Pioneering the next steps
in Drone Deployment

DRONE PORT MONTROSE PROJECT

DPM BVLOS TRIALS AREA MANUAL

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Revision Register

Rev No	Description of changes	Author	Date
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This document is controlled by Drone Port Montrose (DPM). The initial release version and any subsequent revision will be subject to the approval of DPM. Amendments to this document will be recorded in the Revision Register. For reference, a copy of this version and all superseded versions will be stored on a secure server. If this document is updated following meetings with the Civil Aviation Authority (CAA) or for any other reason, DPM will publish a new version for relevant stakeholders to view. This is to enable stakeholders to refer to the correct version if it needs to publish a determination of whether an airspace change is a relevant option to investigate.

Referenced Documents

Document	Version	Version & Date	Source
ANO 2016	The Air Navigation Order (ANO) 2016 and Regulations	Version 5.6 - 21 March 2019	CAA
CAP 1616	Airspace Change – Guidance on the regulatory process for changing the notified airspace design and planning and planned and permanent redistribution of air traffic, and on providing airspace information	Version 3.0 - 22 Jan 2020	CAA
CAP 722	Unmanned Aircraft System Operations in UK Airspace – Guidance	Version 7.3 - 4 Sep 2019	CAA
CAP 1496	Aviation Safety Reporting Portal UK user	April 2018	CAA
Regulation (EU) No 996/2010	The Investigation And Prevention Of Accidents And Incidents In Civil Aviation	Version L 295/35 - 29 Oct 2010	EASA
Regulation (EU) No 376/20165	The Reporting, Analysis And Follow-Up Of Occurrences In Civil Aviation	Version L 122/18 – 27 May	EASA

Contents

1. DELIVERING SAFE OPERATIONS

1.1. INTRODUCTION

DPM adopts best industry practice to ensure that all flight operations using UASs are carried out as safely as possible. This document addresses DPM operations in the United Kingdom and overseas. In the UK, the National Aviation Authority (NAA) is the Civil Aviation Authority (CAA).

It is the goal of DPM to oversee the trials and operation of clients UASs in a manner which avoids harm, injury or damage to any persons or property. The client's Remote Pilot (RP) will comply with all safety requirements and limitations of the Permission for clients Operations issued by the UK CAA to DPM.

DPM is committed to maintaining the highest standards of UAS flight safety and aims to minimise harm to any persons of property by confirming that thorough risk assessment and crew training have been conducted and ensuring that UAS systems are in operational condition through regular inspection and maintenance programmes.

DPM is committed to providing a safe environment in which its clients can conduct UAS operations safely and impose no greater risk to manned aviation than exists at present.

Drone Port Montrose's Safety Statement

As a fundamental principle of its approach to safety, Drone Port Montrose will continually embrace a culture of openness and willingness to continually adapt developing safety management systems, thus demonstrating procedural excellence and transparency to the Regulator

Drone Port Montrose's Operating Principles

Safety First
Procedural Excellence
Positive Contribution to all Stakeholders

Drone Port Montrose's Operating Philosophy

Demonstrable Competence
Iterative Development
Empowerment of All Stakeholders

1.2. SAFETY POLICY

Drone Port Montrose's Safety Policy is detailed in *Appendix 26 – Safety Policy*

The policy is displayed in prominent locations at Drone Port Montrose and is provided to Clients by DPM as part of the planning phase for their Trial Programme.

DPM shall aim to have zero accidents and will work towards meeting this target at every opportunity. Whilst we shall strive to meet this target, DPM staff and clients must consider that all risks are mitigated to a level deemed ALARP whilst ensuring that the appropriate procedures are in place to guarantee that should an incident or accident occur an Emergency

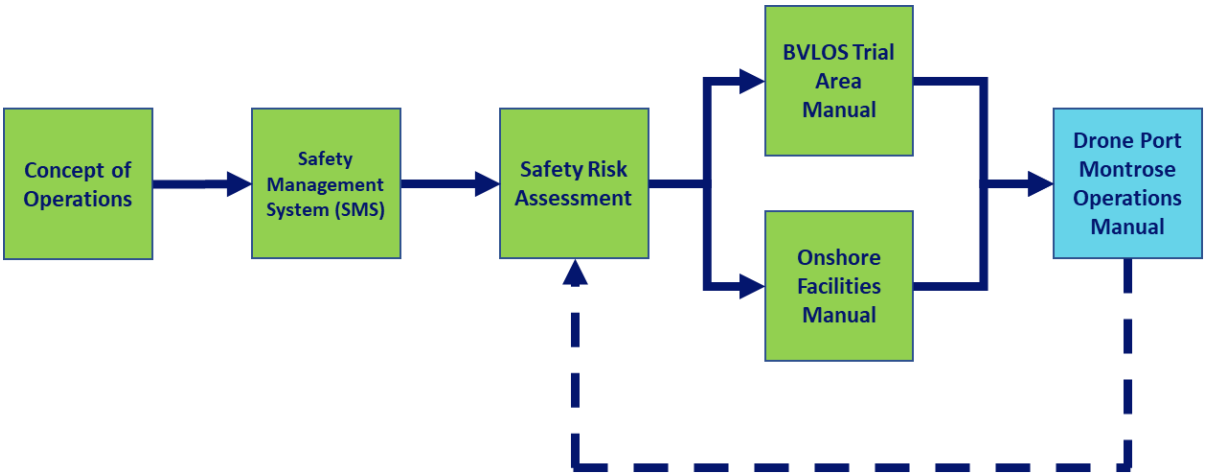
Response Procedure (ERP) procedure (*Appendix 8*) can be implemented quickly and effectively.

DPM monitors its safety performance quantitively using a number of Key Performance Indicators (KPI). They can be found in *Appendix 27 – Safety Performance Reporting*

1.3. DRONE PORT MONTROSE OPERATIONS MANUAL

Whilst being five separate documents, they are maintained in a single location to ensure all operational requirements can be available and accessible simply, quickly and without confusion.

- Detailed information providing rules, guidance and constraints for the safe use of the airspace associated with DPM. Its contents are the product of the analysis of the Safety Risk Assessment.
- This document will be provided to the CAA and provide the basis for drone operations insurance.



A schematic detailing process followed to create Drone Port Montrose's Operations Manual (solid arrows) and the ongoing review cycle (dashed arrow)

The Operations Manual for DPM has not been compiled in isolation. It is a document which reflects not just the technical issues identified by project to establish the facilities but also the knowledge and concerns of a broad range of stakeholders who were consulted during its production.

In order to remain current and for DPM to establish a reputation as an example of best practice within a rapidly evolving industry, proactive consultation will continue to be conducted with Stakeholders and a simple pathway to report issues maintained for those who may otherwise have been overlooked in error.

2. BVLOS UAS OPERATIONS

2.1. DOCUMENT PURPOSE AND STRUCTURE

This is DPM's BVLOS Trial Area Manual. It sets out the minimum requirements for clients to operate safely and details how DPM operations will be deconflicted with other air users.

In order for the Remote Pilot (RP) to operate safely their BVLOS Operational Safety Case (OSC) shall be read in conjunction with the following DPM documents for BVLOS operations within the Trials Area to be deemed 'approved' by the CAA.

- Safety Management System (SMS)
- DPM BVLOS Trial Area Safety Case (this document)
- Risk Assessment

The Onshore Facilities Manual details the activities which take place at DPM to ensure safe day to day operation occurs at the facilities. Visual Line of Sight (VLOS) activities conducted at DPM are conducted in accordance with CAP 722, as summarised in the Drone Code, and are included within the Onshore Facilities Manual.

2.2. SCOPE

Beyond Visual Line of Sight (BVLOS) operations present a complex requirement beyond the scope of CAP722. Operations at DPM have been approved by the CAA following a Temporary Airspace Change Application conducted in line with CAP 1616.

DPM'S APPROACH IS DIFFERENT TO TRADITIONAL AIRSPACE TRIALS IN THAT THE AIRSPACE WILL BE AVAILABLE TO ALL UAS RATHER THAN BEING DESIGNED AROUND THE SPECIFICATIONS OF A SPECIFIC UAS AND SPECIFIC TRIAL.

The intent of Drone Port Montrose is to provide a safe, multi-scenario, easily accessible Airspace Trial Area within which technology developers, drone service providers and end users can develop, trial and demonstrate the capability of UAS and supporting operational systems and infrastructure.

IF THE TRIALS PROGRAMME FALLS OUTSIDE THE SCOPE OF THE DPM OPERATIONS MANUAL IT CANNOT BE CONDUCTED WITHOUT ADDITIONAL AND SPECIFIC PERMISSION FROM THE REGULATOR OBTAINED AT THE UAS OPERATOR'S EXPENSE.

Whilst the ultimate aim of DPM is to facilitate an increasing degree of integration between manned and unmanned aviation, as a trial facility its purpose is to support the conduct of the safe trialing of the technology and procedures which will ultimately be required for the wide scale adoption of BVLOS, autonomous drone operations. As the enabling technology will itself be under trial at DPM, safe operations are primarily managed through the segregation of airspace and effective deconfliction procedures. Therefore:

WHILST ELECTRONIC CONSPICUITY AND DETECT AND AVOID SYSTEMS ARE ENCOURAGED, THEY ARE NOT A MANDATED REQUIREMENT FOR EITHER VLOS OR BVLOS OPERATIONS AT DPM.

