

The University Of Edinburgh
School of GeoSciences

RPAS Operations Manual – Internal & Private Operations

This Operations Manual covers the following aircraft & purposes:

Type	Class	Aerial Work	Private / Internal
All	Fixed Wing, <20 kg	No	Yes
All	Multi-Rotor, < 20 kg	No	Yes



Bormatec UAV Explorer

Amendment Record

Rev.	Date	Author	Comments	Signature (T. Wade)
R0-1	2015-11-05	Tom Wade	Initial first draft of combined document, parts ABC.	
R1-1	2015-11-23	Tom Wade	Initial release version for Safety Committee Approval	
R1-2	2016-04-12	Tom Wade	Internal references (appendices) renumbered and updated	



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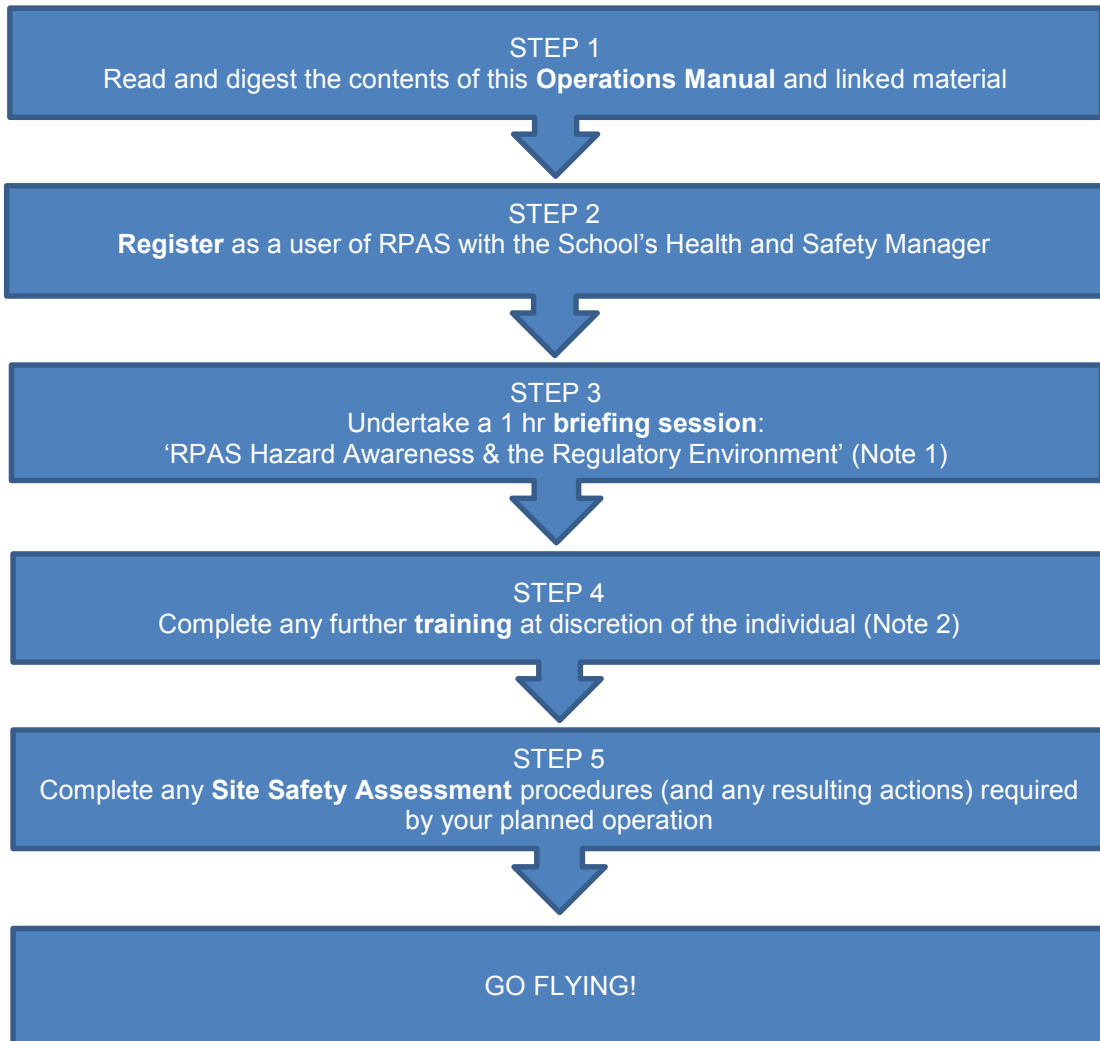
Terminology

