power contingency.  Added GNSS data fields in 3.2 UA performance characteristics and 3.7 Navigation.  Minor typos corrected. |

Enquiries regarding the content of this publication should be addressed to: uavenquires@caa.co.uk

The latest version of this document is available in electronic format at: [Drone and remote piloted aircraft publications | Civil Aviation Authority (caa.co.uk)](https://www.caa.co.uk/drones/updates-and-publications/drone-and-remote-piloted-aircraft-publications/#:~:text=The%20CAA%20publications%20library%20All%20our%20publications%20can,and%20Acceptable%20Means%20of%20Compliance%20and%20Guidance%20Material)

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About this PDRA01 operations manual template

The UAS Operators obligation to have an operations manual

All PDRA01 UAS operators must have an operations manual to comply with requirements in CAP 722H. The CAA have an oversight program to ensure compliance and can request to see the operations manual at any time.

This template should be used to assist UAS operators in creating an operations manual for PDRA01 operations as it meets an acceptable means of compliance that conforms to the UAS regulations.

How to use this document

Start at the beginning of the template and work your way through in a methodical manner. Delete any red guide text (see below) once each section has been completed.

Text colours

Black text

Black text in this document is *suggested* wording that is compliant. However, you may want to change or add to this if it is appropriate. If you do change any wording, it **must** be highlighted.

Red text

Red text provides advice for that section and should be deleted when the document is finished. **Bold red** text is very important information which **must** be followed. All red text **must** be deleted, once that section is complete.

Tables

There are a number of tables in this template that will require populating with information and editing to make them relevant to your UAS and operations.

Keep information relevant

Some tables will have areas that are not relevant to your UAS or type of operation, in which case, those parts of the tables can be deleted. For example, some tables request information for fixed wing UAS, but you may only operate multirotor UAS.

Some of the tables will ask for specification details of the UAS. The manufacturer should have a specification sheet that will give the most important information for this section. However, if information cannot be easily found for this table items in this section, put ‘unknown’.

This operations manual must reflect the activities and UAS used by the UAS operator. It may be necessary to add other rows, columns and/or new tables, depending upon the UAS system.

Formatting

The operations manual must be presented so it is easy to read. Where possible, try not to let tables become split across multiple pages.

Pictures and graphics

Pictures and graphics may be added to evidence systems and their components, and aid descriptions of processes and procedures.

Links to external websites and resources

External resources and websites are referenced throughout this operations manual template. Additional external links and references will also be required. It is the responsibility of the UAS operator to ensure any third parties are suitably validated and appropriate to their UAS operations.

Style

You may change fonts and colours within this document to reflect your corporate style. However, fonts must be easy to read and any such design must not detract from the purpose of the operations manual.

Editing this template

Most of this template simply requires reading and agreeing. If you wish to add to the content or change it in anyway then the following actions **must** be conducted:

* The heading or subheading **must** be highlighted
* Any text or tables **must** be highlighted
* Any images or graphics added **must** be accompanied with highlighted text explaining what the image or graphic represents.

**Do not** change the headings or restructure their order. However, additional sub-headings can be added, to reflect the UAS operations to be conducted by the UAS operator.

Adding to the Annexes

You may add additional documents to the annexes, such as:

* Remote pilot certificates
* PDRA01 operational authorisation (upon receipt)
* Insurance documents
* Other relevant documents

Operating outside the scope of the PDRA01

If you wish to operate outside the scope of a PDRA01 operational authorisation, as defined in [CAP 722H](https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=11731#:~:text=Description%3A%20CAP%20722H%20lays%20out%20the%20conditions%20and,Operators%20for%20use%20in%20the%20Specific%20category%20only.), you will need to submit an OSC (Operating Safety Case) based upon your own risk assessment, in order to obtain an operational authorisation. [CAP 722A](https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=9167#:~:text=Reference%3A%20CAP%20722A%20Title%3A%20Unmanned%20Aircraft%20System%20Operations,of%20the%20application%20process%20for%20an%20Operational%20Authorisation.) provides guidance and a template to assist UAS operators with OSC submissions.

PDRA01 operations manual

|  |  |
| --- | --- |
| **UAS operator ID** | Insert the UK CAA UAS operator ID that will be displayed on the Operational Authorisation |
| **Accountable manager’s name** | Insert name of the accountable manager |
| **Email** | Insert email for the accountable manager |
| **Phone number** | Insert phone number for the accountable manager |

|  |  |
| --- | --- |
| **Company/business/entity details** | |
| **Company/business/entity** | Insert name |
| **Company number** | Insert Companies House number if applicable |
| **Country of registration** | Insert country of registration for Companies House, if applicable |
| **Address** | Insert the contact address |

|  |  |  |  |
| --- | --- | --- | --- |
| **UAS systems** | | | |
| **Make** | **Model** | **Type** | **Quantity** |
| Insert make | Insert model | Multirotor, fixed wing, VTOL, DIAB, etc. | Insert quantity |
| Insert make | Insert model | Multirotor, fixed wing, VTOL, DIAB, etc. | Insert quantity |
| Insert make | Insert model | Multirotor, fixed wing, VTOL, DIAB, etc. | Insert quantity |

|  |  |
| --- | --- |
| **Operational authorisation details** | |
| OA name | Add the OA name once awarded |
| OA expiry date | Add your OA expiry date once awarded |

|  |  |
| --- | --- |
| **Document details** | |
| Version | 1.0 |
| Date of issue | Insert date |

**About this document**

This UAS PDRA01 operations manual includes organisation detail, safety information and operational procedures required to satisfy the Civil Aviation Authority’s PDRA01 operational authorisation in compliance with UK Reg (EU) No. 2019/947 and CAP 722H.

This operations manual may only be used by competent personnel in accordance with the accountable managers permission.

# Amendment record

|  |  |  |  |
| --- | --- | --- | --- |
| **Version** | **Date** | **Amended by** | **Details of change** |
| 1.0 | Day/month/year | Name of person | Name the sections changed and highlight what is different. |
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|  |  |  |  |
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|  |  |  |  |

Amendments to this document shall be authorised by the accountable manager. All changes shall be read by the remote pilots. Any changes that impact flight operations will be accompanied by additional training. Any recent changes to this document shall be highlighted.

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# Acronyms and abbreviations

Insert abbreviations into the table below that are used in this operations manual.

|  |  |
| --- | --- |
| **Abbreviation** | **Item** |
| AAIB | Air Accident Investigation Board |
| AIAA | Area of Intense Aerial Activity |
| AIRPROX Board | Air Proximity Board (UK) – (Air miss Investigation) |
| ALARP | As Low As Reasonably Practicable |
| AOO | Area Of Operation |
| AMC | Acceptable Means of Compliance |
| ANO | Air Navigation Order |
| ANSP | Air Navigation Service Provider |
| ATC | Air Traffic Control |
| ATS | Air Traffic Services |
| C2 | Command and Control |
| CAA | Civil Aviation Authority |
| CAP | Civil Aviation Publication |
| CG | Centre of Gravity |
| CTR | Control Traffic Region |
| CU | Command Unit |
| EC | Electronic Conspicuity |
| EMI | Electromagnetic Interference |
| ERA | Emergency Response Action |
| ERP | Emergency Response Plan |
| EU | European Union |
| FIS | Flight Information Service |
| FOD | Foreign Object Debris |
| FMS | Flight Management System |
| FRZ | Flight Restriction Zone |
| FW | Fixed Wing |
| GA | General Aviation |
| GNSS | Global Navigation Satellite System |
| HIRTA | High Intensity Radio Transmission Area |
| HMI | Human Machine Interface |
| IP | Ingress Protection |
| IR | UAS Implementing Regulation |
| Kp | Planetarische Kennziffer (planetary index scale used to measure space weather) |
| LFA | Low Flying Area |
| MAMC | Military Airspace Management Cell |
| mb/s | Megabits per second |
| METAR | Meteorological Terminal Aviation Report |
| MOR | Mandatory Occurrence Report |
| MORS | Mandatory Occurrence Reporting Scheme |
| MR | Multirotor |
| m/s | Metres per second |
| MTOM | Maximum Take-Off Mass |
| NAA | National Aviation Authority |
| NOTAM | Notice to Airmen |
| NSF | Non-Standard Flight |
| OM | Operations Manual |
| OS | Ordnance Survey |
| OSC | Operating Safety Case |
| OSD | On Screen Display |
| RLOS | Radio Line Of Sight |
| RP | Remote Pilot |
| RTH | Return to Home |
| s | Second |
| SKU | Stock Keeping Unit |
| TAF | Terminal Aerodrome Forecast |
| TOAL | Take-Off And Landing |
| TOLA | Take-Off and Landing Area |
| TTA | Tactical Training Area |
| UA | Unmanned Aircraft |
| UAS | Unmanned Aircraft System |
| UK | United Kingdom |
| VLOS | Visual Line Of Sight |
| VTOL | Vertical Take-Off and Landing |

# Terminology

Add any terminology that may assist with the reading or understanding of this operations manual.

For example:

**GO**  
Parameters are such that the UAS operation may proceed.

**NO GO**  
Parameters are such that the UAS operation may not proceed.

**Non-smart battery**A battery that does not contain any internal electronics to manage its status or record its charging history.

**Smart battery**A battery with internal electronics that typically assist efficient charging, can be set to automatically discharge the battery into storage state, manage its own temperature and automatically maintain battery charging logs.

**UAS operation**  
A flight made with an unmanned aircraft to conduct an aerial task.

# Publications

Publications that affect the proposed flight operations can be found in the CAA publications library:

[Drone and remote piloted aircraft publications | Civil Aviation Authority (caa.co.uk)](https://www.caa.co.uk/drones/updates-and-publications/drone-and-remote-piloted-aircraft-publications/#:~:text=The%20CAA%20publications%20library%20All%20our%20publications%20can,and%20Acceptable%20Means%20of%20Compliance%20and%20Guidance%20Material)

[CAP 722](https://www.caa.co.uk/our-work/publications/documents/content/cap-722/) contains guidance for UAS operations in the UK.

[CAP 722H](https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=11731#:~:text=Description%3A%20CAP%20722H%20lays%20out%20the%20conditions%20and,Operators%20for%20use%20in%20the%20Specific%20category%20only.) contains information specific to PDRA01 UAS operations.

[UAS Regulation](https://regulatorylibrary.caa.co.uk/2019-947/Content/UAS947_1.htm) contains the Consolidated Regulation, Acceptable Means of Compliance and Guidance Material to UK Regulation (EU) 2019/947 (as assimilated).

Volume 1

# Section 1 – The organisation

## 1.1 Introduction

Write a brief introduction here.

Include:

* What you want to do
* Why you want to do it
* Where the UAS operations will take place

## 1.2 Safety statement

The accountable manager must sign and date the safety statement. The accountable manager can be the same person as the UAS operator or in the case of a company/entity/business, a nominated member of personnel who holds the responsibility for RPAS operations.

The UAS operator shall ensure all UAS systems are safe to operate in the proposed environment and that all systems to be employed will be operated safely. The UAS operator shall ensure that the flight crew adhere to the processes and procedures contained within this operations manual and any CAA authorisation issued.

The UAS operator shall ensure that all flight operations comply with any applicable rules relating to it, in particular with regard to privacy, data protection, liability, insurance, security and environmental protection.

The UAS operator is committed ensure all flight operations are conducted safely and that persons and property shall not be endangered.

All operations must be carried out in accordance with the issued Operational Authorisation PDRA01 and abide by the requirements of the Air Navigation Order 2016 (as amended) and Assimilated Regulation (EU) 2019/947 (The UAS Implementing Regulation) and to its Acceptable Means of Compliance.

Insert the signature of the accountable manager here.

Name: Insert the name of the accountable manager here.

Position: Accountable manager

Date: Day/month/year

## 1.3 Safety policy

The UAS operator adopts best industry practice to ensure all flight operations are conducted as safely as possible. This is achieved by ensuring all hazards are identified, that they are reduced to as low as reasonably practicable and that the outcome shall be tolerable.

All the flight crew shall be trained to the required level of competence in order to conduct the UAS operations detailed in this operations manual.

Just culture is embraced to enable all flight crew to contribute towards the safety targets of the UAS operator.

### 1.3.1 Safety targets

The safety targets for the flight operations are:

* Mitigate all hazards so they are ALARP and tolerable
* Minimise the possibility of occurrences
* Zero expectation of injury to any person
* Encourage an honest and open flight safety reporting policy using ‘Just culture’.

Any person involved in flight operations can offer feedback to the accountable manager, either verbally or in writing, in order to continually improve the level of safety.

## 1.4 Insurance

Insurance **must** comply with regulation (EC) No 785/2004. The only exceptions are government departments who self-insure.

|  |  |
| --- | --- |
| **Insurance** details | |
| **Insurer** | Insert name |
| **Policy number** | Insert policy number |
| **Broker** | Insert broker |
| **Periodicity** | Annual, pay as you fly, time period, etc. |
| **Regulation (EC) No 785/2004 compliant?** | Yes/No. If no, give details. |

## 1.5 Nominated Personnel

### 1.5.1 Change Management

The PDRA01 operational authorisation is the responsibility of the accountable manager. Therefore, UAS flight operations in the Specific category must immediately cease and the CAA notified whenever any of the following occur:

* The accountable manager changes within the business/entity/organisation
* The principal place of business changes
* There is a change of ownership of the business/entity/organisation

The CAA will conduct an audit to decide if the changes can be conducted under the existing operational authorisation, or if a new application needs to be submitted.

### 1.5.2 Accountable manager

[UK Regulation (EU) 2019/947, Article 2, Definitions, (2)](https://regulatorylibrary.caa.co.uk/2019-947/Content/UAS947_1.htm) definition:

*Unmanned aircraft system operator (UAS operator) means any legal or natural person operating or intending to operate one or more UAS.*

The accountable manager can be the same person as the UAS operator or in the case of a company/entity/business, a nominated member of personnel who holds the responsibility for RPAS operations.

### 1.5.3 Remote pilot

[CAP 722D](https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=9802) definition of a remote pilot:

*A natural person responsible for safely conducting the flight of an unmanned aircraft by operating its flight controls, either manually or, when the unmanned aircraft flies automatically, by monitoring its course and remaining able to intervene and change the course at any time.*

Add any other roles that are used, such as chief pilot, safety manager, operations manager, etc.