Operations may be A to A and/or A to B operations within the Airspace Trials Area so long as they take place within the constraints laid out in both DPM's Operations Manual and the Client's UAS Operational Safety Case. The Regulator may at any point intervene where they are not satisfied that the UAS operator's operations are not ALARP and request additional clarification to ensure the execution of safe operations.

2.3. REGULATORY FRAMEWORK AND PERMISSIONS

2.3.1. REGULATORY FRAMEWORK

All personnel associated with UAS operations will be familiar with the current national regulations under which they operate. For UK operations, the following resources exist:

2.3.2. OPERATIONS MANUAL AND OPERATIONAL SAFETY CASES

OSC Definition and Authority

An Operational Safety Case (OSC) is a structured and evidenced case demonstrating that operations can take place safely and that safety risks have been identified and reduced to a tolerable and As Low As Reasonably Practicable level (ALARP).

The Civil Aviation Authority (CAA) is the UK's independent statutory authority responsible for regulating civil aircraft in the UK, including UAS, and is charged with enforcing the regulations and granting permissions to operate.

DPM Operations Manual

Permission for BVLOS operations to take place from DPM, as defined within DPM's Operations Manual, has been granted by the Regulator (CAA).

UAS OSC

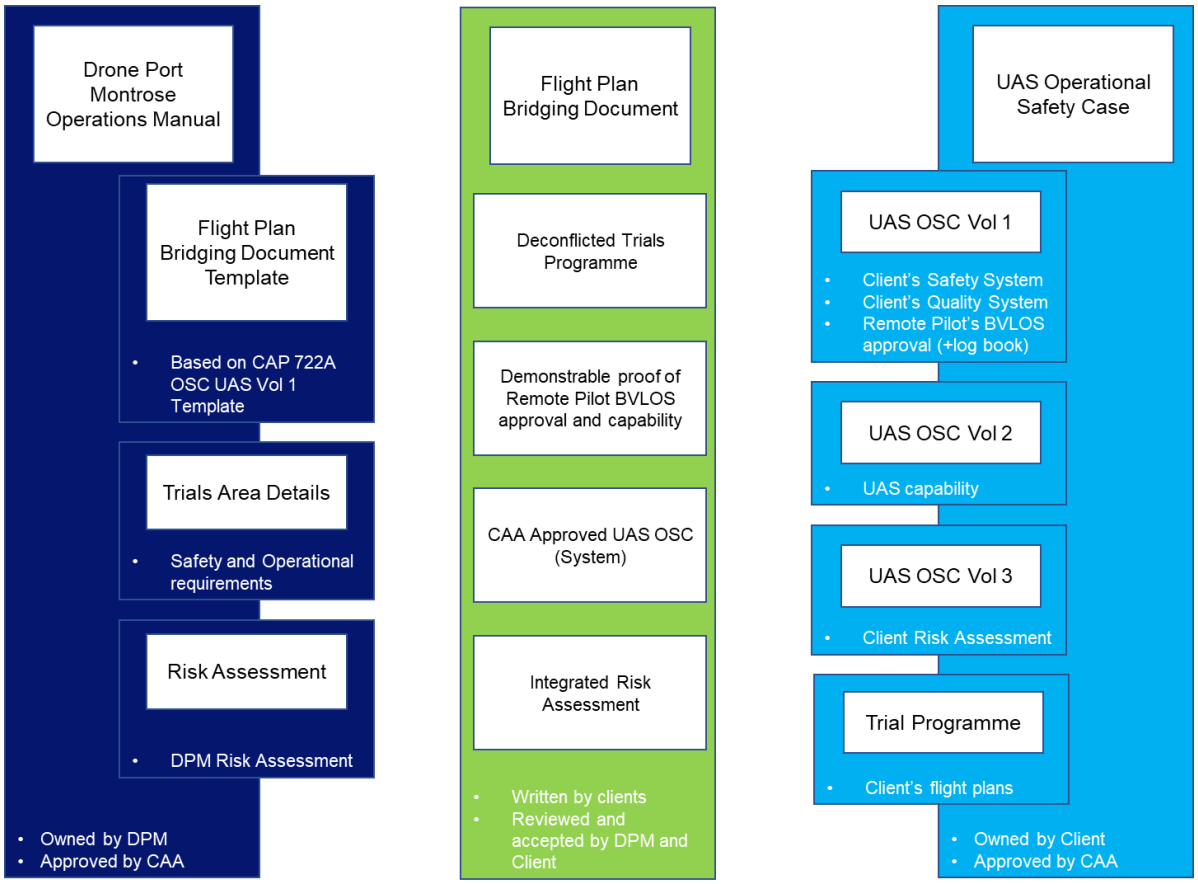
For DPM Clients to conduct BVLOS operations at DPM their UAS, competencies and procedures must be covered by an OSC approved by the CAA. BVLOS flights within the Trials Area (i.e. the segregated airspace) adjacent to DPM are conducted under either:

- The Client's standalone Operational Safety Case written specifically for DPM in accordance with CAP 722A or;
- The Flight Plan Bridging Document which details the requirements of the DPM Operations Manual, demonstrates the Remote Pilot's capability to operate BVLOS and uses the Client's UAS OSC Vol 2 (Systems) to align the boundaries of the Trials Programme with the Regulator's existing approvals

2.3.3. INTEGRATION OF DPM AND CLIENT PERMISSIONS

In order to ensure that the approvals granted to both DPM and the Client by the CAA are aligned the Operations Manuals of both originations need to be aligned to ensure no unauthorised activities take place.

The integration of DPM and client Operations Manuals is carried out by way of a Flight Plan Bridging Document that aligns the constraints detailed within the DPM Operations Manual with the capabilities of Client's and the scope of the intended Trial Programme.



A schematic detailing where the key information within the Flight Plan Bridging Document is drawn from

The Flight Plan Bridging Document Template can be found in Appendix 14.

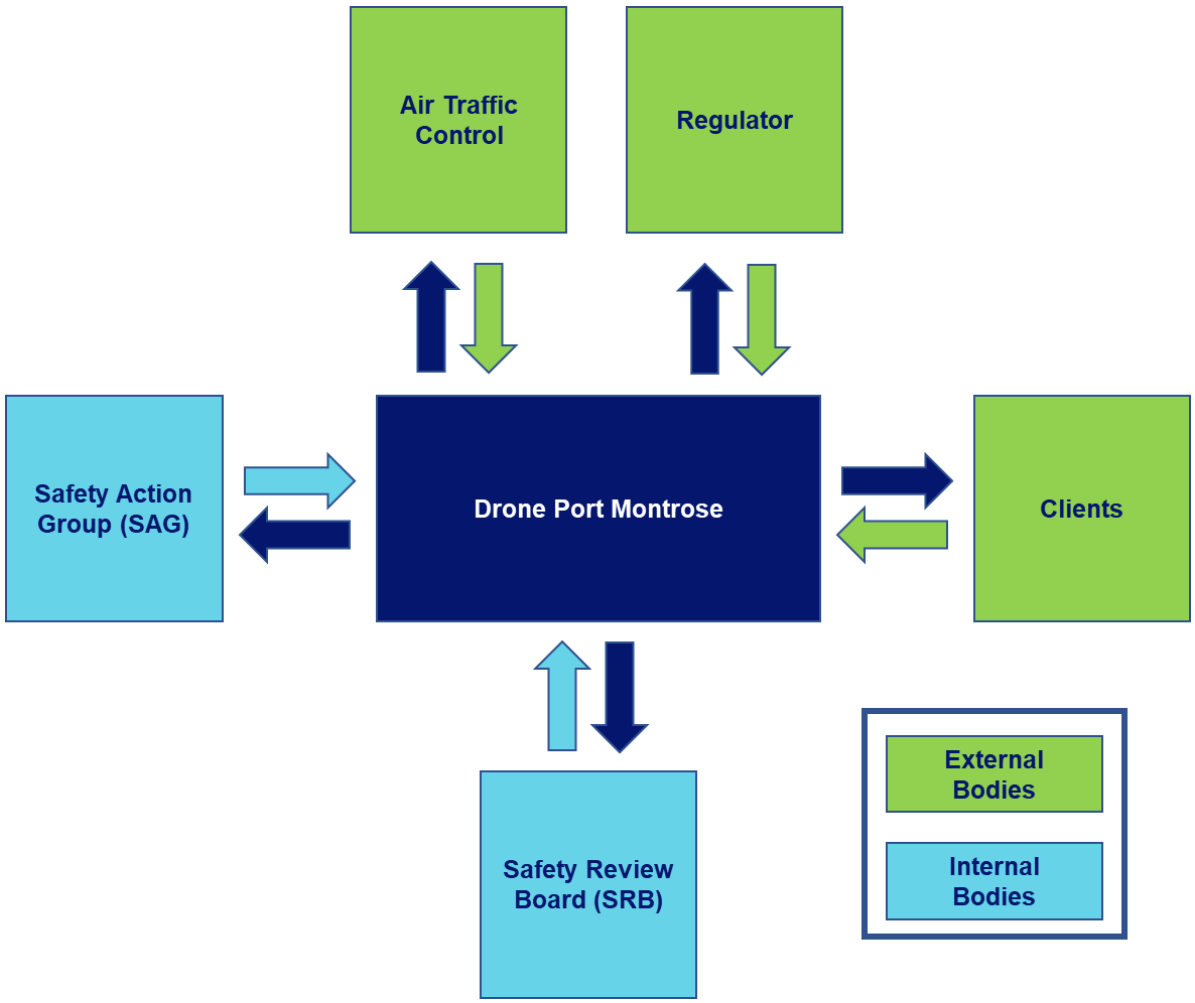
5. ORGANISATION

5.1. REGULATOR – DPM – CLIENT RELATIONSHIP

The Regulator provides both DPM and its clients approval to operate in line with their permission.