Abbreviation / Term	Meaning
Aerial Work operation	Broadly interpreted as 'commercial', although in fact somewhat broader in scope. UK CAA have informed us (T. Wade, ~ 22 June 2014) that research grant and teaching operations would not be considered by them to constitute aerial work.
ATC	Air Traffic Control
CAA	Civil Aviation Authority
CANP	Civil Air Notification Procedure (similar to NOTAM, but military only; faster and simpler to implement than NOTAM, but limited to the HRA only for UAS activities)
FPV	First Person View (on-board camera with real time transmission to the ground control station, which the pilot can view)
FRC	Flight Reference Card (template provided in Appendix D6)
GEC	Ground Environment Controller
GCS	Ground Control Station
GSO	Ground Station Operator
H&S	Health and Safety
HRA	Highlands Restricted Area (reserved area covering large parts of Scottish Highlands for military flight training)
LROE	Low Risk Operation Exemption (applies to the need to complete the full SSA documentation, but does not exempt the PIC from the responsibility to undertake equivalent checks independently)
NOTAM	Notice to Airmen (text information regarding aerial activities and restrictions checked routinely by pilots of conventional aircraft (both civil and military) before flight)
Ofcom	Office of Communications (the UK regulator for radio frequencies etc)
OM	Operations Manual
PIC	Pilot In Command
RPA	Remotely Piloted Aircraft
RPAS	Remotely Piloted Aircraft System
SSA	Site Safety Assessment (form provided in Appendix 2)
SUA	Small Unmanned Aircraft (<20 kg in UK)
SUSA	Small Unmanned Surveillance Aircraft
TS	Task Specialist
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System
UoE	University of Edinburgh
UoE-AG	University of Edinburgh – Airborne GeoSciences (facility)
UoE-SoG	University of Edinburgh – School of GeoSciences
VFR	Visual Flight Rules
VLOS	Visual Line of Sight

OM Part A - Introduction

A1 QUICK START SUMMARY

All new RPAS users within the School of GeoSciences (in particular those planning to act in the role of pilot) should please follow the steps outlined below:



Note 1:

These briefings are provided by the Airborne GeoSciences Facility, and are available either for groups or individuals on demand; normally it will be possible to accommodate a request for a briefing within a couple of days, but please allow as much time as possible to ease scheduling.

Note 2:

Additional training may involve one or more of the following approaches, at the discretion of the individual:

- Formal CAA approved training
- Type-specific training by the aircraft manufacturer
- Structured internal training program (Airborne GeoSciences Facility)
- Informal internal training (i.e. buddy-system with more experienced users)
- Progressive self-familiarisation and training



A2 Scope

This document provides a simplified and abbreviated set of procedures, limitations and guidelines for application by any UoE School of GeoSciences staff or student engaged in operating Remotely Piloted Aircraft Systems (RPAS; also known as Unmanned Aerial Vehicles (UAVs), Unmanned Aerial Systems (UAS) and 'drones').

This document covers **ONLY internal, private operations within the normal UK regulatory environment**, and is NOT applicable for any operation that may be considered to fall under the category of 'aerial work' or that requires reduced separation minima from people, vehicles, vessels or structures. The contents are based around the specific regulations within the UK; for any overseas operations local national regulations must also be applied.

A3 Safety Policy

This manual covers basic requirements and guidelines to ensure that all non-commercial (i.e. non- 'aerial work') UoE-SoG operations of small RPAS (<20kg) are conducted to an acceptable level of safety and in accordance with the applicable regulations, including compliance with the following:

- General requirements from the Health and Safety Executive
- RPAS specific legal requirements from the UK CAA
- Specific requirements from UK OFCOM regarding radio frequency allocation

A4 National Perspective

This document is based around **UK national regulations** for RPAS operations.