## 1.6 Responsibilities and duties of the UAS operator, remote pilot and support personnel

### 1.6.1 UAS operator

The UAS operator is responsible for ensuring each remote pilot fulfil their competency requirements and responsibilities.

|  |  |
| --- | --- |
| **UAS Operator** | **Details** |
| **Regulation** | [UK Regulation (EU) 2019/947, UAS.SPEC.050 Responsibilities of the UAS operator](https://regulatorylibrary.caa.co.uk/2019-947-pdf/PDF.pdf) |
| **Responsibilities** | * Overall responsibility for establishing safety procedures and limitations adapted to the type of operation * Provide procedures to ensure all security requirements for the area of operation are completed by the flight crew * Ensure the UAS cannot be interfered with or accessed by unauthorised persons, either physically of virtually (cyber) * Ensure data is protected and handled responsibly, in particular to images that may capture the identity of uninvolved people * Provide guidelines for remote pilots to minimise nuisances, including noise and emissions to uninvolved people and animals * Ensure the correct and legal use of radio spectrums for command, control and communication * Ensure all remote pilots are suitably trained, qualified, competent and current * Ensure all remote pilots have read and understood the Operations Manual * Designate a suitably qualified remote pilot to each operation * Ensure geographical zones, such as FRZs, RPZs and restricted airspace are kept up to date * Ensure that all flight operations are conducted within the limitations of the UAS, environmental conditions, flight crew and Operational Authorisations * Keep up-to-date records for a minimum of 3 years, to include training logs of the flight crew, personnel in charge of duties, maintenance, flight planning, flight logs and occurrences * Ensure fatigue of the flight crew is minimised * Ensure the UAS is suitable for the proposed operation * Ensure the UAS is maintained in a suitable condition for safe operation * Provide procedures for maintenance, including time periods, training and identification of maintenance staff * Keep an up-to-date list of the personnel and their assigned duties. * Keep an up-to-date list of the remote pilot for each flight * Ensure the safety of the operation of high voltage storage devices * Ensure high voltage storage devices are clearly identified and marked with a suitable warning label to mitigate against injury to uninvolved people * Ensuring all flight activities are logged and held securely on an electronic record * Ensuring battery health and capacity is monitored * Provide processes and procedures to identify the operational volume, flight volume, contingency volume and emergency buffer for every flight location * Provide processes and procedures to ensure the UA does not leave the operational volume * Provide processes and procedures to describe each proposed area of operation utilising maps, diagrams, charts, photographs, as deemed necessary. * Development of processes and procedures to provide a brief description for every proposed operating area * Ensuring all occurrences are reported * Ensuring insurance is in place for every flight * Ensuing the persons and property are not endangered * Ensure a training log is utilised in order to evidence remote pilots training accomplishments. |

### 1.6.2 Remote pilot

Remote pilots operate the UAS through the use of flight controls.

|  |  |
| --- | --- |
| **Remote Pilot** | **Details** |
| **Regulation** | [UK Regulation (EU) 2019/947, UAS.SPEC.060 Responsibilities of the remote pilot](https://regulatorylibrary.caa.co.uk/2019-947-pdf/PDF.pdf) |
| **Responsibilities** | * Not be under the influence of psychoactive substances or alcohol * Be fit to fly * Be in possession of a UK GVC * Be in possession of a UK CAA Flyer ID * Carry evidence of their qualification and competency while operating the UAS * Be familiar with the manufacturers operating instructions * Obtain updated information regarding any geographical zones * Ensure that the operating environment is compatible with the authorised limitations and conditions stated in any UK CAA operational authorisation, PDRA, this operations manual and any UAS being operated * Ensure the UAS is in a safe condition to be flown * Ensure any remote identification is activated and up-to-date (when/if applicable) * Ensure information about the operation has been made available to the relevant air traffic service (ATS) units, other air users and relevant stakeholders, as required by the operational authorisation or by conditions designated in Article 15 of the Implementing Regulation * Comply with authorised limitations and conditions * Avoid risk of collision with any manned aircraft * Discontinue a flight if there is any risk of endangerment to other aircraft, people, animals, environment or property * Comply with the operational limitations in geographical zones designated in Article 15 of the Implementing Regulation * Comply with the operators procedures detailed within this operations manual * Must not fly close to or inside areas where an emergency response effort is occurring, unless permission has been given by the responsible emergency response services |

### 1.6.3 Visual observers

Airspace observers and unmanned aircraft observers are both types of visual observer who can support the remote pilot with the UAS operation. One person can conduct both roles, if deemed appropriately competent by the UAS operator.

|  |  |
| --- | --- |
| **Visual observer** | **Details** |
| **Responsibilities** | * Follow instructions from the remote pilot by performing unaided visual scanning of the airspace in which the unmanned aircraft is operating for any potential hazard in the air or on the ground. * Monitoring the flight path of the UAS to ensure there are no obstacles * Communication with the remote pilot with regards to airspace, hazards, obstacles and uninvolved people * Communication with uninvolved people * Understand how to recover the UAS safely to the ground in case of pilot incapacitation * Know what to do in other emergencies (cordon breach, air incursion, fire, etc) |

#### 1.6.3.1 Airspace observer

[UK Regulation (EU) 2019/947,Article 2, (25)](https://regulatorylibrary.caa.co.uk/2019-947/Content/UAS947_1.htm) definition:

*‘airspace observer’ means a person who assists the remote pilot by performing unaided visual scanning of the airspace in which the unmanned aircraft is operating for any* potential hazard in the air;

#### 1.6.3.2 Unmanned aircraft observer

[UK Regulation (EU) 2019/947,Article 2, (24)](https://regulatorylibrary.caa.co.uk/2019-947/Content/UAS947_1.htm) definition:

*‘Unmanned aircraft observer’ means a person, positioned alongside the remote pilot, who, by unaided visual observation of the unmanned aircraft, assists the remote pilot in keeping the unmanned aircraft in VLOS and safely conducting the flight;*

### 1.6.4 Additional personnel

Add additional support personnel details as required, or delete. Personnel may include a payload operator, safety marshal, etc.

#### 1.6.4.1 Safety marshal

|  |  |
| --- | --- |
| **Safety marshal** | **Details** |
| **Responsibilities** | Follow instructions from the remote pilot. Manage uninvolved people to keep ground safety cordons secure. |

Add other roles, as required.

## 1.7 Qualification, role training, currency and competency

Add, edit and/or delete to reflect your UAS operations.

A training log is utilised in order to evidence training and qualification accomplishments of the flight crew.

CAP 2606A is an Excel spreadsheet that has been provided as a template to fulfil the training log record keeping requirements of the UAS operator. The READ ME tab within the spreadsheet gives instructions and guidance.

If you are going to record the training and qualification accomplishments using a different method, you **must** describe it in this section.

### 1.7.1 UAS operator

|  |  |
| --- | --- |
| **UAS Operator** | **Qualification requirement** |
| **Regulatory requirement** | * Be over 18 years of age * Registered with the UK CAA as a UAS operator |
| **Compulsory reading** | * PDRA01 operations manual (this document) * [CAP 722H](https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=11731#:~:text=Description%3A%20CAP%20722H%20lays%20out%20the%20conditions%20and,Operators%20for%20use%20in%20the%20Specific%20category%20only.) * [UK Regulation (EU) 2019/947, UAS.SPEC.050](https://regulatorylibrary.caa.co.uk/2019-947/Content/UAS947_1.htm) * The UAS operator’s PDRA01 operational authorisation \* |

\* The UAS operator’s PDRA01 operational authorisation can only be read when it has been issued by the CAA.

### 1.7.2 Remote pilot

#### 1.7.2.1 Qualifications

|  |  |
| --- | --- |
| **Remote Pilot** | **Qualification requirement** |
| **Qualifications and certificates** | * UK CAA Flyer ID * UK CAA GVC for fixed wing * UK CAA GVC for multirotor |
| **Compulsory reading** | * UAS manufacturers user manual/s * Payload manufacturers user manual/s * Ancillary equipment manufacturers user manual/s * PDRA01 operations manual (this document) * [CAP 722H](https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=11731#:~:text=Description%3A%20CAP%20722H%20lays%20out%20the%20conditions%20and,Operators%20for%20use%20in%20the%20Specific%20category%20only.) * [UK Regulation (EU) 2019/947, UAS.SPEC.060](https://regulatorylibrary.caa.co.uk/2019-947/Content/UAS947_1.htm) * The UAS operator’s PDRA01 operational authorisation \* |
| **Training provided by UAS operator** | * UAS system training, either in-house, with the manufacturer or an RAE * Procedures for flight planning, flight logging and admin * Standard operating procedures * Emergency procedures * Occurrence reporting procedure |
| **Additional qualifications** | * Must be fit to operate * Insert details as required |

\* The UAS operator’s PDRA01 operational authorisation can only be read when it has been issued by the CAA.

#### 1.7.2.2 Currency

The remote pilot must remain current to be considered competent to conduct a UAS flight operation with a PDRA01 operational authorisation.

To be considered current a remote pilot must have completed the following:

* A minimum of 2 hours **must** be logged on fixed wing UAS in the last 3 months, for remote pilots who hold a fixed wing UK GVC
* A minimum of 2 hours **must** be logged on multirotor UAS in the last 3 months, for remote pilots who hold a multirotor UK GVC
* Remote pilots conducting test flights on novel UAS **must** conduct their currency flights on a similar UAS type
* All currency flights **should** be ‘live’ and not simulated
* All flights **must** be logged and conducted in accordance with the regulatory requirements

If the remote pilot’s currency lapses, they must complete the required time deficit. For example, if the remote pilot has only conducted 30 minutes of flying on a multirotor within the last 3 months, they must conduct a further 1.5 hours of practical flying in a safe environment, to regain currency.

All flights must be recorded in the remote pilot’s logbook to comply with [UK Regulation (EU) 2019/947, UAS.SPEC.090](https://regulatorylibrary.caa.co.uk/2019-947-pdf/PDF.pdf) and [UAS.SPEC.050, 1, (d)](https://regulatorylibrary.caa.co.uk/2019-947-pdf/PDF.pdf).

#### 1.7.2.3 Competence

The remote pilot is only considered to be competent when they can fulfil the following requirements:

* Has a current and in-date UK CAA GVC
* Has a current UK CAA Flyer ID
* Has completed and understood all of the compulsory reading
* Has completed training provided by the UAS operator
* Has obtained all additional qualifications required by the UAS operator
* Is current

### 1.7.3 Visual observers

An airspace observer or unmanned aircraft observer can be any competent person who has been briefed by the remote pilot on the following:

|  |  |
| --- | --- |
| **Visual observer** | **Qualification requirement** |
| **Qualification** | * Must be a suitably competent person * Must be sufficiently fit to assist the remote pilot * Must have been sufficiently briefed by the remote pilot as to their duties and/or trained in their responsibilities * Must be able to communicate with the remote pilot * Must stand next to the remote pilot |

### 1.7.4 Support personnel

Add additional support personnel details as required, or delete. Personnel may include a payload operator, airspace observer, safety marshal, etc.

#### 1.7.4.1 Safety marshal

|  |  |
| --- | --- |
| **Safety marshal** | **Qualification requirement** |
| **Qualification** | Must be a suitably competent person |

Add other roles, as required.

## 1.8 Crew health

The UAS operator has a duty of care to ensure the flight crew are fit for duty by ensuring sensible working hours and the provision of adequate rest periods to prevent fatigue.

The flight crew must ensure they are fit to take part in a UAS operation.

The mnemonic IMSAFE is used to check flight crew’s health.

|  |  |  |
| --- | --- | --- |
| **Item** | **Question** | **Required Response** |
| Illness | Do I have an illness or any symptoms? | No |
| Medication | Have I been taking drugs or medication which may affect my performance? | No |
| Stress | Am I under psychological pressure? | No |
| Alcohol | Have I been drinking within the past 12 hours? | No |
| Fatigue | Am I tired and not adequately rested? | No |
| Eating | Am I hungry or thirsty? | No |

If a ‘yes’ response is given to any of the above, a risk assessment shall be conducted by the remote pilot, in order to decide if the flight crew member is able to participate in the planned operation.

## 1.9 Security and privacy

The UAS operator shall ensure that the UAS is protected from the following:

### 1.9.1 Security

#### 1.9.1.1 Physical security

The UAS operator must protect the UAS from physical tampering by a third party. Therefore, only competent persons shall be authorised to handle the UAS.

#### 1.9.1.2 Cyber security

The UAS operator shall ensure the risk of cyber attack on the UAS is at an acceptably low level. Only competent persons shall be authorised to access the UAS, firmware, software and control frequencies.

### 1.9.2 Privacy

UAS flights will not be conducted if an uninvolved person’s right to privacy is likely to be breached. If the UAS is in flight, the remote pilot shall change the flight path or cancel the flight, before a breach of privacy occurs.

All data captured shall be handled and controlled in line with the [information commissioner’s office](https://www.gdpr-advisor.com/the-role-of-the-information-commissioners-office/).

# Section 2 – Flight operations

## 2.1 UAS operation locations

UAS operations shall be conducted in the following non-specific locations:

* Uncongested areas
* Congested areas

## 2.2 Type of operation

### 2.2.1 VLOS

[[UK Regulation (EU) 2019/947, Article 2, (7)](https://regulatorylibrary.caa.co.uk/2019-947-pdf/PDF.pdf)](https://regulatorylibrary.caa.co.uk/2019-947-pdf/PDF.pdf) definition of VLOS:

*‘Visual line of sight operation’ (VLOS) means a type of UAS operation in which, the remote pilot is able to maintain continuous unaided visual contact with the unmanned aircraft, allowing the remote pilot to control the flight path of the unmanned aircraft in relation to o other aircraft, people and obstacles for the purpose of avoiding collisions.’*

All UAS operations using a PDRA01 operational authorisation shall be within visual line of sight (VLOS) of the remote pilot and/or unmanned aircraft observer.