Clients provide DPM with a Trials Programme which is then deconflicted with other Airspace Users using the NOTAM process managed by National Air Traffic Control Services (NATS) and Letters of Approval (LoA) put in place between DPM and a number of local airspace users on a case-by-case basis.

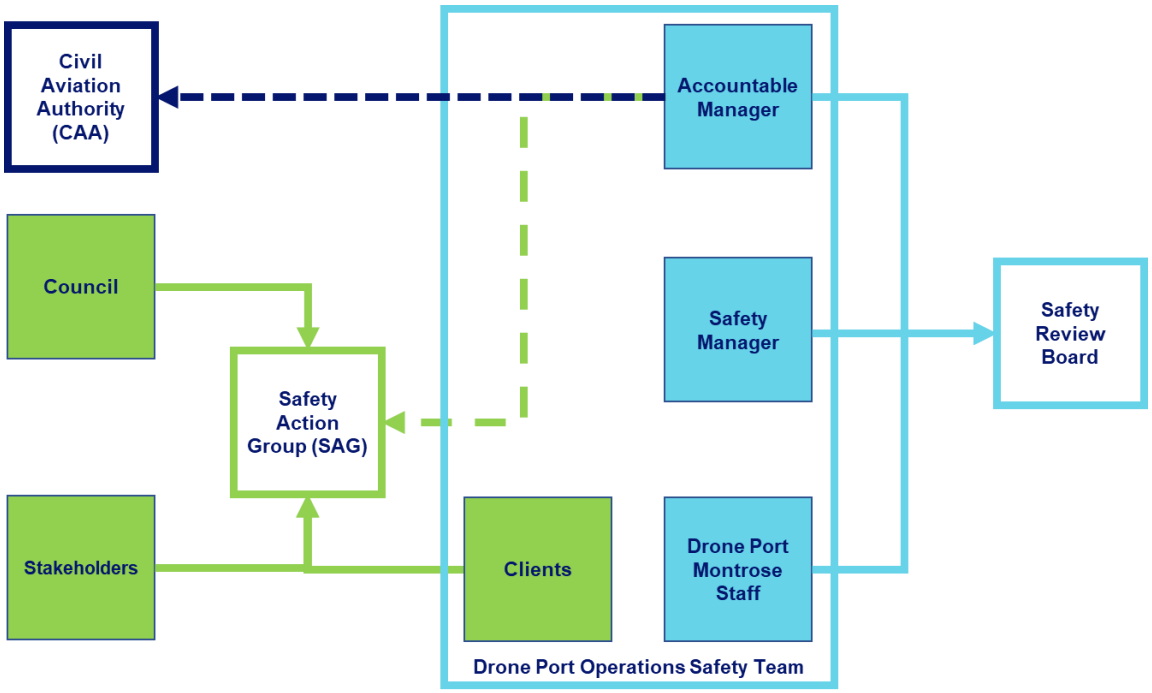
Oversight of DPM operations is provided by the Safety Review Board (SRB) whilst strategic oversight is provided by the Safety Action Group (SAG).



A schematic detailing the primary relationships managed by DPM and the two way flow of information between each

5.2. JOINT VENTURE PARTNERSHIP

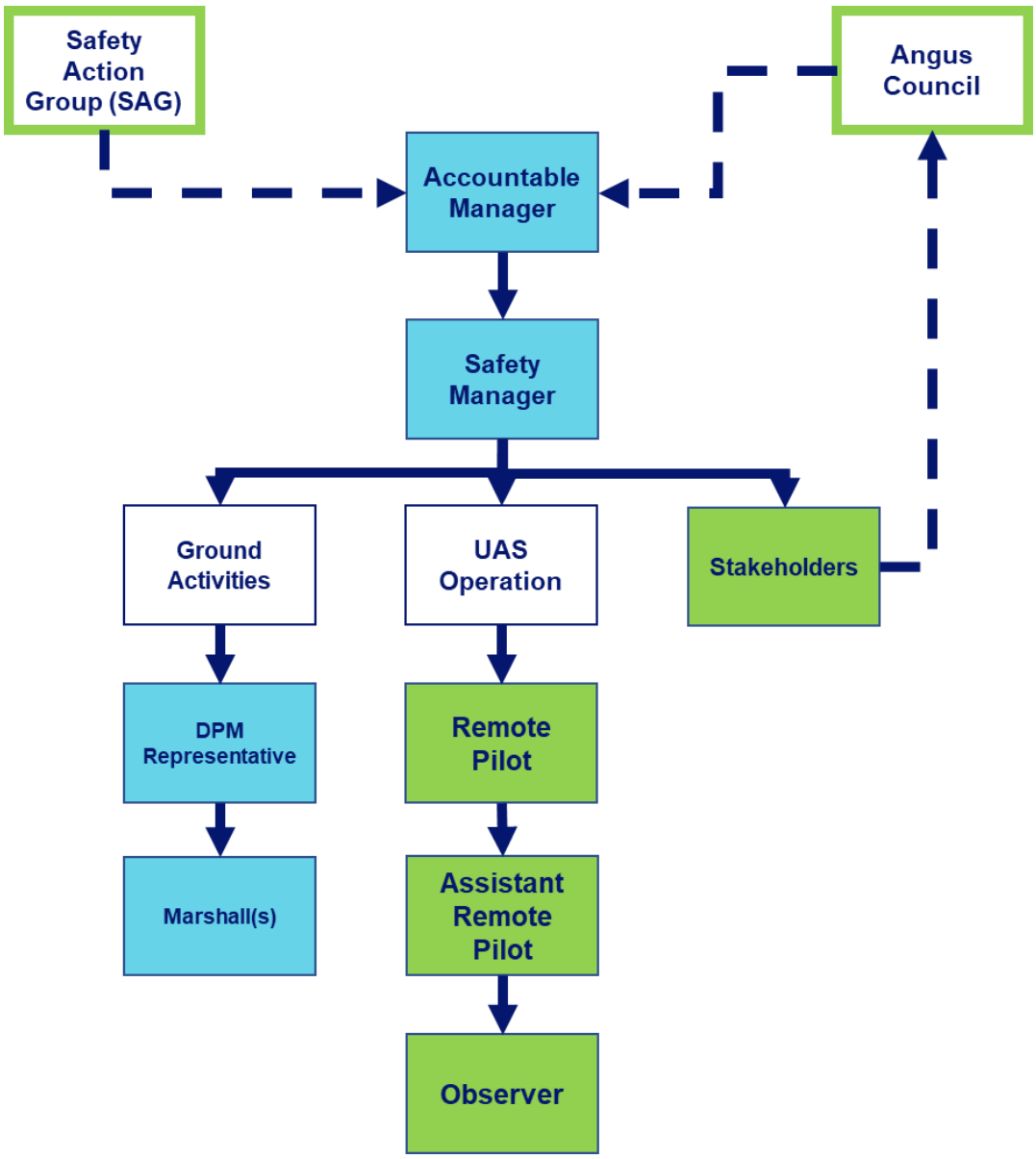
DPM is a joint venture between the private sector (DTL) and a local Government organisation (Angus Council). In the organisational structure DTL provide the executive functions and day to day management of the facility and operations whilst Angus Council will run the Board and provide oversight both from a safety and financial perspective.



A schematic detailing the reporting lines between DTL who perform the executive function at DPM managing the operations and Angus Council who perform the Board function (both safety and business roles)

5.3. DPM OPERATIONS

Operations at DPM are managed by one of the project's Joint Venture Partners, Drone Technologies Limited.



A schematic detailing the key positions involved in the operations at DPM

5.4. ROLES AND RESPONSIBILITIES

The key roles at DPM are:

DPM Personnel:

- Accountable Manager
- Safety Manager / Deputy Safety Manager
- DPM Representative
- Marshall

Client Roles

- Remote Pilot
- Assistant Remote Pilot
- Observer

The roles and responsibilities of each position are detailed in Appendix 28

The named positions of responsibility within this organogram are found in *Appendix 6 – Key named personnel:*

Changes to these named positions are required to follow the formal management of change process and CAA approval sought.

6. OPERATIONAL SAFETY CASE ALIGNMENT

6.1. APPROVAL OF BVLOS OPERATIONS

BVLOS UAS operations in the UK are managed through the compilation of an Operational Safety Case (as defined in CAP 722A) that has been approved by the CAA. An Operational Safety Case is comprised of 3 volumes:

- Vol 1: Operations Manual
  - Details the approach to safety; the organization, roles and responsibilities; the details of the planned operation; emergency response plan and incident reporting and Remote Pilot competancy
- Vol 2: UAS System
  - Details the design, capabilities and limitations of the UAS
- Vol 3: Safety Risk Assessment
  - Identifies and classifies the hazards of conducting the UAS operation planned, evaluates the risk and puts in place mitigations to ensure that any risks are As Low as Reasonably Practicable (ALARP)

Operations in DPM's BVLOS Trial Area can therefore only be conducted by Clients whose Remote Pilots have been approved for BVLOS operations and using a UAS similarly approved for BVLOS flight.