Regulations covering these types of aircraft are currently laid down at the national level, and DO vary considerably between countries. Any crew planning to operate RPAS overseas must check the applicable local regulations well in advance to identify any additional limitations and / or any requirement for additional approvals, exemptions or permissions. A checklist to this effect is included in the site Safety Assessment.

When operating overseas it is **required** that any local operational regulations and limitations be complied with at all times; where any requirements laid out in this manual (based on UK regulations) are more restrictive than local regulations, it is **recommended** that the more restrictive case be applied. Where no local regulations are in place (e.g. some developing countries), it is **recommended** that the requirements laid out in this manual should be applied in full.

A5 Document Control and Amendment Process

This document is controlled by the School of GeoSciences' Health and Safety Manager.

The initial release version and any subsequent significant revision will be subject to the approval of the School's Health and Safety Committee which meets quarterly; if for safety or regulatory reasons any urgent changes are required, this may be accomplished upon the authority of the Head of School outwith the Committee's meeting cycle.

Suggestions and feedback based on operational experience are welcomed and encouraged; a 'Change Request' form is included as Appendix 8 to this document. Change requests will be collated and if deemed appropriate will be included in the next revision of the document (subject to approval of the School's Health and Safety Committee).



A6 Additional References & Reading

All RPAS users should be familiar with the national regulations under which they operate. For UK operations the following references should be consulted:

- CAA website ([UAS section](#)) – provides up to date information and guidance from the CAA.
- The Air Navigation Order (latest edition) – this is the underlying legal document that lays down regulations for aviation activities within the UK (at least those still legislated at national level), including UAS. This is reproduced via the CAA as [CAP393](#). Specifically see Articles 253, 138, 166, 167.
- UK CAA [CAP722](#) – guidance material specific to Unmanned Aircraft from the UK CAA. This includes small UAS, but also other categories as well, so please don't be put off by the size of the document – the relevant sections are very informative and quite manageable.
- UK CAA [CAP382](#) - outlines requirements for mandatory reporting with respect to aviation incidents and accidents (see also Part H below)

A7 In-House Documentation and Server Space

The Operations Manual, associated Appendices and any general internal guidance material are available on the UoE-SoG Health and Safety web pages here. **[NB this is yet to be set up, pending Safety Committee approval of the OM]**

Shared server space is made available for RPAS material and records is available at:

<\\csce.datastore.ed.ac.uk\csce\geos\groups\rpas>

All registered RPAS users will be given access to this server space, and any other interested parties will also be given access upon request. Further information on use of this space will be given on the H&S web-pages for RPAS.



OM Part B - Aircraft Technical

B1 Airworthiness

There are no specific airworthiness criteria laid out by the authorities governing small RPA used within visual line of sight. There is however a legal requirement for the pilot-in-command (PIC) to ensure that all appropriate measures are taken to ensure the safety of the flight (ANO Articles 138, 166), which may be taken to include checking that the aircraft is technically fit to fly.

As an absolute minimum this should involve a thorough pre-flight check of the aircraft, to confirm that all parts are properly attached, that the avionics and on-board software are appropriately configured, and that batteries are properly charged and in good condition etc. (in most cases a short list of type specific items will be provided by the manufacturer). Such a pre-flight checklist is **required** for all UoE-SoG RPA flights.

If a suitable checklist is not available from the manufacturer, a suitable list should be drawn up and documented to ensure that nothing is missed in the field. It is **recommended** that this be formatted as part of a 'Flight Reference Card' for the aircraft (see section below and Appendix 6).

A more thorough approach, which is **recommended** for all UoE-SoG RPA, is to ensure that all maintenance / modifications / repairs, as well as the aircraft's accumulating flight hours, are recorded in a technical logbook for the specific aircraft, so that the PIC can assess the general state and history of the aircraft before flying (this does not, however mean that a pre-flight check is not required).

An even better approach, which is **recommended** (in particular for any high-value aircraft, or any aircraft which is likely to operate in a safety critical environment) is to undertake a regular program of maintenance including preventative measures, such as replacing motors etc. after a certain number of flight hours, in order to avoid failures and crashes.

B2 Operating Limitations and Conditions

Any RPA pilot must be aware of the aircraft's operating limitations, in particular with respect to loading, endurance (these will be closely linked), and acceptable weather and environmental conditions.