The following aids **must** not be used to aid VLOS:

**Electronic aids:**

* Telemetry
* Video feeds
* Electronic maps
* Any other electronic item

**Non electronic aids:**

* Binoculars
* Telescopes
* Any other similar item

The UAS orientation and attitude **must** be easily discernible to the remote pilot and/or unmanned aircraft observer at all times, unaided by any instrument.

The VLOS limit is dictated by many factors, including:

* The remote pilot’s or visual observer’s eyesight
* The size of the UAS
* Shape of the UAS
* The colour of the UAS
* Navigation lights
* Light levels
* Contrast of the UA with the background

The remote pilot shall maintain unaided VLOS at all times, unless they are looking at a screen for extended periods of time or wearing video goggles, in which case a competent unmanned aircraft observer **must** be used. The unmanned aircraft observer shall stand next to the remote pilot to monitor the ground and airspace for any hazards. If a hazard is identified, they **must** communicate any navigation actions to the remote pilot.

### 2.2.2 PDRA01 limitations

UAS operating limitations are contained within [CAP 722H, 2.1 UKPDRA01](https://www.caa.co.uk/our-work/publications/documents/content/cap-722h/).

UKPDRA01 enables the following operations:

* VLOS only
* Day and night operations (night operations are subject to additional requirements)
* The use of an observer who is stood next to the remote pilot is permitted if the remote pilot needs to look at a screen for extended periods of time or wear video goggles
* Maximum height not to exceed 120 metres or 400 feet above the surface
* Obstacles taller than 105m may be overflown by a maximum of 15m provided that:
  + The person in charge of the obstacle has requested the flight
  + The UAS must not be flown more than 50m horizontally from the obstruction
  + VLOS is maintained at all times
* UAS operation is permitted within 150 metres of any Residential, Commercial, Industrial or Recreational Area
* No flight within 30 metres distance of uninvolved people during take-off and landing
* No flight within 50 metres of any uninvolved person
* No flight over or within 50 metres horizontal distance of assemblies of persons
* No flight within FRZs or restricted airspace unless permitted has been granted by the responsible entity
* Dangerous goods may not be carried
* Dropping of articles is prohibited

### 2.2.3 Night operations

Night operations can only be conducted if the following requirements are fulfilled:

* A site survey **must** be completed during the day in order to identify and mitigate any hazards that may be unseen at night
* Flight plans **must** account for the fact that the VLOS distance at night may be considerably less than during the day
* The TOLA and any emergency landing areas **must** be illuminated for the duration of the flight
* Navigation lights **must** be used in order to indicate the relative path and orientation of the UAS to the flight crew
* Lights on the UAS **must** not emit glare to endanger other air users
* Lights on the UAS **must** not be fitted if they could be mistaken for an aeronautical ground light such as approach lighting near a runway
* A method of recording wind strength and direction **must** be available to determine the take-off and landing direction for fixed wing UAS

## 2.3 Multiple simultaneous operation of UAS

Multiple simultaneous operation of UAS by a single remote pilot is not permitted. Each remote pilot **must** only operate a single UAS at any one time.

## 2.4 Radio licencing requirements

### 2.4.1 Command and control

The UAS operator is responsible for ensuring the C2 and payload communication equipment complies with the Ofcom requirements, and any licences required are obtained.

### 2.4.2 Electronic conspicuity devices

The UAS operator is responsible for obtaining any licenses for EC devices and transponders or other aviation equipment that transmits on the aeronautical band.

### 2.4.3 Communication devices

The UAS operator is responsible for any Ofcom licences required for communication equipment, such as radios. If aviation radios are used, the radio operator requires a Flight Telephony Operators Licence.

## 2.5 Methods to determine the feasibility of the operation

A feasibility study shall initially be conducted as part of the flight planning to identify potential hazards in and around the AOO.

The feasibility study shall comprise of the following:

* Identification of the AOO, TOLAs, holding/loiter areas and emergency landing areas
* Identification of the landowner for TOAL and any permissions required
* Identification of the airspace, the likely amount of air traffic and any permissions required
* Identification of public access points
* On site hazards
* Offsite hazards

A feasibility form is used for this stage of flight planning. This is located in Annex 1.

Tools used to assess the feasibility of the operation include and is not limited to the following:

* Aviation charts
* [UAS restrictions map](https://nats-uk.ead-it.com/cms-nats/opencms/en/uas-restriction-zones/)
* [Non-Standard Flight (NSF) applications](https://nsf.nats.aero/drones-and-model-aircraft/)
* [NATS AIP](https://nats-uk.ead-it.com/cms-nats/opencms/en/Publications/AIP/)
* [Military AIP](https://www.aidu.mod.uk/aip/aipVolumes.html)
* Ordnance survey maps
* UAS flight planning apps
* Weather forecast apps

Insert any tools or resources into the table below that are used to assist this stage of flight planning.

|  |  |  |
| --- | --- | --- |
| **Flight planning tools** | | |
| **Website, app or tool** | **Details** | **Link** |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## 2.6 Pre-notification to third parties

Third parties shall be contacted for the following reasons:

* To ask for permission to enter specific parts and types of controlled airspace
* Out of courtesy, to inform them of the planned UAS operation

When required, the following third parties shall be contacted:

|  |  |  |
| --- | --- | --- |
| **Third party** | **When to be contacted** | **Reason** |
| Aerodrome | When the AOO is within a CTR, but outside the FRZ, at any time | Courtesy |
| Aerodrome manager | When the AOO is within a FRZ outside of ATC operating hours | To obtain permission |
| Aerodrome ATC/FIS | When the AOO is within a FRZ during ATC operating hours | To obtain permission |
| Danger Area, range control | When the AOO is within a Danger Area, at any time | To obtain permission |
| Landowner | Every time | To obtain permission for TOAL |
| Local authority | When the AOO is on public land | To obtain permission for TOAL |
| MAMC | When the AOO is within a LFA or TTA | To obtain permission |
| NOTAM owner for temporarily restricted airspace | When the AOO is within temporary restricted airspace and within the times indicated by the NOTAM | To obtain permission |
| Police | When the AOO is within, or close to, a congested area that could be deemed to be sensitive in nature (e.g., a school, hospital, prison, etc.), at any time | Courtesy |
| Prohibited Area, CAA Airspace Regulation Operations | When the AOO is within a Prohibited Area, at any time | To obtain permission |
| Prohibited place | When the AOO is within or within the vicinity of a prohibited place, as defined in the National Security Act 2023. | To obtain permission |
| Restricted Area, CAA Airspace Regulation Operations | When the AOO is within a Restricted Area, at any time | To obtain permission |
| Uninvolved people | When the AOO is close to uninvolved people | To inform of the operation |

In addition to the table above, local bye-laws must be adhered to. The UAS operator is responsible for ensuring that the required landowner and airspace permissions are always obtained.

### 2.6.1 Obtaining contact details for third parties managing airspace

Contact details for all managed airspace within the flyaway range of the UAS shall be gathered by the remote pilot during the flight planning. The flyaway range is calculated as the maximum distance the UAS can fly in a straight line with full batteries/full tank of fuel. This distance is often included in the manufacturer’s specification sheet for the UAS.

#### 2.6.1.1 Civilian operated aerodromes, heliports and space sites

##### 2.6.1.1.1 Civilian aerodromes

Contact information for civilian operated aerodromes can be found in the NATS AIP <https://nats-uk.ead-it.com/cms-nats/opencms/en/Publications/AIP/>:

|  |  |
| --- | --- |
| **Civilian aerodromes** | |
| 1 | [NATS AIP](https://nats-uk.ead-it.com/cms-nats/opencms/en/Publications/AIP/) |
| 2 | Part 3 |
| 3 | AD2 Aerodromes |
| 4 | Select the aerodrome from the list |
| 5 | AD2.2 Aerodrome Geographical and Administrative Data |

##### 2.6.1.1.2 Civilian heliports

Contact information for civilian operated heliports can be found in the NATS AIP:

|  |  |
| --- | --- |
| **Civilian heliports** | |
| 1 | [NATS AIP](https://nats-uk.ead-it.com/cms-nats/opencms/en/Publications/AIP/) |
| 2 | Part 3 |
| 3 | AD3 heliports |
| 4 | Select the heliport from the list |
| 5 | AD3.2 Aerodrome Geographical and Administrative Data |

##### 2.6.1.1.3 Space sites

There is currently no information on the NATS AIS for space sites. Details can instead be found on the [UAS Restrictions Zones](https://nats-uk.ead-it.com/cms-nats/opencms/en/uas-restriction-zones/) map.

#### 2.6.1.2 Government aerodromes and heliports

##### 2.6.1.2.1 Military aerodromes

Contact information for government operated aerodromes and heliports can be found in the UK Military AIP:

|  |  |
| --- | --- |
| **Military aerodromes** | |
| 1 | [UK Military AIP](https://www.aidu.mod.uk/aip/aipVolumes.html) |
| 2 | AD |
| 3 | AD2 Aerodromes |
| 4 | Select the aerodrome from the list |
| 5 | AD2.2 Aerodrome Geographical and Administrative Data |

##### 2.6.1.2.2 Military heliports

Contact information for government operated aerodromes and heliports can be found in the UK Military AIP:

|  |  |
| --- | --- |
| **Military heliports** | |
| 1 | [UK Military AIP](https://www.aidu.mod.uk/aip/aipVolumes.html) |
| 2 | AD |
| 3 | AD3 heliports |
| 4 | Select the heliport from the list |
| 5 | AD3.2 Aerodrome Geographical and Administrative Data |

#### 2.6.1.3 Restricted airspace

Restricted Airspace includes:

* Danger Areas
* Restricted Areas
* Prohibited Areas

Contact information for restricted airspace can be found in the NATS AIP:

|  |  |
| --- | --- |
| **Restricted airspace** | |
| 1 | [NATS AIP](https://nats-uk.ead-it.com/cms-nats/opencms/en/Publications/AIP/) |
| 2 | Part 2 En-route (ENR) |
| 3 | ENR 5 Navigation Warnings |
| 4 | ENR 5.1 Prohibited, restricted and danger areas |
| 5 | Search the alphanumerical list to find the ID number of the restricted airspace and the contact details within it |

#### 2.6.1.4 Temporarily restricted airspace

Edit the table below. Add additional rows, if/as required.

Contact details for temporarily restricted airspace can be found within NOTAM information.

NOTAMS **must** be checked by the remote pilot before flight operations commence.

|  |  |
| --- | --- |
| **NOTAMs** | |
| **Website** | Insert website name |
| **Weblink** | Insert web link |
| **Mobile app** | Insert app name |

#### 2.6.1.5 Military Airspace Management Cell

The Military Airspace Management Cell (MAMC) **must** be consulted before flying in any Low Flying Area (LFA) or Tactical Training Area TTA) to check for aircraft movements and usage.

Contact details for MAMC and low flying information resources can be found in the following table:

|  |  |
| --- | --- |
| **MAMC** | |
| **Low flying timetable** | <https://www.gov.uk/government/publications/operational-low-flying-training-timetable> |
| **Military low flying** | <https://www.gov.uk/guidance/military-low-flying> |
| **Email for MAMC** | [swk-mamclfcoord@mod.gov.uk](mailto:swk-mamclfcoord@mod.gov.uk) |

### 2.6.2 Obtaining contact details for landowners

The UAS operator **must** consider the need to obtain landowners permission before taking off and **must** avoid committing offenses, such as aggravated trespass or nuisance.

Private land may belong to an organisation or an individual.

Public land belongs to the local authority, so they shall be contacted in such an instance.

## 2.7 Communications

The UAS operator must develop a standard communication procedure for all flight operations.

### 2.7.1 Communication between the flight crew

#### 2.7.1.1 Remote pilot and flight crew

The remote pilot and support personnel, such as an unmanned aircraft observer and/or airspace observer shall be stood next to one another, so no communication equipment will be required.

#### 2.7.1.2 Support personnel

Safety marshals shall be used in situations where crowd control or monitoring of uninvolved people is required, in order to keep them safe.

If the distances involved do not permit unaided communication, whistles, radios or mobile phones shall be used (where appropriate). Whistle signals and other communication language shall be agreed beforehand during the pre-flight briefing. If a mobile phone is to be used, the signal shall be checked on a website and/or app as part of the flight planning.

Edit the table below. Add additional rows, if/as required.

|  |  |
| --- | --- |
| **Mobile phone signal resource** | |
| **Website** | Insert website name |
| **Weblink** | Insert web link |
| **Mobile app** | Insert app name |

#### 2.7.1.3 Communication language

Communication language used between crew members shall be clear and concise.

Specific communication language used is indicated in the table below:

|  |  |
| --- | --- |
| **Communication phrase** | **Meaning** |
| Insert phrase | Insert meaning |
| Insert phrase | Insert meaning |
| Insert phrase | Insert meaning |

Plain language shall be used in addition to the specific communication phrases detailed above.

### 2.7.2 Communication with ANSP, restricted airspace and temporarily restricted airspace managers

Communication shall be conducted via the following methods:

* In person
* Email
* Telephone
* NATS NSF portal

The procedure for seeking permission to operate within a FRZ or temporarily restricted airspace is detailed in the table below:

|  |  |
| --- | --- |
| **Procedure for obtaining permission for the use of managed airspace** | |
| 1 | RP to contact airspace manager with details of the flight plan, including place, date, time and altitude |
| 2 | Airspace manager to access the risk to other air traffic |
| 3 | Airspace manager to issue a GO/NO GO decision |
| 4 | If GO, a communication procedure for the UAS operation shall be agreed with the RP |
| 5 | If NO GO, a different time or day shall be found when it is possible for the UAS flight to be conducted |

Some aerodromes and restricted airspaces require initial contact to be made via a Non-Standard Flight (NSF) application:

[NSF | Non-Standard Flight applications (nats.aero)](https://nsf.nats.aero/)

Temporary restricted airspace managers contact details can be found within NOTAMs.

### 2.7.3 Communication with emergency services

Communication with emergency services shall be conducted via telephone:

* Non-emergency: 101
* Emergency: 999

Prenotification communications for the police may be conducted by telephone (101), on a web portal, via email or in person.

## 2.8 Assessment of environmental conditions

### 2.8.1 Atmospheric weather

The following weather conditions shall be checked before flight and monitored throughout the flight:

* Wind strength at the operating height
* Wind direction
* Urban effects (wind shear, vortices and turbulence)
* Precipitation
* Visibility

Consideration must be made to the wind strength at altitude which will be stronger than at ground level.