For BVLOS operations to take place at DPM the constraints of the DPM Operations Manual (which has been approved by the CAA) must therefore be aligned with that of the Client's capabilities and UAS, similarly approved by the CAA.

This can be done on one of two ways:

- A client with a previously approved Operational Safety Case can compile one based on conducting operations at DPM following the guidance within CAP 722A or:
- A client with a previously approved Operational Safety Case can complete DPM's Flight Plan Bridging Document to align the constraints of DPM with their demonstrable approved capability – both pilot and UAS. (See Section 6.2)

6.2. BVLOS UAS OPERATIONS AT DPM USING A FLIGHT PLAN BRIDGING DOCUMENT

For BVLOS UAS operations to take place at DPM Clients must firstly be in possession of an approved Vol 2 Operational Safety Case for their UAS.

The Flight Plan Bridging Document aligns the constraints and requirements of DPM with the requirements of a Vol 1 Operational Safety Case and includes a risk assessment in which the Client demonstrates that their organisation and UAS can operate safely within the boundaries of DPM's approved Risk Assessment.

The Flight Plan Bridging Document uses the headings found in CAP 722A for Vol 1 – Operations Manual as the template that needs to be completed by the Client. The information included is drawn from DPM's Operations Manual and the client's previously approved UAS OSC Vol 1 Operations Manual(s).

Clients are provided with DPM's Risk Assessment into which they incorporate risks associated with their UAS. The integrated Risk Assessment is then reviewed by both DPM and Client independently and then again at a meeting attended by both parties. This meeting may be conducted either in person at DPM or online.

Whilst the constraints and procedures of the Airspace are clearly defined within DPM's Operations Manual and the capabilities of the UAS similarly well defined with the Client's UAS OSC Vol 2 – UAS, the absence of a specific 'BVLOS' qualification for Remote Pilots is an area of particular complexity. DPM requires demonstrable proof of pilot capability to be provided using past Operational Safety Cases and Remote Pilot Log books and for Trials Programmes to be developed in an iterative, conservative manner.

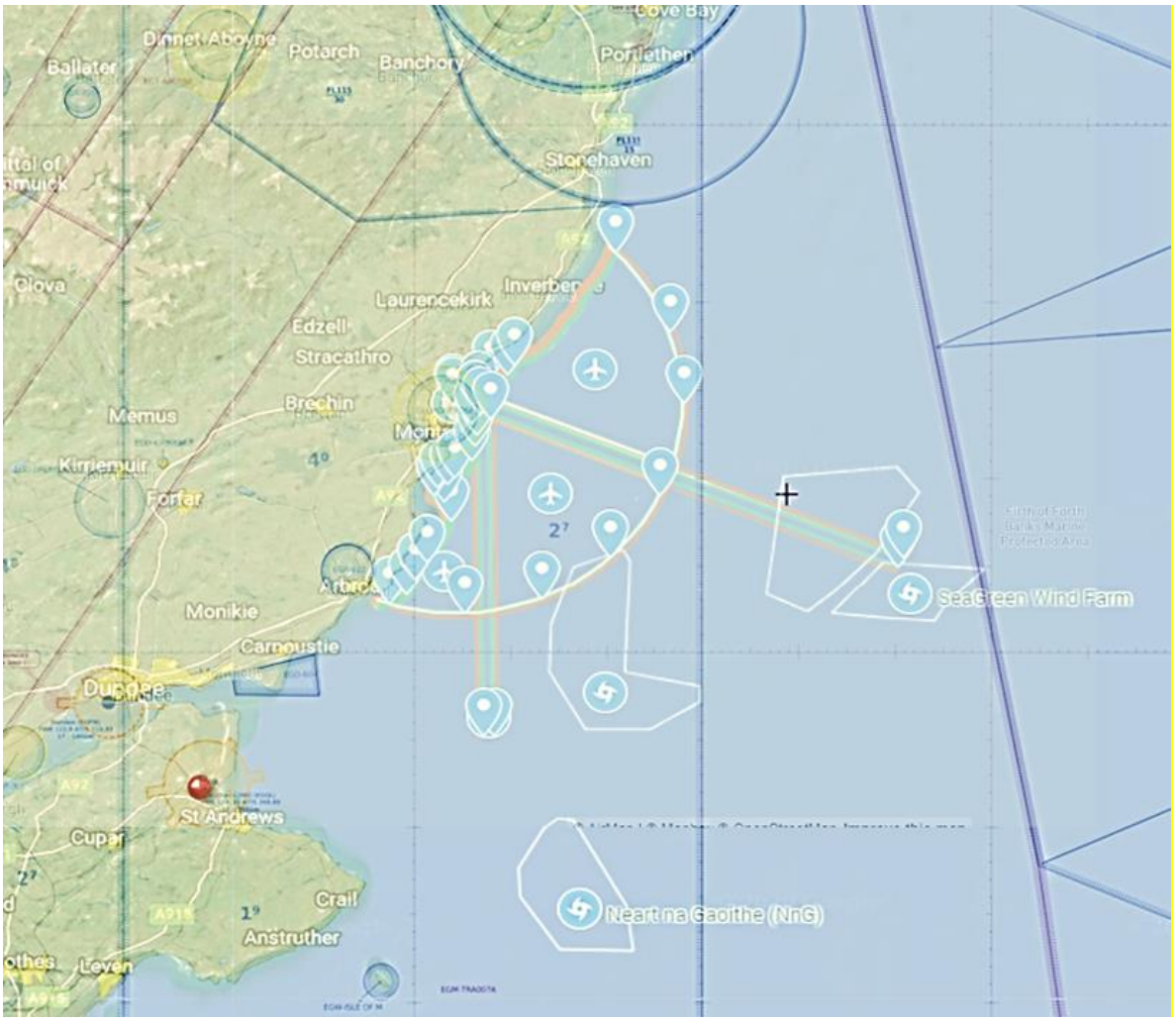
The Flight Plan Bridging Document Template can be found in *Appendix 14*.

7. AIRSPACE FOOTPRINT AND SCHEDULE

7.1.1. AIRSPACE

The Temporary Airspace Trials Area comprises a Temporary Danger Area (TDA) of segregated airspace encompassing:

- a semi-circle with a radius of 11nm extending seawards from a baseline 1nm offshore accessed by a further drone corridor 250 m in width from DPM (known as the *Trials Area*).
- two drone corridors through the *Trials Area*, dividing it into 3 sectors, en-route to the entry point into the windfarms planned at Seagreen and to the Bell Rock Lighthouse



Drone Port Montrose Segregated Airspace

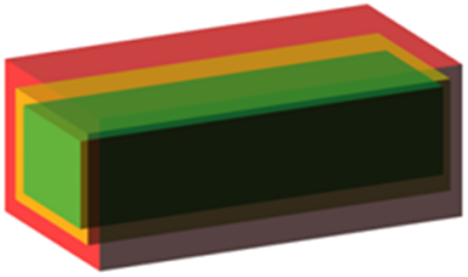
7.1.2. FLIGHT VOLUMES

The area of segregated airspace within the Temporary Danger Area (TDA) and is comprised of the Flight Volume (or 'Green Zone') and the Contingency Volume (or 'Yellow Zone).

- All flights will be planned to take place within the Flight Volume (Green Zone). Geo fencing will be applied to the Green Zone.
- The Contingency Buffer (Yellow Zone) allows for small errors in positioning or environmental conditions affecting the planned flight of the UAS. Should a UAS enter the Contingency Volume the UAS Operator must actively intervene to ensure the UAS returns to the Flight Volume immediately. Where a UAS enters the Contingency Volume, this must be noted in the Post-flight Report for internal review by both DPM and the Safety Action Group (SAG).

Flight Volume
- All flights planned within flight volume
- Within segregated airspace

Contingency Volume
- Weather or technical positioning inaccuracies
- 50 horizontal / 50ft vertical
- Within Segregated Airspace
- Entry into 'Yellow Zone' is reviewed internally and may be submitted to the CAA



Emergency Volume
- 500m horizontal / 500ft vertical
- 500m @ 60kph pilot has 30 seconds to respond
- Unsegregated class G airspace
- Entry into 'red zone' is a major incident
- Flight beyond 'red zone' constitutes a 'fly-away'

Flight Volumes

The Emergency Volume (Red Zone) lies outside the TDA (i.e. the red zone is in unsegregated class G airspace) and acts as a control measure for UAS Operators to define when an incident has occurred.

Should a UAS enter the Red Zone the UAS Operator must actively intervene and endeavor to return the UAS to the Green Zone immediately. Upon returning to the Green Zone the UAS must abort its mission and return to DPM.

Should a UAS pass through the Emergency Buffer and the UAS Operator be unable to return the UAS to the Green Zone, the UAS Operator must declare a 'fly-away' to have occurred and enact the Fly-away Procedure.

Any UAS entering the red zone is operating outside the DPM Operations Manual requirements and will be classed as a Major Incident and subject to a formal investigation by DPM.

Upon either returning to DPM, landing elsewhere, or in the event of the UAS being declared lost, the UAS Operator must compile a Post-flight Report detailing the incursion and support DPM in the conduct of a formal investigation. The Post-flight Report and Investigation Report will be submitted to both the SAG and the CAA for their review / action.