Such information is normally available from the aircraft manufacturer, but in some cases test flights may be required to establish safe limitations for a particular aircraft.

If such information is not readily accessible in the form of a manufacturer's manual or similar, then it is **recommended** that it be documented within a 'Flight Reference Card' for the aircraft (see section below and Appendix 6 for a recommended structure).

B3 Frequency Management

In the UK Ofcom establishes stringent **requirements and limitations** with respect to frequency availability and transmitter power, in particular with respect to those frequencies used for direct radio control, telemetry modules and first-person-view (FPV) systems.

Please note that many such systems (in particular telemetry modules and FPV systems) are **NOT** compliant with UK regulations by default, and will need to be configured through on-board firmware etc. in order to meet the UK requirements on power output etc.

Please also be aware that, according to the Ofcom website regarding use of radio equipment on model aircraft:

"Some offences relating to unauthorised use of radio can attract fines of up to £5000 and/or six months imprisonment".



Ofcom provides a summary regarding 'model aircraft' (including UAVs, or RPAS), radio frequency availability and usage [here](#).

Further detailed information regarding the specific bands operated for such purposes by License Exempt Short Range Devices (LESRDs) including RPAS equipment is provided by Ofcom in the UK Interface Requirements document [IR2030](#).

We provide a brief summary table of the most commonly used bands below, but please see also the Ofcom pages above for full, up-to-date details and additional available bands, as well as awareness of potential interference sources (these bands are not reserved exclusively for RPAS use!).

Frequency Band	Bandwidth (kHz)	Use	Maximum Effective Radiated Power (mW)
433.050 to 434.790 MHz	25	Data telemetry	1
434.04 – 434.79 MHz	25	Data telemetry	10 mW
2.4 GHz	-	Direct Radio Control Wideband Data Transmission Applications.	100 mW e.i.r.p. and 100 mW/100 kHz e.i.r.p. density applies when frequency hopping modulation is used; 10 mW/MHz e.i.r.p. density applies when other types of modulation are used
5.8 GHz	-	FPV systems Wideband Data Transmission Applications.	25 mW

B4 Technical Recording

It is **recommended** that a Technical Log is maintained for each RPA operated within the UoE-SoG. This should include the hours flown (a total for each day, rather than individual flights is sufficient), as well as details of any maintenance, repairs or modifications to the aircraft.

An example format is included in Appendix 5 to this document.

Note that such a technical history may be **required** for any aircraft in the event that it is ever used for aerial work, operations at reduced separation, in some overseas countries, or at extended line of sight, at any point in the future; therefore it is **strongly recommended** that technical recording is undertaken for any aircraft where such operations are a future possibility.

B5 Maintenance Program

It is **recommended** that a simple maintenance program be devised for each RPA type operated within UoE-SoG. This may involve, for example, a 10-hourly check on the condition and security of the various parts of the aircraft (conducted carefully at base, rather than under field conditions), and a deeper check, perhaps replacing parts in a 'preventative maintenance' program, every 50 hours (for example).



If using such a program, it is **recommended** that it be outlined within a 'Flight Reference Card' (FRC) for the aircraft (see section below), or, if no FRC is planned for the aircraft, appended to the technical log.

B6 Flight Reference Cards

Some RPA will come equipped with a detailed manual outlining checklists, maintenance, operational procedures, limitations and performance data etc. In such cases normally no further action need be taken, and the manufacturer's manual can be used as the sole reference for such information.

Where such information is not readily available, or is incomplete, it is **recommended** that an in-house 'Flight Reference Card' be drawn up to provide a single ready reference for technical information, checklists and procedures etc.

An example of a **recommended** format is provided as Appendix 6 to this document.



OM Part C Flight Crew & Training

C1 Responsibility of the Pilot-in-Command (PIC)

The PIC has overall responsibility for the safe and legal conduct of the operation; he/she has full authority to cancel or postpone the operation at any time if in any doubt that it can be completed safely and legally.

It is essential that any crew (including any other members of the flight team) is aware of this responsibility, and has received appropriate training to allow them to act accordingly, prior to un-supervised operations.

C2 Flight Crew Composition

In addition to the Pilot-in-Command (PIC), there will frequently be additional crew members involved in an RPAS operation.