#### 2.8.1.2 Checking weather before a flight

Atmospheric weather can be checked before flight using online resources:

* TAF issued by a local aerodrome
* Insert details of weather forecast apps
* Insert details of weather assessment tools, such as an anemometer, windsock, compass, etc.

#### 2.8.1.3 Checking wind strength and direction on site

The remote pilot shall check the wind strength on site using one or more of the following methods:

* Checking the METAR from the local aerodrome
* Beaufort wind scale
* Vegetation motion
* Anemometer
* Windsock (this may be a piece of ribbon, hazard tape or similar)
* Feeling the wind

Wind direction can be checked by using a windsock in conjunction with a compass.

### 2.8.2 Space weather

Space weather is a global phenomena. A Kp index of 5 or more is classed as a solar storm. Solar storms can affect the safe operation of a UAS, due to the following:

* Degradation of GNSS accuracy
* Electromagnetic interference to compasses and/or other electronics
* Radio frequency interference to command, control and communication signals

A space weather prediction forecast must be consulted before UAS operations for possible adverse effects that may prevent the UAS flight from being conducted safely

Edit the table below. Add additional rows, if/as required

|  |  |
| --- | --- |
| **Space weather forecast resource** | |
| **Website** | Insert website name |
| **Weblink** | Insert web link |
| **Mobile app** | Insert app name |

The remote pilot must make a NO GO decision if the flight cannot be conducted safely.

### 2.8.3 Environmental conditions limitations

The environmental conditions must be suitable for the proposed UAS flight. The conditions must be within limitations of the following:

* All parts of the UAS system/s to be operated
* The flight crew
* No adverse space weather effects

The remote pilot **must not** fly the UAS if the weather is beyond limits for any of the above.

## 2.9 Site procedures

A site survey shall be conducted by the remote pilot to ensure the UAS flight operation is still feasible. The feasibility study form shall be consulted as part of the site survey process, to look for any unplanned hazards that may affect the operation.

If a night flight is planned, the site survey **must** be conducted during the daytime.

The remote pilot shall conduct a site survey that includes the following:

* Environmental conditions
* TOLA including alternatives
* Operating volume
* Contingency volume
* Sources of interference that may affect C2 and/or compass (i.e. ferrous metal structures, microwave dishes, etc)
* Holding/loiter areas
* Emergency landing areas
* Placement of cordons to protect uninvolved people
* Identification of onsite hazards
* Awareness of direction and distance of offsite hazards
* Risk assessment

The outcome of a site survey is to obtain a GO or NO GO decision.

A site survey form is used for this stage of flight planning. This can be found in Annex 2.

### 2.9.1 Site survey outcome - GO

If the remote pilot decides the site survey outcome is a GO, the operation can move onto the next stage.

### 2.9.2 Site survey outcome - NO GO

If the remote pilot decides the site survey outcome is a NO GO, the remote pilot needs to decide if there is anything that can be done to change the outcome.

This may mean waiting for a better weather window of opportunity, changing the time of day to when there are less uninvolved people around or changing the flight plan. An alternative operating site may be required in order to mitigate any hazards resulting in a NO GO decision.

If anything is changed, the site survey must be updated.

### 2.9.3 Pre-flight briefing

Once the site survey has been completed, the remote pilot shall give the flight crew a briefing before flight operations begin.

Subjects to be covered include and is not limited to the following:

* UAS operation details
* UAS system
* Environmental conditions
* Safety objectives
* Mission timings
* Roles and responsibilities of the flight crew
* Airspace
* Cordons including TOLA, AOO and emergency landing areas
* Communications
* Hazards
* Emergency procedures
* Permissions and notifications
* Flight crew health
* Questions

A pre-flight briefing form is supplied in Annex 3 to assist the remote pilot.

## 2.10 Cordon procedure

Cordons are established to protect uninvolved people from the UAS operation. The site survey should identify public access points that need to be constantly monitored throughout the operation.

Cordons are boundaries for the following:

* Ground and air hazards entering the area of operation
* The UA leaving the area of operation

### 2.10.1 Cordon types

There are two types of cordon that shall be used:

* **Hard cordon**

A hard cordon consists of a physical barrier. For example, this could be a fence, a hedge or barrier tape.

* **Soft cordon**

A soft cordon does not consist of a physical barrier, but is known to the flight crew. Strategically placed traffic cones, signs or ground stakes can be used if required where the public have access.

The cordon defines the operational volume and must maintain the following:

* **TOLA**

A minimum distance of 30 metres in all directions around the TOLA.

* **Uninvolved people**

A minimum distance of 50 metres from uninvolved people.

* **Assemblies of people**

A minimum horizontal distance of 50 metres from assemblies of people. UA flown more than 50 metres above the ground must follow the 1:1 rule (i.e. the horizontal distance must not be less than the height of the UA).

If a geo-fencing feature is available on the UAS, it must be set to the appropriate distance to keep the UA the required distance away from the assembly of people.

When the remote pilot is operating alone (with no unmanned aircraft observer), the aircraft must have an appropriately set minimum RTH battery level. Any automatic recovery system such as a return to home function, must not allow the UA to fly over or within 50m of an assembly of uninvolved people (or the appropriate 1:1 distance if operating above 50 metres).

* **Altitude**

Any minimum or maximum altitudes must be adhered to accordingly by the remote pilot.

* **Distance**

Any minimum or maximum distances must be adhered to accordingly by the remote pilot.

Geo-fencing features on the UAS should be used to set the boundaries (distance and altitude) for the flight volume. The cordon boundaries must be known to all members of the flight crew.

Where used, flight crew shall be used to assist the remote pilot in securing any cordons. Safety marshals shall be used where large volumes of uninvolved people may be present.

If the cordon is breached, the remote pilot shall be informed immediately, and emergency procedures followed. This will result in the UA being moved away from uninvolved people and placed in a safe holding area until the situation can be resolved. If the situation cannot be resolved, the remote pilot shall land the UA in a pre-identified emergency landing area.

Uninvolved people cannot be prevented from entering a public place or physically restrained, so the UAS operation must be planned around their possible presence.

### 2.10.2 Contingency volume

A contingency volume shall be used to ensure there is reaction time to prevent cordons from being breached, either by the UA, other aircraft or uninvolved people.

The contingency volume must be large enough to allow the UA to turn around whilst travelling with forward motion. Fixed wing UA require a larger contingency volume than multirotor UA, because unless they have VTOL capability, they cannot hover or travel in reverse.

The size and position of the contingency volume must be included as part of the flight planning for the feasibility study and site survey.

## 2.11 Pre-flight procedures: Assembly and function checks

### 2.11.1 Assembly

The UAS system shall be assembled and checked it is safe to be flown by the remote pilot. Materials to assist with this include the following:

* Manufacturers guidance
* The user manuals for the UAS, payload and ancillary equipment
* In-house procedures and checklists

Components are checked for wear damage or functionality as part of the assembly process. Any items that are damaged or not functioning correctly, that have the potential to affect the safety of the operation, shall be risk assessed by the remote pilot and replaced or repaired before moving to the next stage. Any such remedial actions shall be recorded in the maintenance log.

### 2.11.2 Refuelling

Insert any additional details regarding fuel below.

All fuel must be suitable for use.

**Liquid fuels must be:**

* Clean
* Uncontaminated
* Stable

**Electrical batteries must:**

* Be undamaged
* Have sufficient capacity for the intended flight, including a contingency for use in an emergency
* Have balanced cells

### 2.11.3 Pre-flight checklists

#### 2.11.3.1 Insert make and model of UAS

The pre-flight checklist must be created by referencing the manufacturer’s user manual to ensure the UAS is prepared in accordance with the manufacturer’s instructions, and is therefore safe to be flown. This ensures compliance with UK Regulation (EU) 2019/947, UAS.SPEC.050 Responsibilities of the UAS operator and UAS.SPEC.060 Responsibilities of the remote pilot.

Create a pre-flight checklist for every UAS system operated. UAS systems can share the same checklist if there is no discernible difference, however the checklist must clearly indicate which UAS the checklist represents. Ensure each checklist starts on a new page.

The example below is for a fictional multirotor UAS system. Ensure you replace this with your own checklist/s.

|  |  |  |  |
| --- | --- | --- | --- |
| **Pre-flight checklist for Insert name of UAS/s** | | | |
| **ID** | **Challenge** | **Action** | **Response** |
| 1 | Airframe/fuselage | Clean, dry and undamaged |  |
| 2 | Landing gear | Installed and lock securely into place |  |
| 3 | Rotor arms | Unfold and lock securely into place |  |
| 4 | Propellors | Check for damage, install securely onto motors |  |
| 5 | Payload media | Install |  |
| 6 | Payload | Install and lock securely into place. |  |
| 7 | UAS batteries | Check of damage or swelling, install securely |  |
| 8 | CU battery | Install battery |  |
| 9 | CU antenna | Unfold into the optimum position |  |
| 10 | CU | Switch on and wait for system to initialise |  |
| 11 | UAS | Switch on and wait for system to initialise |  |
| 12 | LED indicators | Normal |  |
| 13 | UAS battery status | Temperature, cell balance and enough power for operation plus contingency |  |
| 14 | Command unit battery status | Enough power for operation plus contingency |  |
| 15 | RTH height | Set according to the environment |  |
| 16 | Out of control/lost C2 action | RTH |  |
| 17 | Geo-fence | Set max distance and height |  |
| 18 | Home point | Select and check on map |  |
| 19 | Battery warnings | Set to 40% low and 30% critical |  |
| 20 | GNSS | Enough for operation |  |
| 21 | RC signal | Good/strong |  |
| 22 | Map | Check map, home point and UAS position |  |
| 23 | Geo-awareness data | Check for updates |  |
| 24 | Control stick mode | Select |  |
| 25 | Flight mode | Select |  |
| 26 | Payload | Check SD card capacity, picture and set parameters |  |
| 27 | Payload function | Function check and test record data |  |
| 28 | GO / NO GO | RP decision – Is the UAS system safe to be flown |  |

Repeat for each platform.

## 2.13 In-flight procedures

The checklists must be created for every stage of flight by referencing the manufacturer’s user manual to ensure the UAS is prepared in accordance with the manufacturer’s instructions, and is therefore safe to be flown. This ensures compliance with UK Regulation (EU) 2019/947, UAS.SPEC.050 Responsibilities of the UAS operator and UAS.SPEC.060 Responsibilities of the remote pilot.

Create checklists for every UAS system operated. UAS systems can share the same checklist if there is no discernible difference, however the checklist must clearly indicate which UAS the checklist represents. Ensure each checklist starts on a new page.

The examples shown in the subheading sections below is for a fictional multirotor UAS system. Ensure you replace these with your own checklists.

In-flight procedures are conducted using checklists and dynamic risk assessments. If a hazard or abnormality is identified during any stage of flight, the emergency checklists shall be followed.

### 2.13.1 Take-off checklist

The flight crew are responsible for assisting the remote pilot with the take-off checklist.

The remote pilot is responsible for dynamically risk assessing any hazards or abnormalities identified during this stage of flight and executing any required emergency actions.

#### 2.13.1.1 Insert make and model of UAS

|  |  |  |  |
| --- | --- | --- | --- |
| **Take-off checklist for Insert name of UAS/s** | | | |
| **ID** | **Challenge** | **Action** | **Response** |
| 1 | Precipitation | Within limitations |  |
| 2 | Wind | Strength and direction within limitations |  |
| 3 | Cordon | Secure |  |
| 4 | UAS status | LEDs normal, system ready to launch |  |
| 5 | Time | Note time |  |
| 6 | Communication | ‘Starting motors’ |  |
| 7 | Start motors | Check props stay on and rotor arms for excess wobble |  |
| 8 | Airspace | Check airspace is clear |  |
| 9 | Communication | ‘Taking off’ |  |
| 10 | Take-off | Enter hover at 3 metres |  |
| 11 | Hover | Check system stability and ensure no signs of EMI |  |
| 12 | Stick inputs | Forward, back, left right, yaw left, yaw right, down, up |  |
| 13 | RTH check | Engage RTH at a height of 10 metres |  |
| 14 | RTH cancel | Cancel RTH when the system starts to land |  |
| 15 | Cordons | Check secure |  |
| 16 | Airspace | Check airspace is clear |  |
| 17 | Start mission | Start mission |  |

Any items that are not functioning correctly must be rectified before progressing to the next stage. This may mean landing and restarting the pre-flight or take-off checklist after remedial action.

### 2.13.2 In-flight checklist

The in-flight checklist **must** be memorised by the remote pilot. However, flight crew are also responsible for assisting the remote pilot with this checklist and can prompt the remote pilot for a response, to ensure the safety of the UAS operation.

The remote pilot is responsible for dynamically risk assessing any hazards or abnormalities identified during this stage of flight and executing any required emergency actions.

#### 2.13.2.1 Insert make and model of UAS

|  |  |  |
| --- | --- | --- |
| **In-flight checklist for Insert name of UAS/s** | | |
| **ID** | **Item** | **Action** |
| 1 | Crew communication | Maintain |
| 2 | Uninvolved people and assemblies of people | Maintain minimum distance away |
| 3 | Cordon security | Monitor |
| 4 | Airspace | Monitor |
| 5 | Weather | Monitor |
| 6 | GNSS | Monitor |
| 7 | Batteries/fuel | Monitor |
| 8 | Time | Monitor |
| 9 | Telemetry | Monitor |
| 10 | LEDs | Monitor |

Any item that becomes a failure in flight must be rectified immediately. This may mean pausing the flight, putting the UAS into a hover or loiter position, returning to home or executing an emergency action.

### 2.13.3 Landing checklist

The landing checklist **must** be memorised by the remote pilot. However, flight crew are also responsible for assisting the remote pilot with this checklist and can prompt the remote pilot for a response, to ensure the safety of the UAS operation.

The remote pilot is responsible for dynamically risk assessing any hazards or abnormalities identified during this stage of flight and executing any required emergency actions.