7.1.3. TRIALS AREA ACCESS CORRIDOR

The Trials Area is accessed from the Drone Port via an Access Corridor.

Figure 1: Drone Hub approaches

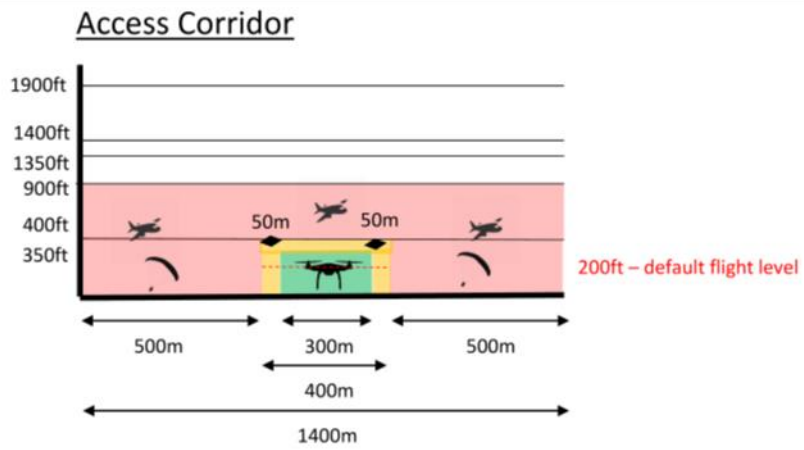
The segregated airspace of the UAS access corridor extends upwards from land/sea to 400ft and extends for 1 nautical mile out to sea.

Lower Sector

- 0ft – 350ft = Flight Volume
- 350ft – 400 ft = Contingency Volume
- 400ft – 900ft = Emergency Buffer

Upper Sector

- No upper sector

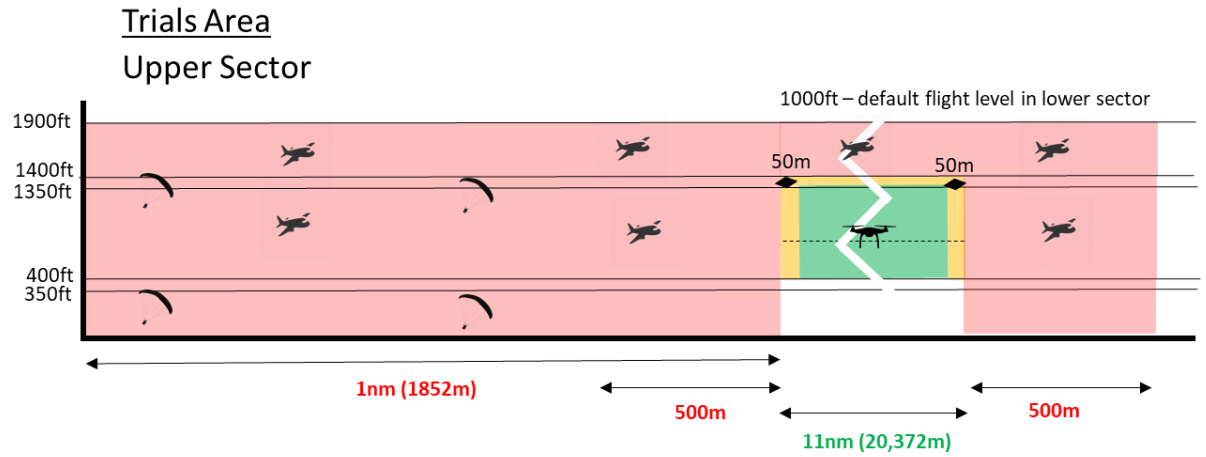


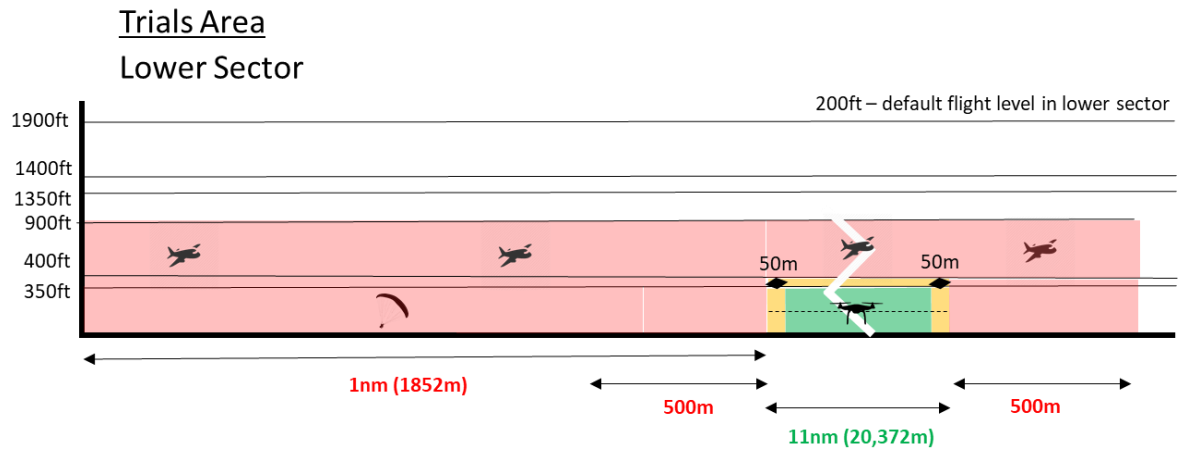
7.1.4. BVLOS TRIALS AREA

The Trials Area lies 1 nm offshore and is comprised of a semi-circle 11nm in radius over the North Sea. It is divided into 3 horizontal sectors, each with a lower sector extending from 0 – 400ft and an upper sector extending upwards from 400ft to 1400ft.

Lower Sector
- 0ft – 350ft = Flight Volume
- 350ft – 400ft = Contingency Volume
- 400ft – 900ft = Emergency Buffer

Upper Sector
- 400ft – 1350ft = Flight Volume
- 1350ft – 1400ft = Contingency Volume
- 1400ft – 1900ft = Emergency Buffer





The horizontal and vertical sectors are each activated individually within the NOTAM. The lower sector can be activated on its own, if the upper sector is activated, the lower sector must also be activated.

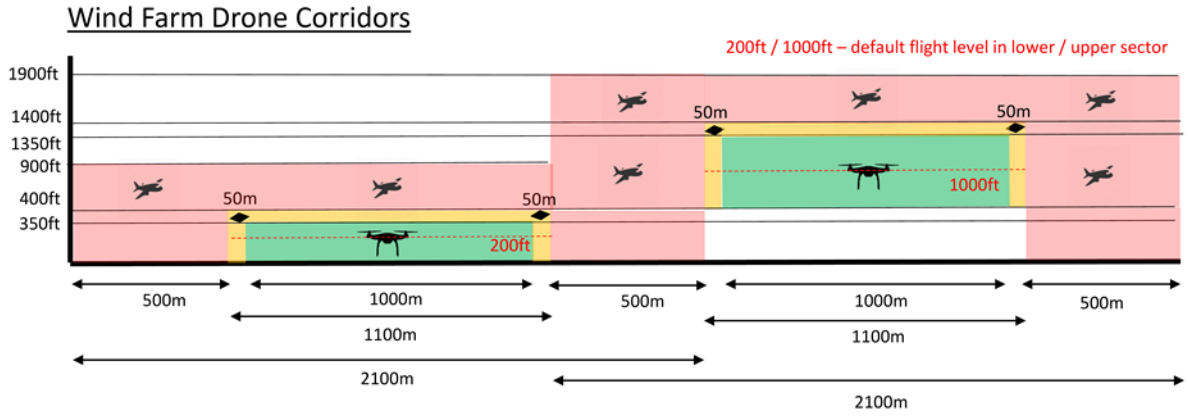
7.1.5. DRONE CORRIDORS

There are two drone corridors: one that extends ESE between DPM and the north west corner of the Seagreen Windfarm (yet to be installed) and southwards between DPM and the Bell Rock Lighthouse.

The Drone corridors are 1100m in width and have a lower (0 – 400ft) sector and an upper (400 – 1400ft) sector.

Lower Sector
- 0ft – 350ft = Flight Volume
- 350ft – 400ft = Contingency Volume
- 400ft – 900ft = Emergency Buffer

Upper Sector
- 400ft – 1350ft = Flight Volume
- 1350ft – 1400ft = Contingency Volume
- 1400ft – 1900ft = Emergency Buffer



7.1.6. TRIAL ROUTES

The routes flown by UAS within the trials area and Drone Corridors will differ from client to client and be defined by DPM in the Trials Programme.

7.1.7. TIMINGS AND NOTIFICATIONS

The trials area will be available both day and night and activated by NOTAM. Part of the trial programme planning will include deconfliction with planned activities by other Air Users and/or local community activities.

Details of each trial will be published on the DPM website and regularly updated as part of the stakeholder notification cycle. A single NOTAM will be prepared for the duration of the trials programme. Where a Trials Programme completes its activities earlier than planned on a particular day, or activities postponed, NOTAMs will be de-activated either temporarily through the issue of a further NOTAM or permanently by its cancellation.

The Notifications Procedure can be found in Appendix 5.