From a regulatory perspective there are no specifically defined roles, and to a large extent the discretion of the PIC may be applied to determine the size and composition of a suitable flight crew. There are however some commonly used terms to describe the nature of various roles which may be useful:

Spotter:

Responsible for increasing the lookout for other aircraft, for helping to control the ground environment (e.g. interacting with the public to help ensure that separation minima are maintained), and helping to set up ground equipment and control point markers etc.

Ground Station Operator (GSO):

Responsible primarily for monitoring and operating any 'Ground Control Station' used to interact with the aircraft via telemetry. It is essential that this be done only in coordination with and under the instructions of the PIC, however, and that clear operational and communication protocols be established between the GSO and PIC to avoid any potential confusion. This role can also include those of the 'Spotter', but is of a more technical nature and will require some specific training on the ground station software and telemetry etc. This role may also be known as the Ground Station Commander (but beware of any confusion as to who is actually in command of the operation!).

Ground Environment Controller (GEC):

Responsible for controlling the ground environment (or coordinating the efforts of Spotters to this effect), in particular where there is elevated risk of public incursion threatening the required separation minima, or where there are other ground hazards (for example this could be the person designated to manage bear hazard in arctic environments).

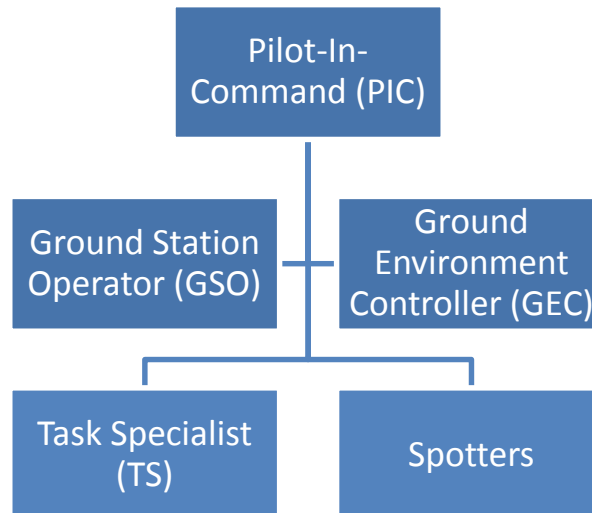
Task Specialist (TS):

Responsible for managing, and possibly operating, the scientific payload, under instruction from the PIC. This role might also be known as 'Payload Operator' or similar, and can in some cases be combined with the duties of a Spotter, for example.

C3 Flight Crew Organisation & Communication

The PIC will be responsible for organising the flight team at his/her discretion. It is **required** however that, whatever the structure employed, the roles, responsibilities, and chain of command are clearly communicated to all involved. This should be undertaken during a thorough pre-flight brief on the day of operations or, preferably, ahead of time in order to allow additional preparation if required.

An example organigram for a typical field team (for a fairly complex operation) is given below.



It is also essential that due thought is given to the means by which the team will communicate in the field. It is **strongly recommended** that two-way handled radios be used by all team members. Suitable equipment will be available from The AG facility upon request.

It is also **recommended** that for larger teams the GSO, GEC or equivalent is used to filter communications from the broader team, before passing critical information to the PIC. This will reduce the likelihood of pilot distraction and overload during critical phases of flight. Again, the plan for implementing such a process must be clearly explained to all involved during the pre-flight brief.

C4 Pilot Qualification

For pilots conducting purely internal or private operations, such as training or currency flights, support of research grant projects and support for teaching programs, staying within normal line of sight rules and maintaining at least the normal separation minima from people and property, a formally recognised pilot qualification is **NOT** a legal requirement in the UK, as the UK CAA does not consider these activities to fall under the category of 'Aerial Work' or require a special permission.

It is, however, **recommended** that any pilot expecting to undertake regular flight operations should undertake a formally recognised training and assessment course, if time and budget permit. This will ensure a high standard of professional knowledge and safety as well as establishing connections with the external professional community.

Please note that in some countries such operations DO require an approval and this may involve a recognised pilot qualification. It is therefore **strongly recommended** that local regulations are checked well in advance prior to overseas operations (the Site Safety Assessment form, Appendix 2 contains a summary of the sorts of things to look for when planning overseas operations).