#### 2.13.3.1 Insert make and model of UAS

|  |  |  |
| --- | --- | --- |
| **Landing checklist for Insert name of UAS/s** | | |
| **ID** | **Challenge** | **Action** |
| 1 | Communication | Communicate intention to land |
| 2 | Landing site | Communicate the selection to the flight crew |
| 3 | Landing gear | Check intact/down |
| 4 | Cordon | Secure |
| 5 | Flight mode | Select |
| 6 | Wind | Check strength and direction |
| 7 | Clearance | Check it is safe to land with the visual observer |
| 8 | Communication | ‘Landing’ |
| 9 | Land | Land |
| 10 | Communication | ‘SOD’ (safely on deck) |

Any item that becomes a failure in flight must be rectified immediately by using the emergency response plan. This may mean pausing the flight, putting the UAS into a hover or loiter position, landing at a predesignated emergency landing area or executing an emergency action.

### 2.13.4 Shut down checklist

The remote pilot is responsible for running the shut down checklist.

#### 2.13.4.1 Insert make and model of UAS

|  |  |  |  |
| --- | --- | --- | --- |
| **Shut down checklist for Insert name of UAS/s** | | | |
| **ID** | **Challenge** | **Action** | **Response** |
| 1 | Motors | Stop |  |
| 2 | Propellors | Check stationary |  |
| 3 | Time | Note time |  |
| 4 | Aircraft power | Switch off |  |
| 5 | Command unit | Switch off |  |
| 6 | Communication | ‘Aircraft safe’ |  |

## 2.14 Post-flight and between flight checks

### 2.14.1 Post-flight inspection

The UAS system shall be inspected by the remote pilot after every battery change for the following:

* **Loose or missing parts**

The aircraft shall be inspected for any loose or missing parts.

The remote pilot must risk assess the affect any loose of missing parts may have upon the safe operation of the system. If the outcome reveals a safety risk, the remote pilot must report the finding to UAS operator and an MOR submitted.

In this instance, the aircraft shall be grounded until remedial actions have been taken. Any repairs shall be recorded in the maintenance log and any modification recorded in the operations manual.

* **Damage**

The aircraft shall be inspected by the remote pilot for any damage.

The remote pilot must risk assess the affect any damage may have upon the safe operation of the system. If the outcome is that there is a safety risk, the remote pilot must report the finding to UAS operator and an MOR submitted.

In this instance, the aircraft shall be grounded until remedial actions have been taken. Any repairs shall be recorded in the maintenance log and any modification recorded in the operations manual.

* **Cleanliness**

Any dirt or grime shall be cleaned off the propellors, navigation sensors, payload sensors, LED lights and strobes.

* **Freedom from moisture**

The system shall be wiped down and left intact until it is fully dry to prevent unwanted moisture ingress.

### 2.14.2 Debrief

The remote pilot shall debrief the flight crew after the operation has been complete, or in between flights, if items have been identified that will benefit the safety and efficiency of the current operation.

The aim of the debrief is to allow all members of the flight crew to offer their feedback and analyse the operation to identify scope for improvement. The flight crew are encouraged to offer feedback as part of just culture.

A debrief form is included in Annex 4.

### 2.14.3 Flight logs

Flight logs must be kept by the following personnel:

* The UAS operator
* The remote pilot

As a minimum, flight log details must include:

* Date
* Location
* Task
* Flight crew
* UAS system
* Take-off time
* Landing time
* Time of each flight

Flights shall normally be logged during flight operations, or recorded after the flight by either filling the log in manually, or by downloading the flight logs.

UAS operator and remote pilot flight logs are provided in an Excel spreadsheet.

CAP 2606A and CAP 2606B are Excel spreadsheets that have been provided as templates to fulfil the record keeping requirements of the UAS operator and remote pilots. The READ ME tab within each spreadsheet gives instructions and guidance.

If you are going to record the flight logs using a different method, you **must** describe it in this section.

## 2.15 Flight Safety Program

The flight safety program shall be followed by the flight crew in the event of any hazard or abnormal situation affecting or having the potential to adversely affect the safety of the UAS flight operation.

The flight safety program consists of the following:

* Threat and error management
* Emergency response actions
* Emergency procedures

### 

### 2.15.1 Threat and error management

Emergency Response Actions (ERAs) form the basis of threat and error management for UAS flight operations.

ERAs ensure the remote pilot does not endanger any person or property with the UAS. In the event of an emergency, the ERA shall be initiated.

The goal of the ERA is to:

* Take control of the situation
* Prevent the situation from escalating (getting worse)
* Minimise the severity of any outcome
* Prioritise the safety of people, whether involved or not
* Bring the situation back to ‘condition normal’

The mnemonic ‘**SEA**’ forms the three parts of an ERA:

* **S - See**

Look at what is occurring or could occur

* **E - Evaluate**

Consider what needs to be done to prevent an undesirable outcome

* **A – Action**

Move the UAS away from the hazard to deconflict the risk, or in the event of loss of control, move people out of harms way

Details of ERAs:

* The remote pilot **must** move the UAS away from all hazards
* In the event of an unplanned controlled airspace incursion or excursion, the relevant ATC **must** be informed immediately
* In the event of injury to a person or persons, damage to property or fire, medical treatment **must** be prioritised and the relevant emergency service/s shall be informed immediately (999)
* In the event of an airprox, the Airprox Board **must** be notified with 7 days
* In the event of any occurrence, the remote pilot **must** complete an MOR and/or contact the AAIB within 72 hours

The ERA shall be activated:

* Any time an unmitigated hazard is identified with the UAS system on the ground with engine on or propellors turning
* Any time an unmitigated hazard is identified when the aircraft is in flight
* Any time an abnormal situation occurs
* Anytime there is risk of endangerment to people
* Anytime there is risk of endangerment to property
* Anytime there is risk of endangerment to the environment
* Anytime there is a potential for legal limitations to be broken, such as the minimum distance from uninvolved people

Some ERAs may result in the deliberate destruction of the UAS, by the remote pilot, in order to protect people and/or property (controlled flight into terrain).

### 2.15.2 Emergency procedure training

Training is conducted in-house in order to practice the use of ERAs and specific emergency procedures detailed in this operations manual.

These training flights shall be recorded in the training log.

## 2.16 Specific emergency procedures

Emergency procedures in red in the list below are UA specific and will need to be edited or deleted according to the UA operated.

Emergency procedures have been included for multirotor and fixed wing UAS. Edit, delete and add to this section as required. Ensure emergency procedures are relevant to the UAS system being operated.

The specific emergency procedure checklists detailed in this operations manual shall be memorised by the remote pilot.

* 2.16.1 Abnormal environmental conditions - Visibility
* 2.16.2 Abnormal environmental conditions - Wind
* 2.16.3 Air incursion
* 2.16.4 Air excursion
* 2.16.5 Control signal loss
* 2.16.6 Fire
* 2.16.7 Flyaway
* 2.16.8 GNSS signal loss
* 2.16.9 Ground incursion
* 2.16.10 Landing gear failure - Fixed wing
* 2.16.11 Landing gear failure - Multirotor
* 2.16.12 Loss of control
* 2.16.13 Power loss - CU
* 2.16.14 Power loss (partial)
* 2.16.15 Power loss (full)
* 2.16.16 Propulsion system loss (full or partial) - Fixed wing
* 2.16.17 Propulsion system loss (full) - Multirotor
* 2.16.18 Propulsion system loss (single motor) - Insert UAS make and model
* 2.16.19 Propulsion system loss (multiple motors) - Insert UAS make and model
* 2.16.20 Navigation light failure at night
* 2.16.21 Pilot incapacitation
* 2.16.22 Structural failure

### 2.16.1 Abnormal environmental conditions - Visibility

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

Visibility may be reduced due to low clouds, smoke, mist, fog or light levels.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Abnormal environmental conditions - Visibility** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘Bad vis’ | | | |
| 2 | Move UA closer to RP to ensure clear visibility | | | |
| 3 | Terminate flight operation is there is a risk of VLOS not being able to be maintained | | | |

### 2.16.2 Abnormal environmental conditions - Wind

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

Abnormal environmental conditions may occur when the UA is in flight. For example, when operating from a cliff top or in an urban environment. In such cases, wind can behave unpredictably due to wind shear.

If the UA is adversely affected by the wind, the remote pilot may be tempted to retrieve the UA as quickly as possible by flying the aircraft manually. However, this could result in battery failure, resulting in the total loss of power and propulsion. In this situation, the RTH failsafe must be activated to allow the FMS to automatically control the current draw required by the UA in order to minimise the risk of the emergency escalating.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Abnormal environmental conditions - Wind** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘Wind’ | | | |
| 2 | Pause the flight and hover (MR) or enter loiter mode (FW) | | | |
| 3 | Note wind direction and strength | | | |
| 4 | Try to regain control | | | |
| 5 | If control is not regained, engage RTH | | | |
| 6 | Identify landing site | | | |
| 7 | Immediately clear the area of people | | | |
| 8 | UAS will automatically land and shut the motors off | | | |

### 2.16.3 Air excursion

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

An air excursion is when the UA has left the operational volume. If the control of the UA has been lost, the emergency procedure for a flyaway must be followed.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Air excursion** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘All stop, all stop, all stop’ | | | |
| 2 | Pause the flight and hover (MR) or enter loiter mode (FW) | | | |
| 3 | Regain control | | | |
| 4 | Check airspace is clear | | | |
| 5 | Navigate the UA back into the operational volume | | | |
| 6 | Abort or continue with the mission as required | | | |

### 2.16.4 Air incursion

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

An air incursion is when an aircraft, bird or wind-blown rubbish has the potential to enter or enters the area of operation without adequate separation. If an air incursion occurs with another aircraft (either crewed or another UA), the incident shall be reported to the UK Airprox Board within 7 days.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Air incursion** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘Air incursion’ | | | |
| 2 | Assess the heading, speed and altitude of the incursion | | | |
| 3 | Assess the heading, speed and altitude of the UA | | | |
| 4 | Acquire orientation of the UA | | | |
| 5 | See and avoid the incursion by changing altitude and moving the UA at 90° to the incoming hazard’s flight path | | | |

### 2.16.5 Control signal loss

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

The UAS is programmed by the remote pilot during the pre-flight checks to ensure the RTH failsafe is automatically activated if the C2 link is lost.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Control signal loss** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘C2 lost’ | | | |
| 2 | Check antenna | | | |
| 3 | Try to regain control | | | |
| 4 | If control is not regained, RTH should automatically engage | | | |
| 5 | Identify landing site | | | |
| 6 | Immediately clear the area of people | | | |
| 7 | UA will automatically land and shut the motors off | | | |

If the C2 link does not re-establish and the UAS failsafe does not engage, the emergency procedure for a flyaway must be followed.

### 2.16.6 Fire

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

If the UA catches fire whilst in flight, the primary objectives must be to protect uninvolved people and to prevent the fire from spreading. Particular care must be taken when operating in rural areas with dry crops, such as wheat or barley.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Fire** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘Fire, fire, fire’ | | | |
| 2 | Identify a non-flammable area landing area | | | |
| 3 | Immediately clear the area of people | | | |
| 4 | Land as soon as possible | | | |
| 5 | Put out fire, if trained, equipped and safe to do so | | | |
| 6 | Call the emergency services if required | | | |

### 2.16.7 Flyaway

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

A flyaway occurs when the UA fails to respond to any navigation inputs due to a malfunction or C2 signal interference. A flyaway is normally linear (in a straight line), but it can also result in the UA changing direction and/or altitude.

The landing/crash site of the UA for a linear flyaway can be predicted using the equation below:

*Speed in knots x estimated remaining battery time in minutes x 30.8 = Distance in metres*

Flight logs, the map and video telemetry can all be used to assist with finding the crashed UA. It is essential that the command unit is left switched on to capture the flight log data.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Flyaway** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘Flyaway’ | | | |
| 2 | Note time | | | |
| 3 | Note heading | | | |
| 4 | Calculate remaining flight time | | | |
| 5 | Plot potential crash site using the equation above | | | |
| 6 | Leave the command unit on and monitor the telemetry | | | |
| 7 | Inform the appropriate ATC and/or other airspace managers in the direction of the flyaway | | | |
| 8 | Inform police | | | |
| 9 | Remain at the AOO until the UAS either returns due to the RTH failsafe activating, or runs out of fuel | | | |
| 10 | Find crash site using map built in command unit or obtain latitude and longitude from the command unit’s digital flight log | | | |

### 2.16.8 GNSS signal loss

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

If the GNSS signal is lost the UA will automatically enter altitude mode, which means it will hold its altitude but not its position. Telemetry position data will be lost. Navigation using waypoint modes and the RTH failsafe will not work.