The DPM website can be found at: To be added once Live

7.1.8. LETTERS OF AGREEMENT

There are a number of Letters of Agreement (LoA) in place to deconflict Trials Programmes with a number of stakeholders:

- Aberdeen Hang Gliding and Para Gliding Club: to deconflict activities of the club flying over the beach near shore at St Cyrus and Montrose beaches
- MOD: to be agreed on a case-by-case basis with RAF Leuchars when a Client's Trial Programme intends to utilise the Drone Corridors
- Montrose Heritage Air Museum: to deconflict occasional air show activities in the vicinity of the Drone Port onshore facilities.

8. REMOTE PILOT AND LOCATION

8.1. REMOTE PILOT

For a Remote Pilot to operate a UAS BVLOS at DPM they must be able to provide demonstrable proof of CAA approval to conduct BVLOS operations. Their capability is demonstrated through provision of their log book and either:

- a Volume 1 Operational Safety Case compiled specifically for trials at DPM or;
- provision of a previously approved Vol 1 Operational Safety Case involving BVLOS flight.
- In either case this evidence must be supplemented by the Remote Pilot's Log Book including these flights.

The Remote Pilot is required to have an Assistant Remote Pilot capable of taking over and safety landing the UAS should the primary pilot be incapacitated. The Assistant Remote Pilot must be able to demonstrate their capability as per the primary Remote Pilot.

8.2. FLIGHT CREW LOCATIONS

8.2.1. A TO A

Flights taking off and landing at DPM (i.e. A to A) are required to have as a minimum a UAS Operator and an Assistant to be located at DPM.

The UAS Operator is responsible for operating the UAS safely and in accordance with their Trials Programme, Operational Safety Case and the DPM Operations Manual.

The Assistant supports the UAS Operator to operate the UAS safely, acts as an alternate pilot should the UAS Operator be incapacitated, and maintains communications with DPM.

Marshalls drawn from either client or DPM personnel will be nominated prior to take off to assist with ad hoc occurrences, or the public entering the Drone Port during operations.

8.2.2. A TO B

Flights taking off at DPM but landing elsewhere (i.e. A to B) require a UAS Operator and an Assistant to be located at DPM (i.e. A) and an Assistant to be located at the alternate landing/take off area (i.e. B).

The UAS Operator is responsible for operating the UAS safely and in accordance with their Trials Programme, Operational Safety Case and the DPM Operations Manual.

The Assistant supports the UAS Operator operate the UAS safely, acts as an alternate pilot should the UAS Operator be incapacitated and maintains communications with DPM and the Notifications

8.2.3. ASSISTANT LOCATED AT B.

The Assistant at B is responsible for maintaining communications with the Assistant at DPM (i.e. A) and must have visual Line of Sight of the UAS as it lands and takes off at B.

Marshalls drawn from either client or DPM personnel will be nominated prior to take off to deal with ad hoc occurrences, or the public entering the Drone Port during operations.

8.3. FLIGHT TEAM HEALTH

Flight crew are required to disclose any conditions that may affect the safety of an operation. It is the responsibility of the individual to determine if they are in a physically and mentally sound condition to operate as part of the flight. Should DPM personnel assess the Client's flight crew to not be physically or mentally capable of performing the task DPM personnel are authorized to cancel the flight at any point.

Any members of the flight team should advise the Remote Pilot (or another member of the Flight Crew if a craft is in flight) if they feel unable to continue with their assigned responsibilities.

DPM will use the mnemonic 'IMSAFE' as a tool to assess crew health on the day of operation. The mnemonic is:

- Illness - Is any member of the flight team suffering from any illness or symptom of an illness which might affect them during flight?
- Medication – Are any members of the flight team currently taking any drugs (prescription or over- the-counter), and could these affect their performance as it relates to safe UAS operation?
- Stress – Are any members of the flight team pilot overly worried about other factors in their life? Psychological pressures can be a powerful distraction and consequently affect a pilot or member of the flight crew's performance.
- Alcohol - Members of the flight team should consider their alcohol consumption within the last 8 to 24 hours. Flights will not be carried out if the effects of alcohol are likely to compromise the ability of the flight team to carry out the operation safely.
- Fatigue – Have the flight team had sufficient sleep and adequate nutrition?
- Eating - ensuring proper hydration, sustenance, and correct nutrition.

If any doubt over a member of the flight team's medical fitness is suspected, they shall be required by DPM Accountable Manager to undergo a medical examination and/or eye test to ensure that safety can be assured during an operation.

If a Remote Pilot or member of the flight team refuses to undergo these examinations when requested, the DPM Accountable Manager holds the authority to suspend their role in UAS operations until such a time as they feel safety will not be compromised.

9. UNMANNED AIRCRAFT

9.1.1. AIRCRAFT APPROVAL

The capabilities of the UAS to be used are defined in Volume 2 of the Client's Operational Safety Case. For the UAS to be flown BVLOS at DPM this document must have been approved by the CAA.

9.1.2. AIRCRAFT TYPE

Any UAS certified to operate in the UK and/or covered by CAA Approved Operational Safety Case (Vol 2) can operate from the DPM facility within the confines of the DPM Operations Manual.

At present the facility does not have a runway and it is therefore envisaged that UAV will be limited to the following types:

- Single rotor
- Multi-rotor
- Fixed Wing / propeller Vertical Take Off and Landing (VTOL)
- Catapult launch (where no runway is required for landing)

The potential exists to create a runway(s) for traditional fixed wing take-off and landing but at present this is not within the scope of DPM and would necessitate a Management of Change process to be conducted by DPM.

9.2. UAS DESCRIPTION

9.2.1. BVLOS AIRCRAFT

All UAS operating BVLOS must be covered by a CAA Approved Safety Case. As a minimum, the UAS Operator must provide DPM the following details:

- UAS Name:
- UAS Type: Single rotor / multi-rotor / VTOL / fixed wing
- Operational Safety Manual Reference
- Top Speed:
- Max Range:
- Max Endurance
- Pax Payload
- Maximum Tale Off Weight (excl fuel)
- Noise data
- Power type
- GPS
- Communications System(s)
- Frequency used
- UTM Make/Model
- Conspicuity (if installed)
- Detect and Avoid system (if installed)

These are to be noted in the *Flight Plan Bridging Document – see Appendix 14*

9.3. WEATHER LIMITATIONS

The UAS Operator must check the weather conditions prior to take off and for the expected duration of the flight. Take off will be after having confirmed and logged that they are within the safe operating window of the aircraft for the duration of the trial flight.

The UAS operator must provide DPM with the following operating constraints of the aircraft they intend to operate at the facility.

- Max Wind Speed
- Min visibility
- Precipitation operational limits
- Cloud ceiling
- Min / Max Operating Temperatures

The environmental constraints for the clients' UAS will be provided in the *Flight Plan Bridging Document – see Appendix 14.*.

10. TRIAL PROGRAMME

10.1. TRIAL PROGRAMME DESIGN CONSIDERATIONS

The testing of new technology and procedures introduces inherent uncertainty and therefore risk which must be minimised if operations are to be conducted in line with DPM's ALARP approach.

In addition to ensuring that clients can demonstrate technical capability and competence DPM requires Clients to adopt an iterative, step-by step approach within their Trials Programmes proving the system and team's existing capabilities before taking the next manageable step. A successful Trials Programme should therefore be comprised of a number of test flights that demonstrate various of capabilities independently that can ultimately be combined to demonstrate a more complex or advanced technical or operational capability.

These steps may be a change to enhance an existing procedure or capability, test an alteration to an existing system or develop a pilot. The number of new variables under test during each flight must be limited and mitigations developed to ensure that, should anything go wrong, most responses are already in place and understood.

Explanatory examples are:

- Development of UAS from VLOS flight to BVLOS flight:
  - Initial flight to prove existing capabilities of the system VLOS
  - Second flight proving the UAS within VLOS, but simulating the procedures to be used with BVLOS
  - Third flight conducted either EVLOS or extending BVLOS perhaps out to 1km
  - Future flights extending BVLOS flight in increments, perhaps 3nm, 6nm, 12nm etc
  - Following each flight, a post flight review would be conducted, the risk register reviewed, and any additional mitigations put in place prior to the next flight taking place
- Development of commercial operation procedures

- Initial flight confirming the existing capabilities of the UAS and team experience
- Several flights simulating each part of the operation as individual components and the testing of identified risks (e.g. weather, light, commercial time constraints, distance etc)
- A flight combining some or all the simulated operational components to prove the concept
- Several flights conducting each part (or a number of parts) of the operation under commercial conditions
- A proof of concept flight proving the commercial operation under commercial conditions
- Following each flight, a post flight review would be conducted, the risk register reviewed, and any additional mitigations put in place prior to the next flight taking place

10.2. TRIAL PROGRAMME EXECUTION

All flights are conducted in accordance within the constraints of the DPM Operations Manual, the capabilities of the UAS as defined within its UAS OSC Vol 2 and have been risk assessed.

The default planning altitude for BVLOS flight in the Lower Sector (i.e. 0 – 400ft) is 200ft whilst in the Upper Sector (i.e. 400 – 1400ft) it is 1000ft.

Prior to Take Off Remote Pilots must have pre-planned an alternative Return to Home route using the sector boundaries should a point-to-point route not be possible in the event of an emergency.

The first flight of a BVLOS Trials Programme must demonstrate the UAS systems to be functioning in a VLOS environment.

UAS must have key functions checked during each flight. As a minimum this must include communication checks at a number of ranges (e.g. 3nm, 6nm, 9nm etc). These should be noted in the Risk Assessment prepared for the Trials Programme.