C5 Internal RPAS Pilot Registration

Any UoE-SoG staff member or student planning to act as Pilot-In-Command of an RPAS will be **required** to add their names to a central register of individuals active in this field. This will permit the effective dissemination of any new or updated safety or regulatory information (including, for example, notification of updates to this manual), as well as permitting the School's health and safety management system to maintain a broad overview of such activities. Such an overview could be very important in the event of, for example, an insurance claim. Prospective / current RPAS users should email the School H&S manager with the subject header 'RPAS User Registration'; please include your UUN username to allow provide access to the shared server space.



C6 Internal RPAS Pilot Training

It is **required** that any UoE-SoG staff or student planning to act as PIC for RPAS flight operations should as a minimum complete a 1 hr briefing on hazard awareness and the regulatory environment provided by the Airborne GeoSciences (AG) Facility. This will ensure that a basic standard of knowledge and awareness is present across all active personnel.

At the time of writing, the AG facility is actively developing a concise, structured training program, including theoretical briefings and practical flying exercises, for new RPAS pilots and crews. The facility is also able to provide an immersive (projected) flight simulator system and a number of small, ultra-lightweight indoor multi-rotor aircraft to help develop and maintain basic handling skills. Prospective RPAS crews are warmly invited to engage in this process and make use of these facilities.

It is **recommended** that active RPAS pilots undertake at least 30 mins of flight per month to maintain a reasonable level of currency. This of course can be challenging given busy schedules and poor weather; again, the simulator and indoor platforms available through the AG facility are available to help in this respect.

C7 Crew Health

Pilots, and other members of the flight crew, should only undertake flight operations if they are fit and well enough to do so effectively and without undermining the safety of the operation; it is the responsibility of the individuals involved to assess whether that is the case. Please note that ensuring the fitness to fly of the entire crew can be considered as a legal **requirement** under the PIC's responsibility for the safe conduct of flight.

C8 Pilot Logbooks and Records

Pilots are **strongly recommended** to log their flight times in order to provide a documented record of their experience and currency should the need arise. Such records will also be invaluable should the pilot ever need to obtain a formal pilot qualification, or demonstrate currency following an incident or accident. Example pilot logbook formats are provided in Appendix 5.