The UA will drift with the wind and will need manual control inputs from the remote pilot to control its flight path.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **GNSS signal loss** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘GNSS lost’ | | | |
| 2 | Gain altitude, if required to avoid collision with obstacles | | | |
| 3 | Note wind direction and strength | | | |
| 4 | Obtain control of the UAS | | | |
| 5 | Identify landing site | | | |
| 6 | Immediately clear the area of people | | | |
| 7 | Land | | | |

### 2.16.9 Ground incursion

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

If an uninvolved person breaches the cordon around the area of operation, TOLA or emergency landing area, the minimum legal distances must be maintained by the remote pilot.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ground incursion** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘Cordon breach’ | | | |
| 2 | Move UAS to a holding area at a safe and legal distance away from the uninvolved person/s | | | |
| 3 | Clear area of uninvolved person/s, if possible | | | |
| 4 | Resume mission if the area of operation is cleared of uninvolved person/s  **or**  Land at alternative location if uninvolved person/s cannot be cleared | | | |

### 2.16.10 Landing gear failure – Fixed wing

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

If the landing gear fails, the UA can still be landed, but the location may need to change. The UA may need to be landed on a soft target with all gear up to minimise damage.

|  |  |  |  |
| --- | --- | --- | --- |
| **Landing gear failure – Fixed wing** | | **Any FW UAS** | **FW** |
| ID | Requirement | | |
| 1 | Communication ‘No landing gear’ | | |
| 2 | Identify landing site | | |
| 3 | Immediately clear the area of people | | |
| 4 | Point the payload gimbal up to protect any sensor lenses (if possible) | | |
| 5 | Land | | |
| 6 | Cut motors | | |

### 2.16.11 Landing gear failure - Multirotor

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

If the landing gear fails, the UA can still be landed, but the location may need to change. The UA may have to be landed on a soft target to minimise damage.

|  |  |  |  |
| --- | --- | --- | --- |
| **Landing gear failure - Multirotor** | | **Any MR UAS** | **MR** |
| ID | Requirement | | |
| 1 | Communication ‘Legs lost’ | | |
| 2 | Identify landing site | | |
| 3 | Immediately clear the area of people | | |
| 4 | Point the payload gimbal up to protect any sensor lenses (if possible) | | |
| 5 | Find or make a soft target to land on | | |
| 6 | Hover as low as possible over the soft target | | |
| 7 | Cut the motors | | |

### 2.16.12 Loss of control

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

A loss of control is declared if the UA fails to respond to navigation inputs due to a malfunction or C2 signal interference.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Loss of control** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘Loss of control’ | | | |
| 2 | Activate RTH failsafe | | | |
| 3 | **If** UA responds, clear area and let the failsafe automatically land the UA | | | |
| 4 | **If** the UA does not respond and the area is clear of uninvolved people, cut propulsion | | | |
| 5 | **If** the propulsion does not shut down, reboot the command unit | | | |
| 6 | **If** control cannot be regained, follow the emergency procedure for a flyaway | | | |

### 2.16.13 Power loss – Command unit

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

The UAS is programmed by the remote pilot during the pre-flight checks to ensure the RTH failsafe is automatically activated whenever the C2 link is lost, which may be due to command unit power failure.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Power loss – Command unit** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘Dead stick’ | | | |
| 2 | Wait for RTH to automatically engage | | | |
| 3 | Identify landing site | | | |
| 4 | Immediately clear the area of people | | | |
| 5 | UAS will automatically land and shut the motors off | | | |

### 2.16.14 Power loss - UA (partial)

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

If a partial loss of power is experienced, such as the failure of a battery on a UA that has more than one, the UA will continue to fly. However, it may not be able to fly against the wind, or as fast and should be landed as soon as possible. The remote pilot may have to make a controlled flight into terrain in order to protect uninvolved people.

If partial power is lost, the remote pilot may be tempted to retrieve the UA as quickly as possible by flying the aircraft manually. However, this could result in battery failure, resulting in the total loss of power and propulsion. In this situation, the RTH failsafe must be activated to allow the FMS to automatically control the current draw required by the UA in order to minimise the risk of the emergency escalating.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Power loss (partial)** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘Power failure’ | | | |
| 2 | Check power/fuel status | | | |
| 3 | **If** the area is clear of uninvolved people below the UAS, land immediately | | | |
| 4 | **If** the area below the UA is not clear, navigate the UA gently downwind to the next available area and land immediately. | | | |
| 5 | **If** the area below the UA is not clear and there are no suitable alternative landing sites down wind, activate the RTH failsafe. | | | |
| 6 | Immediately clear the area of people | | | |
| 7 | UA will automatically land and shut the motors off | | | |
| 8 | **If** the UA cannot make headway against the wind in RTH mode, identify a crash landing site down wind | | | |
| 9 | Immediately clear the area of people | | | |
| 10 | Make a controlled flight into terrain | | | |

### 2.16.15 Power loss – UA (full)

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

If a full loss of power occurs, the UA will no longer maintain lift as all propulsion will be lost along with any control, resulting in a crash landing. A multirotor will descend uncontrollably, whereas a fixed wing UA may continue to glide before impacting terrain.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Power loss (full)** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘Dead stick’ | | | |
| 2 | Identify the likely crash landing site | | | |
| 3 | Immediately clear the area of people | | | |
| 4 | If the UA catches fire upon impact, follow the relevant sections of the ‘fire’ emergency procedure | | | |

### 2.16.16 Propulsion system loss (total or partial) - Fixed wing

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

If propulsion is lost the UA will glide. There may be some remaining control that the remote pilot can use to navigate the UA to an emergency landing area. The remote pilot may have to deliberately fly the UA into a structure or the ground in order to protect uninvolved people.

|  |  |  |  |
| --- | --- | --- | --- |
| **Propulsion system loss** | | **Any FW UAS** | **FW** |
| ID | Requirement | | |
| 1 | Communication ‘Power lost’ | | |
| 2 | Use remaining flight control | | |
| 3 | Identify landing site | | |
| 4 | Immediately clear the area of people | | |
| 5 | Land | | |
| 6 | If the UA catches fire upon landing, follow the relevant sections of the ‘fire’ emergency procedure | | |

### 2.16.17 Propulsion system loss (single motor) - Multirotor

**This emergency procedure checklist is only for UAS that have single motor redundancy.** **Edit or delete, as appropriate.**

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

The insert make and model UA has a motor recovery mode, which will automatically engage should a single motor fail. The UA will recovery after a brief free fall of around xx metres and spin around its own axis.

The UA can then be navigated by the remote pilot using compass cardinal points.

* North = forward
* East = right
* South = backwards
* West = left

Landing is achieved by navigating the UA to an emergency landing zone and cutting the motors. This is best achieved over soft vegetation in order to minimise damage to the UA.

|  |  |  |  |
| --- | --- | --- | --- |
| **Propulsion system loss (single motor)** | | **Insert UAS make and model** | **MR** |
| ID | Requirement | | |
| 1 | Communication ‘Engine lost’ | | |
| 2 | Immediately gain altitude | | |
| 3 | Remote pilot to turn their body to face north to aid navigation | | |
| 4 | Identify landing site | | |
| 5 | Immediately clear the area of people | | |
| 6 | Hover as low as possible over the landing site | | |
| 7 | Cut motors | | |

### 2.16.18 Propulsion system loss (multiple motors) - Multirotor

**This emergency procedure checklist is only for UAS that have multiple motor redundancy. Edit or delete, as appropriate.**

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

The UA will continue to fly if it loses two motors that are opposite one another.

|  |  |  |  |
| --- | --- | --- | --- |
| **Propulsion system loss (multiple motors)** | | **Insert UAS make and model** | **MR** |
| ID | Requirement | | |
| 1 | Communication ‘Engines lost’ | | |
| 2 | Identify landing site | | |
| 3 | Immediately clear the area of people | | |
| 4 | Land | | |
| 5 | If area not clear, engage RTH | | |
| 6 | Immediately clear the area of people | | |
| 7 | Land | | |

### 2.16.19 Propulsion system loss (full) - Multirotor

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

If propulsion is lost the UA will fail to maintain lift and will descend in an uncontrolled manner.

|  |  |  |  |
| --- | --- | --- | --- |
| **Propulsion loss (full)** | | **Any MR UAS** | **MR** |
| ID | Requirement | | |
| 1 | Communication ‘Power lost’ | | |
| 2 | Identify landing site | | |
| 3 | Immediately clear the area of people | | |
| 4 | If the UA catches fire upon impact, follow the relevant sections of the ‘fire’ emergency procedure | | |

### 2.16.20 Navigation light failure at night

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

If navigation lights fail during flight at night VLOS shall be lost. There are several ways that the remote pilot can ascertain the approximate position of then UA. These include the following:

* Map feature on the command unit
* Onboard camera or payloads
* Strobes (if fitted and working)

If navigation lights are lost the remote pilot should immediately pause the flight by hovering (MR) or loitering (FW).

The altitude telemetry should be checked and if required, additional altitude given to prevent collision with any obstructions. The RTH failsafe should then be activated to retrieve the UAS to the landing zone. Flight crew should use torches to illuminate the aircraft. Reflective tape attached to the airframe will help make the UA visible in this situation.

Once illuminated, a steady and controlled landing should be made. This may mean deactivating the RTH and manually landing.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Navigation light failure at night** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘Nav lights dark’ | | | |
| 2 | Hover (MR) or loiter (FW) | | | |
| 3 | Check navigation lights are switched on | | | |
| 4 | Turn on any strobes or additional lighting | | | |
| 5 | Gain altitude, if required to avoid collision with obstacles | | | |
| 6 | Activate RTH failsafe | | | |
| 7 | Allow RTH failsafe to return UA to the landing site | | | |
| 8 | Illuminate with torches or other light sources | | | |
| 9 | Land | | | |

### 2.16.21 Pilot Incapacitation

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

If the remote pilot becomes incapacitated a member of the flight crew shall recover the UA by activating the RTH failsafe. All members of the flight crew are briefed how to increase altitude and activate the RTH button on the controller as part of the pre-flight brief.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Pilot incapacitation** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘Terminate mission’ | | | |
| 2 | Increase altitude if required | | | |
| 3 | Activate RTH failsafe | | | |
| 4 | Immediately clear the area of people | | | |
| 5 | UAS will automatically land and shut the motors off | | | |
| 6 | Seek medical assistance | | | |

### 2.16.22 Structural failure

This is an example, create your own, considering your UAS operation. Consider any instructions given by the UAS manufacturer in their user manual.

If the airframe fails due to component failure, bird strike or collision, the UA is likely to become uncontrollable and crash.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Structural failure** | | **Any UAS** | **MR** | **FW** |
| ID | Requirement | | | |
| 1 | Communication ‘Crash, crash, crash | | | |
| 2 | Identify landing site | | | |
| 3 | Immediately clear the area of people | | | |
| 4 | If the UA catches fire upon impact, follow the relevant sections of the ‘fire’ emergency procedure | | | |

## 2.17 Emergency Response Plan

The Emergency Response Plan (ERP) shall be used after an occurrence.

The priorities are:

1. Protect uninvolved people
2. Protect property
3. Gather evidence
4. Submit and occurrence report
5. Conduct an investigation
6. Deliver outcome actions to prevent a repeat occurrence

### 2.17.1 Reportable occurrences

The following occurrences shall be reported:

**Technical failure**

* Technical failure during transfer to/from launch control/mission control stations
* Functional failures
* Loss of C2 link
* Loss of navigation function
* Command unit configuration changes/errors
* Loss of communication between remote pilot stations
* Display failures
* Structural failures that resulted in control difficulties or loss of the aircraft
* Airspace infringement
* Any technical failure that resulted in injury to a third party

**Human factors**

* Human error during transfer to/from launch control/mission control stations
* Functional failures of the UAS which led to loss of situational awareness
* Mishandling by the pilot in command including mis-selection of flight parameters via the Command Unit (CU)
* Crew resource management failures / confusion
* Human errors
* Pilot incapacitation
* Any human error that resulted in injury to a third party

A full list of reportable occurrences can be found in UK Reg (EU) No 2015/1018 (the UK MOR Occurrences Regulation).

An occurrence/airprox reporting form is included in Annex 5.

### 2.17.2 Mandatory Occurrence Reporting Scheme (MORS)

All occurrences shall be reported as an MOR within 72 hours in accordance with UK Reg (EU) No 376/2014 (the UK Mandatory Occurrence Reporting Regulation).

MORs are submitted online via ECCAIRS2 web portal:

<https://aviationreporting.eu/>

Any serious accident or incident must also be reported to the Air Accident Investigation Branch:

Air Accidents Investigation Branch   
Farnborough House  
Berkshire Copse Road  
Aldershot   
HANTS   
GU11 2HH

24 hour accident/incident reporting line: +44 (0) 1252 512299

Administration and general enquiries Tel: +44 (0) 1252 510300

Fax: +44 (0) 1252 376999

E-mail: enquiries@aaib.gov.uk

### 2.17.3 Occurrence investigation

In the event of an occurrence the UAS operator shall be informed immediately. A full investigation shall be conducted to find out what occurred and why.

To aid the investigation, evidence shall be gathered in the form of:

* Photographs
* Witness statements
* Digital flight logs
* Onsite paperwork, including the risk assessment
* Weather conditions at the time

The remote pilot shall fill in an occurrence reporting form as part of the ERP to ensure all required evidence is collected.

### 2.17.4 Occurrence outcome actions

All flight crew will be debriefed about the occurrence to ascertain how and why it happened. The results of the investigation will form the basis of new procedures to prevent the same occurrence happening again. All flight crew will be informed of the investigation outcome and trained in any new procedures.

## 2.18 Airprox reporting

An airprox is defined as any situation where two aircraft become so close that it is considered to be dangerous. All airprox shall be reported to the UK Airprox Board with 7 days:

[Report an Airprox | UK Airprox Board](https://www.airproxboard.org.uk/report-an-airprox/)

Details to be gathered include the following:

* Date and time
* Location
* Airspace class/type
* Type of airspace (FRZ, restricted airspace, etc)
* Was a NOTAM issued?
* Description of all aircraft involved (UAS, helicopter, GA, etc)
* Identification of other aircraft (tail number, etc)
* Speed, heading and altitude of US
* Estimated speed, heading and altitude of other aircraft
* Flight activity being conducted
* Was the UAS operator/remote pilot in communication with the other aircraft?
* Who infringed on the airspace? (UA or other aircraft)
* Airprox details
* Weather conditions
* Visibility (mist, fog, sun, light levels)

An occurrence/airprox reporting form is included in Annex 5.

## 2.19 Maintenance

### 2.19.1 Maintenance procedure

The table below is for a fictional multirotor UAS system. Ensure you replace these with your own checklists. If you have multiple types of maintenance, ensure they are detailed in this section.

The UAS must be kept in a ‘safe to be flown’ condition. Scheduled maintenance shall be conducted in addition to the inspections conducted as part of the pre and post flight procedures.