Where a UAS fails to function as planned the UAS must be returned to DPM.

10.3. PROCEDURES

10.3.1. DPM AND CLIENT PROCEDURES

Flights from DPM are required to follow a set of specific procedures which detail actions and responsibilities from initial contact between DPM and the Client through to the post flight reporting and any incident investigation and reporting.

Up until the UAS Takes Off, the Accountable Manager at DPM is responsible for ensuring all procedures are enacted. Between Take Off and Landing the Remote Pilot is responsible for the safe operation of the UAS in line with the Client's flight procedures and, where an unplanned event occurs, responding in accordance the procedures approved by the CAA as part of the DPM Operations Manual.

10.3.2. TRIAL PROGRAMME PROCEDURES

The following procedures are detailed in *Appendix 7*

- Trial Programme Planning

- Details the activities to be completed from the first contact between DPM and the Client to the publishing of the NOTAM.

- Preparations for Trial
  - Details the deconfliction of Trials Programme with other Air Users, the arrival of the Client and their move to the Take Off (TO) and Landing Area (LA)
- Flight Procedures
  - Details the actions to be taken during the UAS flight and 'Actions On' specific events occurring
- Post-Flight Procedures
  - Details the procedure to be followed once the UAS flight is complete including post flight report and any incident reporting.

10.3.3. EMERGENCY PROCEDURES

In the event of an unplanned or emergency event occurring the Remote Pilot is responsible for ensuring evasive action is taken in a manner that is as Safe as Reasonably Practicable.

In all circumstances the first consideration of the Remote Pilot must the safety of manned aviation and the public.

Where an unplanned event occurs and the Remote Pilot decides to return the UAS to DPM as a minimum their considerations over the route to take should consider:

- Can the UAS temporarily hover or maintain a holding position to avoid an obstruction/aircraft?
- What is the safest altitude being aware of both aviation and shipping traffic?
- Is a simple straight line point to point route viable? If not the Pilot should consider an alternate route returning either clockwise or anti-clockwise along one of the sector boundaries?

The following Emergency Procedures are detailed in *Appendix 8*

- Aircraft Incursion
  - Details the 'Actions on' in the event of an either an unplanned but pre-warned aircraft entering the segregated airspace (e.g. search and rescue) or an unplanned, unannounced incursion (e.g. a straying General Aviation Aircraft)
- Flyaway
  - Details the process to be followed if the UAS leaves the Emergency Volume (Red Zone), an action which defines the term 'fly-away' at DPM

During the preparation of the Trials Programme risks may be identified which, during the Risk Assessment, result in additional mitigations being put in place. Where these are not specific to the one Trial further procedures will be established and risk assessed.

11. CO-ORDINATING INSTRUCTIONS

11.1. COMMUNICATIONS

11.1.1. COMMUNICATION CAPABILITIES

DPM will operate using telephone, handheld radios and email.

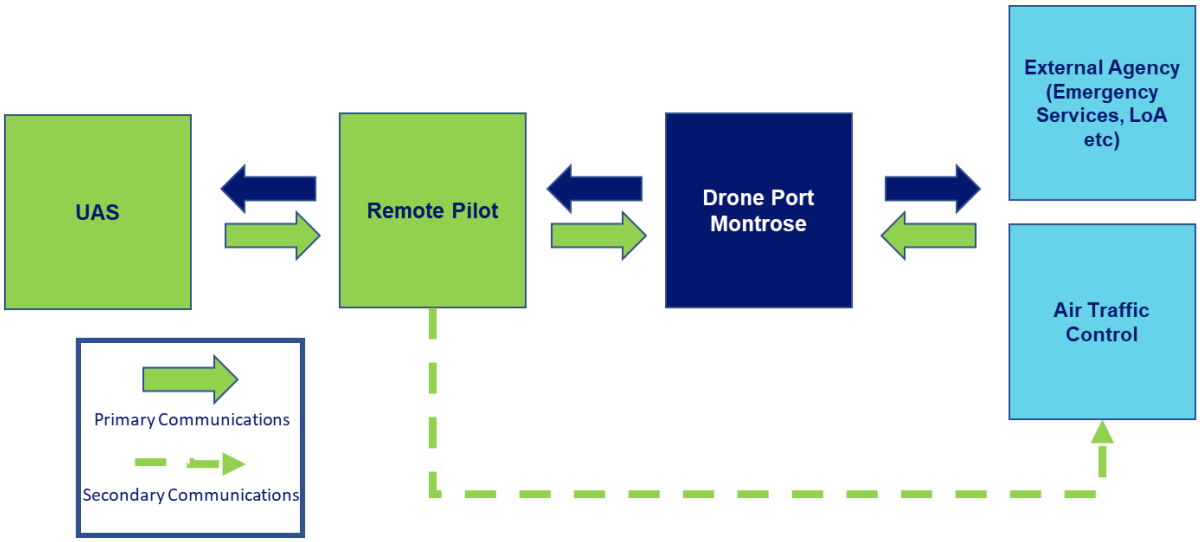
The primary means of communication used by DPM for communication with clients and agencies during flight operations is the telephone.

Key communications (e.g. notification of agencies of take-off / landing etc) will be logged by DPM. Where supported by a Letter of Agreement these activities may be conducted via email.

A list of DPM and agency telephone numbers can be found within Annex 19. Agencies will be made aware of any additional phone numbers (e.g. the UAS Operator etc) to be used during each Trial Programme on a case-by-case basis.

It is the responsibility of the DPM Representative to ensure that the phone numbers of both DPM and the Clients (including the Remote Pilot) are collated and circulated to all personnel with responsibilities for the execution of the Trials Programme on a daily basis.

If deemed necessary, handheld radios will be issued to members of the flight team and in the event of an emergency, instructions may be given over handheld radio



A schematic detailing the flow of information during UAS operations at DPM

11.1.2. COMMUNICATION BETWEEN DPM – DPM REPRESENTATIVE – REMOTE PILOT

Communication around DPM and the individuals on the site will be achieved via mobile phones. These may be supplemented by hand-held commercially available radios on an ad hoc basis.

11.1.3. COMMUNICATION BETWEEN REMOTE PILOT – UAS

The communications between the Remote Pilot/UAS Controller and the UAS will be in line with that detailed in the Client's UAS OSC (vol 2).

11.1.4. COMMUNICATION BETWEEN DPM AND THIRD PARTY

During flight operations the DPM Representative will ensure at least one mobile phone is retained exclusively for communication with third parties in the event of emergencies. This number will be promulgated to all parties during the pre-flight briefing.

11.1.5. COMMUNICATION DURING FLIGHT OPERATIONS IN DRONE CORRIDORS

Flights beyond the trial area in the drone corridors are required by the MOD to use radio communications. The nature of this requirement will be defined in a Letter of Agreement (LoA) put in place between DPM and RAF Leuchars specifically for each Trial Programme as art of the planning process. It is DPM's responsibility to ensure this LoA is put in place prior to the first flight of the Trials Programme being conducted.

11.2. TRACKING

11.2.1. CLIENT UAS TRACKING

The UAS will be tracked by the Remote Pilot via the onboard GPS and viewed on the Client's UTM.

11.2.2. AIRCRAFT

As the airspace is segregated there is no requirement to track aircraft movements

11.2.3. VESSELS

The client is responsible for monitoring marine traffic during UAS operations. The default altitude for flight planning is 200ft as an allowance that ensures clearance of the majority of vessels. The Remote Pilot must be aware that there may still be some vessels that require greater clearance and it is the Remote Pilot's responsibility to ensure sufficient clearance is provided or the vessel avoided.

The client will download a ship tracking app for monitoring of vessels that may be sailing while the UAS is carrying out trials in the restricted air space. A number of ship tracking apps can be found below:

- Shipfinder
- Marine Traffic
- Ship Tracker
- MarineTraffic
- FleetMon
- Vesseltracker
- VT Explorer
- Myship tracking

11.3. AGENCY INFLIGHT DECONFLICTION PROTOCOL

11.3.1. OVERVIEW

There will be occasions when Emergency Services the MOD of other priority users may be required to enter the segregated airspace of the Trial Area when UAS operations are being conducted.

The following organisations will be contacted by DPM in accordance with the Notification Procedure via the Aeronautical Rescue Coordination Centre (ARCC) or the Distress and Diversion Cell (D&D)

- Military – Navy / Army / RAF
- Emergency Services - Police Scotland / Air Ambulance
- Maritime and Coastguard Agency, including Search and Rescue (SAR)

Notification of these agencies will be done in accordance with DPM will provide by email a written daily schedule of proposed flights the evening prior and before operations commence.

As part of the notifications procedure DPM's contact phone numbers will have been confirmed with these users prior to Take Off. Should access be required DPM will be contacted via phone and the mode of deconfliction agreed.

11.3.2. EMERGENCY SERVICES

When agencies require access to the Trials Area during UAS operations they will normally contact DPM by the Aeronautical Rescue Coordination Centre (ARCC) or the Distress and Diversion Cell (D&D)

Agencies, such as Search and Rescue (SARS) and or Emergency Services, will provide notice of an aircraft's intention to enter the Trials Area - the primary order for all UAS operations is to Return To Home. It is likely that this notice will be in the order of 10 – 30 mins but it may be immediate. If time and distance do not allow a point-to-point return-to-home there are a further three scenarios:

1. Use of lower or upper air space to maintain separation, or
2. Remain clear of emergency operational airspace
3. Use the pre-planned secondary Return to Home route utilizing the sector boundaries.

DPM will advise the Remote Pilot in person or mobile phone and agree the safest option – DPM will then relay this to the Agency immediately.

DPM will continue to advise the Agency of the UAS location until the Agency has left the Trials Area or the UAS has landed.

When DPM has been advised by ARCC or D&D that aircraft are clear of DPM restricted airspace, clearance to resume operations will be given by DPM.

11.3.3. ROYAL NAVY / MOD

Unless there is no safe alternative, should the Royal Navy require unplanned access to the Segregated airspace the UAS must be returned to DPM (as per the Emergency Services).

The UAS must remain grounded for the duration of the scheduled/emergency operation. No flights will resume without prior clearance from DPM that the airspace is clear

11.4. WEATHER

Weather limits of the Client's UAS are defined within Vol 2 of the Operational Safety Case for each of their UAS. Flights may not take place out with these defined limits.

The Remote Pilot is responsible for assessing the suitability of the weather (both current and forecast) to conduct the Trials Programme.

Where the DPM Representative assesses that the weather forecast will unsuitable at some point during the Flight, they have the authorization to over-rule the Remote Pilot's intention to fly.

11.5. TRAINING

11.5.1. DPM PERSONNEL

DPM personnel will be fully conversant with the DPM Operations Manual.

Training of DPM Personnel includes DPM's: Safety Management System (SMS), safety policy, reporting procedures, safety responsibilities, and how individuals can contribute at all levels. Safety training will include periodic refresher training. A log of all safety training conducted by DPM staff will be maintained and reviewed on an annual basis.

11.5.2. CLIENT TRAINING

UAS Operators will be trained to a level defined within their UAS Operational Safety Case.

Where a UAS Operator is themself under training they will be supervised by a UAS Operator trained to the level defined in their Operational Safety Case.

Client Personnel will receive a DPM induction prior to the Trials Programme commencing.

11.6. DOCUMENT CONTROL AND CHANGE MANAGEMENT

11.6.1. ACCOUNTABILITY

In order to ensure operations can be well managed and controlled a robust Document Control and Change Management System is required.

Ensuring that both systems are managed effectively is the responsibility of DPM's Accountable Manager.

11.6.2. DOCUMENT CONTROL

DPM uses Microsoft software and stores documents securely on OneDrive. Where required the CAA are provided access to the system.

DPM's Document Control Procedure is detailed in DTL-DPM001-017-20 Document Control Procedure and defines numbering, version control systems and distribution lists used.

11.6.3. CHANGE MANAGEMENT

All changes to DPM procedures follow DPM's Change Management Procedure. This procedure can be found in *Annex 17 – Management of Change Procedure*

11.7. LOGS AND RECORDS

DPM will maintain a log of all key events taking place at DPM. These will be made available to the CAA upon request.

The Client and their Remote Pilot are required to maintain adequate logs of any operation to ensure that suitable evidence can be provided for both investigation and review should an issue come to light.

As part of the post flight procedures clients are required to provide a download of the flight logs from the UAS.

DPM will require a copy of both pilot and UAS logs and records, either digital or written as part of the Post-Flight Report. These will be stored on a secure server, administered by the DPM team. Data is automatically backed up at regular intervals. DPM adheres to the Data Protection Act 1998, which governs the collection, processing and disposal of data held about individuals and the rights of individuals to access this data. All DPM UAS operations will adhere to the DPM Data Protection Policy.

Logs and records that are to be kept and filed are:

- Pilot logbooks
- Pilot qualifications
- Pre-deployment forms
- On-site survey forms
- Risk assessments
- Flight authorisation forms (if required)
- Maintenance forms

12. INCIDENT INVESTIGATION AND MANDATORY OCCURRENCE REPORTING

12.1.1. INCIDENT DEFINITION AND HANDLING

An incident is judged to have occurred when the flight deviated from that detailed within the Trials Programme.

In the event of any incident occurring the severity must be assessed. The following lists are designed to identify the two categories of incident:

Minor Incident:

- An unplanned event which occurs within the TDA and is managed successfully by the UAS Operator and DPM personnel using the procedures in place. Examples include an Emergency Services entry into the TDA, an incursion into the contingency volume by the UAS which is subsequently returned to the Flight Volume, damage occurs to the UAS and the incapacitation of the UAS Operator where the Assistant successfully intervenes and returns the UAS to DPM without further incident.
- Any unusual or unexpected flight behavior from the craft which does not result in damage or loss.
- Any failure of any aircraft system which does not result in damage or loss.

Major Incident:

- An unplanned event which either occurs out with the TDA or one which occurs within the TDA but is not managed successfully using the procedures in place. Examples include a UAS incursion into the Emergency Volume, a UAS fly-away or crash and a deviation from the procedures where the UAS Operator has deemed a safer alternative to required.
- Any unusual or unexpected flight behavior from the aircraft which results in damage or loss.
- Any significant damage to the aircraft caused by an aircraft system failure.
- Any significant danger or damage to persons, possessions or property during flight operations.
- Any public encroachments or aircraft incursions which required preventative measures to be actioned.

When a minor incident occurs the procedures normally require the UAS Operator to abort the mission and return to DPM. **When a major incident occurs the UAS Operator must abort the mission and return to DPM.**

Where an accident or incident occurs the immediate actions to be taken are detailed in *Appendix 12 - Incident, Accident and Near Miss Procedure*

12.1.2. INCIDENT REPORTING

All Incidents will be reported. The Post-flight report will detail all incidents using the templates in *Appendix 12 - Incident, Accident and Near Miss Procedure*

Minor Incidents will be reviewed by DPM and an assessment made as to whether they merit immediate further investigation and a suspension of operations. All minor incidents will be reviewed by the Safety Action Group (SAG) and be made available to the Regulator for information.

A **Major incident** will result in an immediate suspension of the Trials Programme and an investigation by DPM, supported by the UAS Operator. All major incidents will be reported to both the Safety Action Group and the Regulator.

Before recommencing the trials Programme the following must have taken place:

- Where a technical issue with the UAS resulted in the incident occurring the trials programme may only re-commence when the UAS Operator is content that any repair or replacement returns the UAS to the standards defined in their Operational Safety Case (OSC).
- Where an incident is the result of the UAS Operator error the UAS Operator must either be replaced or undergo sufficient remedial training so that the UAS Operator meets the standards defined in the client's Operational Safety Case (OSC)

Following an incident of either category, DPM reserves the right to keep operations suspended, consult the Regulator or cancel the Training Programme.

Should any costs be incurred beyond that of DPM or client personnel in reporting and incident, conducting of an investigation or other follow up activities these will be the responsibility of the Client.

12.1.3. INCIDENT INVESTIGATION

All **Minor** and **Major incidents** will be subject to an immediate investigation lead by the DPM representative.

The incident investigation procedure can be found in *appendix 12*.

12.1.4. MANDATORY REPORTING REQUIREMENTS

Mandatory Occurrence Reporting will be completed as required by the NAA. For instance, occurrence reporting in the UK and the rest of Europe is described by CAP 382

('Mandatory Occurrence Reporting Scheme'), and is governed by European Regulation 376/2014, which requires the reporting, analysis and follow-up of occurrence in civil aviation and delivers a European Just Culture Declaration. An 'occurrence' is defined as any safety-related event which endangers or which, if not corrected or addressed, could endanger an aircraft, its occupants or any other person.

The relevant compliance document for UAS operations carried out in the United Kingdom is the UK ANO 2016, which states that "Any incident which endangers or which, if not corrected, would endanger an aircraft, its occupants or any other person" is a reportable occurrence.

Mandatory Occurrence Reporting

Mandatory Occurrence Reporting (MOR) will be carried out via the Aviation Safety Reporting portal at

- ECCAIRS @ www.aviationreporting.eu

In the event that a person is injured or killed, the DPM or other nominated DPM staff (such as the Accountable Manager) will contact the UK Air Accident Investigation Branch (AAIB)

- 24-hour hotline (+44 1252 512 299).
- Following registration of the incident, the AAIB will advise as to whether any additional information is required.
- The above ensures compliance with CAP 393, Section 226.

Airprox Incidents

If an 'air proximity' (Airprox) incident has occurred, such as the incursion of another air user into UAS airspace, an Airprox report will be filed using the UK Airprox Board's online reporting platform

- www.airproxboard.org.uk

For clarification, an Airprox is defined as:

'a situation in which, in the opinion of a pilot or air traffic services personnel, the distance between aircraft as well as their relative positions and speed have been such that the safety of the aircraft involved may have been compromised.'

(Source: https://www.airproxboard.org.uk/File-an-Airprox/File-an-Airprox/)

12.1.4.1. Incident Source Documents

The Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996.

Regulation (EU) No. 996/2010 on the investigation and prevention of accidents and incidents in civil aviation.

Regulation (EU) 376/2014 on the reporting, analysis and follow-up of occurrences in civil aviation.

ICAO Annex 13 – Aircraft Accident and Incident Investigation.

12.1.4.2. Points of Contact

All points of contact for DPM, emergency services and aeronautical can be found in Appendix 19.

Additional guidance on MORs (Mandatory Occurrence Reports) and VORs (Voluntary Occurrence Reports) can be found on the CAA website: https://www.caa.co.uk/Our-work/Make-a-report-or-complaint/MOR/Occurrence-reporting