Scheduled maintenance shall include checking the following items:

|  |  |
| --- | --- |
| **UAS 1** | **Details** |
| **UA** |  |
| Clean the UAS and payloads |  |
| Corrosion |  |
| Cracks or fractures |  |
| Loose or missing fixings |  |
| Joints, connections and locks |  |
| Security of removeable items |  |
| Cable wear |  |
| Motors |  |
| Propellor stress cracks and damage |  |
| Gimbal rubbers |  |
| Payload safety cables |  |
| Watertightness of seals |  |
| Check batteries are free from swelling and undamaged |  |
| Calibrate compass |  |
| Calibrate IMU |  |
| Antenna |  |
| GNSS receiver |  |
| Test navigation lights and strobes |  |
| Check firmware is up-to-date |  |
| **Command unit** |  |
| Clean the command unit |  |
| Corrosion |  |
| Cracks or fractures |  |
| Rubber seals |  |
| Cable ports |  |
| Calibrate sticks |  |
| Switches, dials, knobs, buttons, etc. |  |
| Firmware |  |
| Check geo-awareness is up-to-date |  |
| Check battery health |  |
| **Ancillary items** |  |
| Check the transport case sufficiently protects the UAS |  |

### 2.19.2 Maintenance schedule

All elements of the UAS shall be maintained in accordance with the manufacturers maintenance procedure. If none is provided by the manufacturer, the UAS operator shall determine the maintenance schedule.

|  |  |
| --- | --- |
| **UAS 1, 2, 3** | **Details** |
| **Make** | Insert details |
| **Model** | Insert details |
| **Maintenance schedule** | Monthly, 30 flying hours, etc. |

Repeat for each UAS, as required.

|  |  |
| --- | --- |
| **UAS 4** | **Details** |
| **Make** | Insert details |
| **Model** | Insert details |
| **Maintenance schedule** | Monthly, 30 flying hours, etc. |

### 2.19.3 Maintenance personnel

The following personnel have been authorised to conduct maintenance on the UAS:

|  |  |
| --- | --- |
| **All UAS** | **Details** |
| **In-house personnel** | |
| **Insert role (maintenance manager, RP, etc)** | Insert name, repeat as necessary |
| **External entities** | |
| **Manufacturer** | Insert details |
| **Dealerships** | Insert details |

Repeat for each UAS, as required.

### 2.19.4 Repairs

Repairs shall be conducted in accordance with the manufacturer’s instructions.

Replacement of user serviceable parts, such as propellors, can be conducted in-house.

Advanced repairs shall be conducted by the manufacturer or an authorised dealership.

The following personnel have been authorised to conduct repairs on the UAS:

|  |  |
| --- | --- |
| **All UAS** | **Details** |
| **In-house personnel** | |
| **Name** | Insert details, repeat as necessary |
| **External entities** | |
| **Manufacturer** | Insert details |
| **Dealerships** | Insert details |

Repeat for each UAS, as required.

After repairs have been conducted, the UAS shall be test flown in a safe environment to ensure the defect has been rectified.

### 2.19.5 Maintenance and repair log

All maintenance and repairs shall be recorded in a technical logbook and made available to the CAA upon request. Each UAS has its own technical logbook.

Maintenance and repairs logs are provided in an Excel spreadsheet.

CAP 2606A is an Excel spreadsheet that has been provided as a template to fulfil the maintenance and repair log record keeping requirements of the UAS operator. The READ ME tab within the spreadsheet gives instructions and guidance.

If you are going to record the maintenance and repairs using a different method, you **must** describe it in this section.

### 2.19.6 Storing lithium polymer batteries

Lithium polymer UAS batteries shall be put into storage state when not in use and stored in a suitable container. Battery logs shall be kept for batteries that do not have an internal logging mechanism (often found on smart batteries).

Procedure for putting non-smart batteries into storage state:

Describe the procedure for putting non-smart batteries into storage state according to the manufacturer’s instructions. Non-smart batteries will need to be put into storage state manually.

Procedure for putting smart batteries into storage state:

Describe the procedure for putting batteries into storage state according to the manufacturer’s instructions. Smart batteries may be able to be placed into storage state automatically.

### 2.19.7 Storage of UAS

The UAS shall be stored in a secure, dry location when not in use.

### 2.19.8 Use of third-party equipment

Third-party equipment shall only be used if:

* It is accompanied by the relevant maintenance logs
* The UAS operator deems the equipment safe to be used
* The remote pilot deems the equipment safe to be used
* The UAS displays the UAS operator ID

The equipment use must not exceed any stated maintenance schedules for either the UAS operator or the third-party owner.

Copies of the maintenance logs for third-party equipment must be kept by the UAS operator in accordance with 2.20 Logs and records.

## 2.20 Logs and records

Logs and records are required in order to comply with [UK Regulation (EU) 2019/947, SPEC.050(1)(g)](https://regulatorylibrary.caa.co.uk/2019-947-pdf/PDF.pdf).

Logs and records are contained within the UAS operator technical logbook.

Records shall be held for:

* UAS operations flight log
* Training of the flight crew personnel and maintenance staff
* Remote pilot qualifications
* UAS maintenance and repair
* Batteries
* Occurrence and airprox reports

Logs and records shall be held electronically or as a hard copy by the UAS operator for a minimum period of three years and shall be made available to the CAA any time they are requested.

UAS operator technical logbook is provided in an Excel spreadsheet.

CAP 2606A is an Excel spreadsheet that has been provided as a template to fulfil the record keeping requirements of the UAS operator. The READ ME tab within the spreadsheet gives instructions and guidance.

If you are going to record the maintenance and repairs using a different method, you **must** describe it in this section.

Volume 2

# Section 3 ­– UAS description

Only UA with a MTOM of less than 25kg can be operated with a PDRA01 operational authorisation. Details of compliant UA can be found in this section.

## 3.1 Details of UAS

Edit this table as required for each UAS operated. Delete any sections that are not appropriate to your UAS. Add other relevant information, if required.

|  |  |  |
| --- | --- | --- |
| **Description** | **UAS 1** | Insert a photo or image of each UAS, if desired |
| Make |  |
| Model |  |
| Type of aircraft | Fixed wing, multirotor or VTOL |
| Weblink to aircraft specification | Insert weblink |
| Mass | Empty mass | xxkg |
| Maximum Take-Off Mass (MTOM) | xxkg (This includes payloads and fuel) |
| Dimensions for fixed-wing | Wingspan |  |
| Fuselage length |  |
| Fuselage diameter |  |
| Dimensions for rotorcraft/multirotor | Length of aircraft body |  |
| Width of aircraft body |  |
| Height of aircraft body |  |
| Propellor dimensions |  |
| Propellor configuration | Quadcopter, octocopter, etc. |
| Centre of Gravity (CG) | |  |

## 3.2 UA performance characteristics

Edit this table as required for each UAS operated. Delete any sections that are not appropriate to your UAS. Add other relevant information, if required.

The flight envelope limitations for each UAS are detailed below.

|  |  |  |
| --- | --- | --- |
| **Description** | **UAS 1** | **UAS 2** |
| Maximum Take Off Mass / Flying Weight | kg | kg |
| Maximum airspeed | Knots or m/s | Knots or m/s |
| Minimum airspeed to maintain safe flight | Knots or m/s | Knots or m/s |
| Maximum bank angle | degrees | degrees |
| Normal/typical operating height range | AMSL | AMSL |
| Maximum flight time during normal operations | minutes | minutes |
| Maximum flight range during normal conditions | km | km |
| Glide distances | km | km |
| Maximum radio range of the C2 Link | km | km |
| Maximum operating height  (service ceiling) | Feet AMSL | Feet AMSL |
| Minimum number of satellites required for GNSS assisted flight |  |  |
| Any other relevant information |  |  |

## 3.3 UAS environmental limitations

Edit this table as required for each UAS operated. Delete any sections that are not appropriate to your UAS. Add other relevant information, if required.

The environmental limitations for each UAS are detailed below:

|  |  |  |
| --- | --- | --- |
| **Description** | **UAS 1** | **UAS 2** |
| Wind speed limits including gusts for take off and landing | Knots or m/s | Knots or m/s |
| Wind speed limits including gusts when cruising | Knots or m/s | Knots or m/s |
| IP rating | IPxx | IPxx |
| Precipitation limits | mm/hour | mm/hour |
| Maximum air temperature | °c | °c |
| Minimum air temperature | °c | °c |
| In-flight icing condition limits | Freezing temperatures, humidity, precipitation, airspeed, altitude, etc. | Freezing temperatures, humidity, precipitation, airspeed, altitude, etc. |
| Space weather limitation | Ensure no adverse effects | Ensure no adverse effects |

## 3.4 Fuel

Edit this table as required for each UAS operated. Delete any sections that are not appropriate to your UAS. Add other relevant information, if required.

|  |  |  |
| --- | --- | --- |
| **Description** | **UAS 1** | **UAS 2** |
| **Fuel** | | |
| Type | Electric (batteries), petrol, hydrogen gas, etc. | Electric (batteries), petrol, hydrogen gas, etc. |
| Quantity | Amount of fuel carried, number of batteries, etc. | Amount of fuel carried, number of batteries, etc. |
| Means of identifying the fuel | Label on the UA, etc. | Label on the UA, etc. |
| List of hazardous fuel substances carried by the UA and their characteristics | Flammable, corrosive, etc. | Flammable, corrosive, etc. |
| Fuel status indicators |  |  |
| Fuel alert messages |  |  |
| Any other relevant information |  |  |

The UAS operator **must** ensure all hazardous fuel types used by the UAS are clearly labelled on the UAS, storage containers and/or storage devices.

## 3.5 Batteries

Edit this table as required for each UAS operated. Delete any sections that are not appropriate to your UAS. Add other relevant information, if required.

Repeat as required for every battery type. Only insert details that can be found easily.

Create your own table for electrical generators that are used to power UAS ground equipment.

|  |  |  |
| --- | --- | --- |
| **Description** | **UAS 1** | **UAS 2** |
| **Batteries** | | |
| Type | Non-smart or smart | Non-smart or smart |
| Manufacturer |  |  |
| Manufacturer SKU code |  |  |
| Minimum quantity required for flight |  |  |
| Maximum quantity that can be used by the UAS for flight |  |  |
| Chemistry | LiPo, LiHV, Lion, etc. | LiPo, LiHV, Lion, etc. |
| Connector | Propriety, XT60, etc. | Propriety, XT60, etc. |
| Voltage | v | v |
| Wattage | watts | watts |
| mAh | mAh | mAh |
| Number of cells | XS | XS |
| C-rating - discharge | XC | XC |
| C-rating - burst | XC | XC |
| Battery arrangement | Series, parallel or series-parallel | Series, parallel or series-parallel |
| Physical restraint | Clips, straps, latches, etc. | Clips, straps, latches, etc. |
| Electrical loads |  |  |
| Any other relevant information |  |  |

The UAS operator **must** ensure all high-powered electrical storage devices used by the UAS are clearly labelled as an electrical hazard.

## 3.6 Engines and propellors

Edit this table as required for each UAS operated. Delete any sections that are not appropriate to your UAS. Add other relevant information, if required.

Only insert details that can be found easily.

|  |  |  |
| --- | --- | --- |
| **Description** | UAS 1 | UAS 2 |
| **Engines** | | |
| Type of engine | Electric, ICE, GTE, etc. | Electric, ICE, GTE, etc. |
| Quantity |  |  |
| Arrangement | Quadcopter, hexacopter, X8, etc. | Quadcopter, hexacopter, X8, etc. |
| Type of propulsion unit | Pusher or puller | Pusher or puller |
| Power output (Hp for ICE/GTE and Kv for electric motors) | XHp or XKv | XHp or XKv |
| Any other relevant information |  |  |
| **Propellors** | | |
| Type | Rigid or folding | Rigid or folding |
| Length of blade (tip to tip) |  |  |
| Number of blades per engine/motor |  |  |
| Build material | Carbon fibre, plastic, etc. | Carbon fibre, plastic, etc. |
| Propellor fixing mechanism | Quick release, bolt, etc. | Quick release, bolt, etc. |
| Any other relevant information |  |  |

## 3.7 Navigation

Edit this table as required for each UAS operated. Delete any sections that are not appropriate to your UAS. Add other relevant information, if required.

Only insert details that can be found easily.

|  |  |  |
| --- | --- | --- |
| **Description** | **UAS 1** | **UAS 2** |
| **Navigation** | | |
| Type | Optical, radar, etc. | Optical, radar, etc. |
| Quantity |  |  |
| Location | Omnidirectional, nose, rear, sides, up, down, port, starboard, etc. | Omnidirectional, nose, rear, sides, up, down, port, starboard, etc. |
| **GNSS** | | |
| GNSS constellations | GPS, GLONASS, Galileo, BeiDou, etc. | GPS, GLONASS, Galileo, BeiDou, etc. |
| Minimum quantity of satellites required |  |  |
| **Automatic flight controls** | | |
| Automatic flight control functions | Waypoint mode, etc. | Waypoint mode, etc. |
| Geo-awareness functions | Built-in map showing FRZs, restricted airspace, etc. | Built-in map showing FRZs, restricted airspace, etc. |
| Altitude geo-fencing | User settable maximum altitude | User settable maximum altitude |
| Horizontal distance geo-fencing | User settable maximum distance | User settable maximum distance |
| Any other relevant information |  |  |
| **Redundancy** | | |
| Backup Means of Navigation and Guidance | Satcom, LTE, etc. | Satcom, LTE, etc. |
| **Human machine interface (HMI)** | | |
| Information indicated to the remote pilot during normal operation | Map, icon of UAS showing position, altitude and attitude, etc. | Map, icon of UAS showing position, altitude and attitude, etc. |
| Alert messages indicated to the remote pilot when geo-fence limits are reached | ‘Maximum altitude limit reached’ warning, etc. | ‘Maximum altitude limit reached’ warning, etc. |

## 3.8 C2 link

Edit this table as required for each UAS operated. Delete any sections that are not appropriate to your UAS. Add other relevant information, if required.

Only insert details that can be found easily.

|  |  |  |
| --- | --- | --- |
| **Description** | **UAS 1** | **UAS 2** |
| **C2 link** | | |
| Range | km | km |
| Operating frequency used | GHz | GHz |
| Power level of transmitter/transceivers | dBm | dBm |
| Power level of modems | (if used) | (if used) |
| Latency | ms or s | ms or s |
| Any other relevant information |  |  |
| **Third party links** | | |
| Third party link service provider | Satcom, LTE, etc. | Satcom, LTE, etc. |
| Optimum data rate | mb/s | mb/s |
| Minimum data rate required | mb/s | mb/s |
| Latency | ms or s | ms or s |
| Any other relevant information |  |  |

## 3.9 Geo-awareness

Describe the process used to ensure the geo-awareness data on the UAS is kept up to date. An example is given below.

If geo-awareness is available for use on a UAS, the following procedures shall be followed:

* **Updates**The geo-awareness data is checked for updates on the UAS as part of the pre-flight checklist. If an update is available, it shall be downloaded and installed immediately.

However, if the update cannot be conducted at the flying location (maybe due to lack of mobile data signal), it shall be downloaded and installed at the next available opportunity before further flight operations are conducted.

* **Reliance**

Resources that give details of permanent and temporary flight restrictions shall be consulted as part of the pre-flight planning to ensure technical geo-awareness of the UAS is not relied upon.

* **Responsibility**The UAS operator and remote pilot both have a responsibility to ensure the UAS is not operated in airspace that has either temporary or permanent flight restrictions in place.

## 3.10 Modifications to the system

Modifications to the system are any modification that changes the appearance or operational characteristics of the UAS and its associated command units.

### 3.10.1 Insert title of modification

|  |  |  |
| --- | --- | --- |
| **Insert description** | **Details** | **Photo of modification** |
| **System** | Insert details | Insert photo of modification |
| **Make** | Insert details |
| **Model** | Insert details |
| **Modification** | Insert details |
| **Conducted by** | Insert entity |
| **Name of engineer** | Insert name |
| **Date of modification** | Insert details |
| **Purpose of modification** | Insert details |

Add additional modifications, as required.

Annexes

# Annex 1 - Feasibility study form

The form below is an example what may be used, or you can create your own.

|  |  |
| --- | --- |
| **Feasibility study** | |
| UAS operator ID | Insert the UAS operator ID |
| Feasibility study number | Insert number |
| Date of study | Insert date |
| Feasible? | Yes / No |
| **Client details** | |
| Name |  |
| Phone number |  |
| Email |  |
| Billing address |  |
| Operation address |  |
| what3words | Insert what 3 words if required |
| Task | Insert reason for UAS operation |
| Date of UAS operation |  |
| **UAS System most suitable for the operation** | |
| UAS |  |
| Payload |  |
| Other equipment |  |
| **Flight Crew required** | |
| Remote pilot |  |
| Visual observer |  |
| Payload operator |  |
| Other |  |
| **AOO** | |
| Take-off and landing |  |
| Alternative TOLA |  |
| Emergency landing area/s |  |
| Area of operation |  |
| Contingency volume |  |
| Holding/loiter area |  |
| Cordons required? |  |
| **Airspace** | |
| Class |  |
| Type | FRZ, Danger Area, Restricted Area, Prohibited Area, TDA, etc. |
| Name of nearest aerodrome |  |
| Contact details |  |
| Distance to nearest aerodrome | Xkm |
| Bearing to nearest aerodrome  (use compass cardinal points from the AOO) | N, NNE, NE, ENE, E, ESE, SE, SSE, S, etc. |
| Name of nearest aerodrome with ATC (if different from above) |  |
| Contact details |  |
| Distance to nearest aerodrome | Xkm |
| Bearing to nearest aerodrome  (if different from above) | N, NNE, NE, ENE, E, ESE, SE, SSE, S, etc. |
| Is a Non-Standard Flight authorisation required? | Yes / No |
| Are any NOTAMS published for this location? | Yes / No |
| If yes to above, give details that affect UAS operations. |  |
| Is a NOTAM required? | Yes / No |
| If yes to above, who is responsible for obtaining the NOTAM? |  |
| Details of other close by aerodromes, heliports, gliding sites or air user information |  |
| **Onsite and offsite hazards** | |
| FRZ | If yes, identify and insert contact details |
| Restricted airspace  (Danger Area, Restricted Area, Prohibited Area) | If yes, identify and insert contact details |
| Military low flying area | If yes, identify and insert contact details |
| HIRTA | If yes, identify and insert contact details |
| AIAA |  |
| Power station |  |
| Wind turbines |  |
| Heavy industry |  |
| Building site |  |
| Tall obstructions |  |
| National grid power lines |  |
| Overhead cables |  |
| Body of water |  |
| Tidal area |  |
| Sources of electromagnetic interference |  |
| Other |  |
| **Uninvolved people and assemblies of people** | |
| Footpaths |  |
| Bridleways |  |
| Pavements |  |
| Roads |  |
| Public car park |  |
| Canals |  |
| River |  |
| Estuary |  |
| Marina |  |
| Harbour |  |
| Beach |  |
| Common land |  |
| Recreation area (park, golf course, etc.) |  |
| Sporting ground |  |
| School |  |
| Hospital/medical centre |  |
| Other |  |
| **Permissions** | |
| Airspace | Insert details if required |
| Take-off and landing | Insert landowner details |
| Emergency landing area |  |
| **Weather forecast** | |
| Wind within limits? | Yes / No |
| Precipitation within limits? | Yes / No |
| Temperatures within limits? | Yes / No |
| Visibility within limits? | Yes / No |
| Space weather within limits? | Yes / No / Unknown at this time |
| **Welfare and amenities** | |
| Parking |  |
| Toilets |  |
| Electricity |  |
| Mobile phone signal |  |
| **Additional information** | |
|  | |

# Annex 2 - Site survey form

The form below is an example what may be used, or you can create your own.

|  |  |  |
| --- | --- | --- |
| **Site survey form** | | |
| Site survey number | Insert number | |
| Date of site survey | Insert date | |
| Time of site survey | Insert time | |
| GO / NO GO? | GO / NO GO | |
| **Client details** | | |
| Name | Insert details | |
| Phone number | Insert details | |
| Location | Insert details | |
| Task | Insert reason for UAS operation | |
| **UAS System used for the operation** | | |
| UAS | Insert details | |
| Payload | Insert details | |
| Other equipment | Insert details | |
| **Names of the flight crew** | **Name** | **Fit to fly** |
| Remote pilot | Insert details | Yes / No |
| Flyer ID | Insert details |
| Visual observer | Insert details | Yes / No |
| Payload operator | Insert details | Yes / No |
| Safety marshal | Insert details | Yes / No |
| Other |  |  |
| GO or NO GO? | GO / NO GO | |
| **Actual weather conditions** | | |
| Wind strength | knots | |
| Wind direction | N, NNE, NE, ENE, E, ESE, SE, SSE, S, etc. | |
| Urban effects (wind sheer, vortices, turbulence) | Insert details | |
| Precipitation | Insert actual measurement | |
| Temperature | Insert actual measurement | |
| Visibility | Insert actual measurement | |
| Space weather | Kp-index | |
| Are all conditions within limits? | Yes / No / Borderline | |
| GO or NO GO? | GO / NO GO | |
| **Airspace** | | |
| Have all notifications been issued? | Yes / No | |
| Have all permissions been obtained? | Yes / No | |
| Are any NOTAMS published for this location? | Yes / No | |
| If yes to above, give details that affect the UAS operation. |  | |
| Is the airspace clear? | Yes / No | |
| GO or NO GO? | GO / NO GO | |
| **TOLA landowner** |  | |
| Have all permissions been obtained? | Yes / No | |
| GO or NO GO? | GO / NO GO | |
| **Police** | | |
| Have the police been informed? | Yes, no, not required | |
| GO or NO GO? | GO / NO GO | |
| **Conformation on other permissions** | | |
| Local authority | Yes / No / Not applicable | |
| Filming licence | Yes / No / Not applicable | |
| Permit to work | Yes / No / Not applicable | |
| GO or NO GO? | GO / NO GO | |

|  |  |
| --- | --- |
| **On site hazards** | |
| Uninvolved people | Identify and risk assess |
| Assemblies of people | Identify and risk assess |
| Public access points | Identify and risk assess |
| Unanticipated hazards | Identify and risk assess |
| Obstructions | Identify and risk assess |
| VLOS limitations | Identify and risk assess |
| RLOS limitations | Identify and risk assess |
| Sources of electromagnetic interference | Identify and risk assess |
| Livestock | Identify and risk assess |
| Birds | Identify and risk assess |
| Additional risk assessment completed | Yes / No |
| GO or NO GO? | GO / NO GO |
| **Offsite hazards** | |
| Locations and distances identified | Give details / Not applicable |
| GO or NO GO? | GO / NO GO |
| **TOLAs including alternative landing area** | |
| Free of FOD | Yes / No |
| Free of obstructions | Yes / No |
| Airspace clear | Yes / No |
| Devoid of uninvolved people and assemblies | Yes / No |
| Cordons required | Yes / No, Insert details |
| GO or NO GO? | GO / NO GO |
| **Operational volume and contingency volume** | |
| Free of obstructions | Yes / No |
| Airspace clear | Yes / No |
| Devoid of uninvolved people and assemblies | Yes / No |
| Cordons required | Yes / No, Insert details |
| GO or NO GO? | GO / NO GO |
| **Holding/loiter areas** | |
| Free of obstructions | Yes / No |
| Airspace clear | Yes / No |
| Devoid of uninvolved people and assemblies | Yes / No |
| Cordons required | Yes / No, Insert details |
| GO or NO GO? | GO / NO GO |
| **Emergency landing area** | |
| Free of FOD | Yes / No |
| Free of obstructions | Yes / No |
| Airspace clear |  |
| Devoid of uninvolved people and assemblies | Yes / No |
| Cordons required | Yes / No, Insert details |
| GO or NO GO? | GO / NO GO |
| **Additional notes** | |
| Add notes, as required | |
| **Operation GO / NO GO decision** | |
| GO or NO GO? | GO / NO GO |

# Annex 3 - Pre-flight briefing form

The form below is an example what may be used, or you can create your own.

|  |  |
| --- | --- |
| **Pre-flight briefing form** | |
| **Operation details** | |
| Client |  |
| Task |  |
| **UAS system** | |
| UAS |  |
| Payload |  |
| Command unit |  |
| Other equipment |  |
| **Environmental conditions** | |
| Sunrise and sunset |  |
| METAR |  |
| TAF |  |
| Wind direction |  |
| Wind strength on the surface |  |
| Wind strength at operating altitude |  |
| Wind shear, vortices and turbulence |  |
| Precipitation |  |
| Temperature |  |
| Dew point |  |
| Cloud cover |  |
| Space weather |  |
| Tide times |  |

|  |  |  |
| --- | --- | --- |
| **Safety objectives** | | |
| Safe flight with no incidents |  | |
| **Mission timings** | | |
| Time of launch |  | |
| Time to be finished |  | |
| **Roles and responsibilities** | | |
| Visual observer |  | |
| Payload operator |  | |
| Safety marshal/s |  | |
| Other |  | |
| **Airspace** | | |
| Class |  | |
| Type |  | |
| NOTAMS |  | |
| Hazards |  | |
| Nearest aerodromes/heliports |  | |
| Nearest ATCs |  | |
| Other airspace considerations (Danger Area, Restricted Area, Prohibited Area, FRZs, etc.) |  | |
| ATC/airspace manager contact details within flyaway radius of the UAS |  | |
| **Cordons** | | |
| TOLA |  | |
| Identify operational volume |  | |
| Identify contingency volume |  | |
| Emergency landing areas |  | |
| Identify public access points |  | |
| Identify marshalling points |  | |
| **Communications** | | |
| Mobile phone signal | |  |
| Data signal | |  |
| Radios | |  |
| whistles | |  |
| Communication language | |  |
| **Hazards** | | |
| Risk assessment result | |  |
| Airspace hazards | |  |
| Ground hazards | |  |
| Areas to avoid | |  |
| **Emergency procedures** | | |
| Pilot incapacitation procedure | |  |
| Air incursion | |  |
| Ground incursion | |  |
| Fire | |  |
| Flyaway | |  |
| Abnormal weather | |  |
| **Permissions and notifications** | | |
| Landowner (local authority or private entity) | |  |
| Police | |  |
| Airspace managers (ATC, etc) | |  |
| **Flight crew health** | | |
| IMSAFE | |  |
| Fit to fly? | |  |
| **Questions** | | |
| Any questions? | |  |

# Annex 4 - Debriefing form

The form below is an example what may be used, or you can create your own.

|  |  |
| --- | --- |
| **Debriefing form** | |
| Weather | Any issues? |
| Mission timings | On time? |
| Objectives | Achieved? |
| Safe flight | Achieved? |
| Cordon | Kept secure? |
| Airspace | Any incursions? |
| Overview of phases of the operation | Detail |
| Communications | Clear, concise, on time? |
| Identify what went well | Detail |
| Identify what could be improved | Detail |
| Questions | Ask |

# Annex 5 - Occurrence and airprox reporting form

The form below is an example what may be used, or you can create your own.

|  |  |  |  |
| --- | --- | --- | --- |
| **Occurrence form** | | | |
| **Reference** |  | | |
| **Date** |  | **Time** |  |
| **what3words** |  | **Airspace class** |  |
| **NOTAMs** |  | **Airspace type** |  |
| **Incident type** | Occurrence - Incident | Occurrence - Accident | Airprox |
| **Causal factor** | Technical failure | Human factor | Other |
| **UA category** |  | **UA type** |  |
| **UA serial number** |  | **MTOM** |  |
| **Remote pilot** |  | | |
| **Flight crew** |  | | |
| **Wind direction** |  | **Wind strength** |  |
| **Gusts** |  | **Precipitation** |  |
| **Cloud cover** |  | **Visibility** |  |
| **Air temperature** |  | **Kp-Index** |  |
| **Details of occurrence/airprox** | | | |
| **Witness details** |  | | |
| **Photos/video** | Have photos or video be taken to aid any investigation? | | |
| **General notes** |  | | |

|  |
| --- |
| **Diagram of occurrence/airprox** |

After an occurrence the remote pilot **must** complete the following:

* Follow the emergency response plan in the UAS operators operations manual
* Report to the UAS operator as soon as possible

**Incidents and accidents**

* File a mandatory occurrence report within 72 hours on ECCAIRS2 <https://e2.aviationreporting.eu/reporting>

**Report an accident or serious incident**

* Air Accidents Investigation Branch
* <https://www.gov.uk/government/organisations/air-accidents-investigation-branch>
* Telephone - 24 hours reporting 01252 512299
* [enquiries@aaib.gov.uk](mailto:enquiries@aaib.gov.uk)
* General enquiries: 01252 510300

**Airprox**

* File an airprox within 7 days   
  <https://www.airproxboard.org.uk/report-an-airprox/>

# Annex 6 - Other documents

You may add other documents into the annexes.

Documents you may wish to add may include:

* Insurance document
* PDRA01 operational authorisation
* Remote pilot Flyer ID certificates
* Remote pilot UK GVC certificates