OM Part D - Flight Planning & Preparation

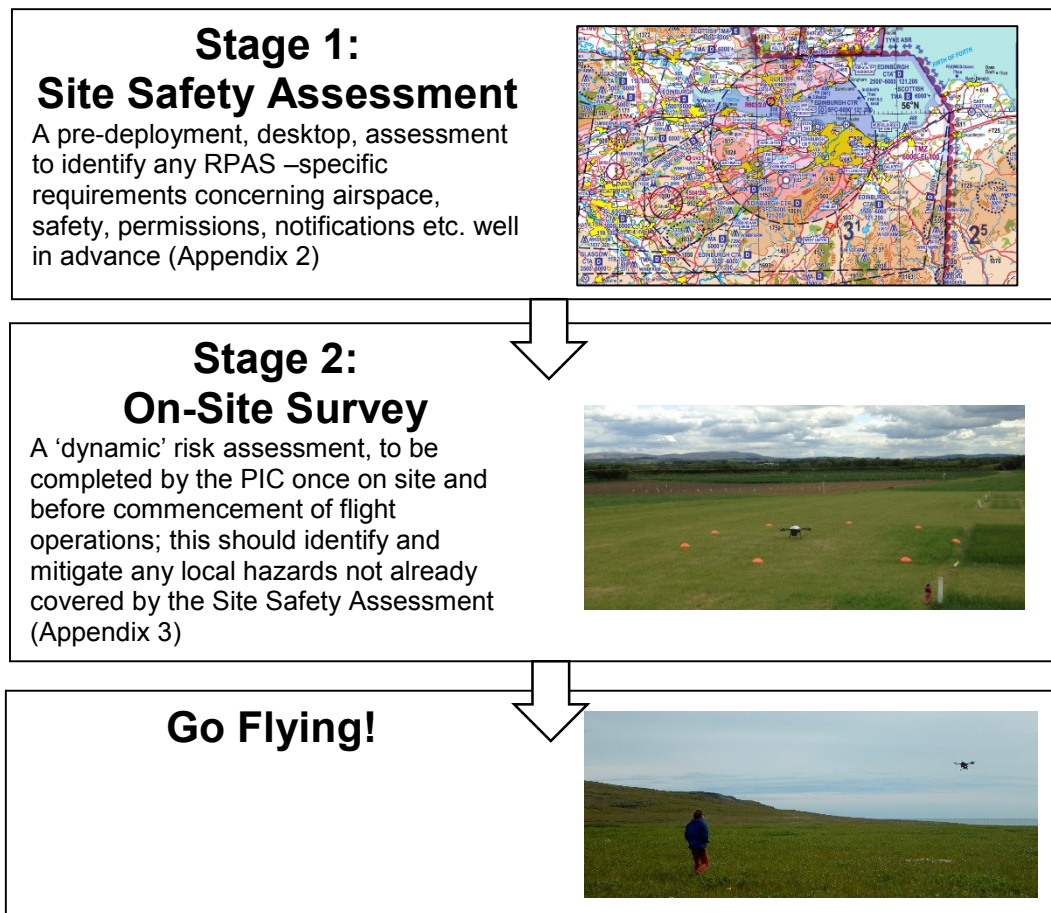
D1 Safety Assessments

UK Health and Safety regulations require that, within an institution such as UoE, an appropriate risk assessment be carried out prior to undertaking an activity.

Following a review of existing risk assessment formats, it was concluded that existing arrangements did not provide a sufficiently specific list of checks and procedures to be considered as appropriate for RPAS operations, in particular with respect to potential hazards to, and arising from, the aeronautical environment (e.g. other aircraft, potentially high energy crashes etc.)

Consequently a new, simple, set of safety assessment procedures has been designed, based upon CAA guidance material, to provide a specific checklist of aeronautical considerations and hazards arising from RPAS operations. The admittedly rather prescribed format is particularly important within the academic / research environment, where the majority of RPAS crews operate without formal training or qualification; however we have done our best to ensure that the process is proportionate and not overly burdensome.

UoE-SoG will normally **require** a two stage operational safety assessment and planning process:



The forms for this process (Site Safety Assessment and On-Site Survey) are available as Appendices 2 and 3 to this document.

Completed SSA forms should be forwarded to the School of GeoSciences Health and Safety Manager and to the Airborne GeoSciences (AG) facility manager (who, as professionally qualified pilot, will provide an independent check on aeronautical considerations). Note that the AG facility manager check will NOT be



required when the individual submitting the SSA holds a full nationally (CAA) recognised RPAS pilot qualification.

Whenever possible please submit the completed SSA for the above sign-offs at least **2 weeks** prior to the planned operation.

The AG facility manager is also available to assist with the initial assessment, coordination with any authorities, and to help arrange any permissions or notifications as may be required, but please allow plenty of time for this process, especially for overseas operations or in complex or busy areas.

D2 Low-Risk Operation Exemption from the Full SSA

It is permissible, but generally **not recommended**, to skip the full Site Safety Assessment form ('stage 1' above), for certain types of operation that are deemed to be of very low risk by their nature. This will only be permissible under some very specific conditions, namely:

- UK operations only
- Not within 5 nm of an aerodrome or airport
- Multi-Rotor RPA with mass not above 7 kg
- The aircraft will be operated at **not more than 30 m above ground level**
- The aircraft will be operated at **not more than 60 m horizontally** from the PIC
- The separation minima described in the flight operations section below are met in full, with no potential for public access within the flying area
- A full On-Site Survey (stage 2 above) must still be performed according to the provided format including a thorough risk assessment of aeronautical and other hazards
- Landowner permission must still be granted and documented on the On-Site Survey form

ALL of the above conditions must be met in order to work under a Low-Risk Operation exemption, and only then at the discretion of the PIC.

When working under a Low-Risk Operation Exemption, the PIC assumes responsibility for the decision to use this route and should in any case conduct an informal assessment of the general aeronautical context in well in advance.

For insurance purposes it is, however, important that the School is at least aware of such operations. All operations under a Low-Risk Operation Exemption are therefore **required** to be notified to the Health and Safety manager in advance using the form provided in the Appendix 4 to this document, which should normally be submitted at least 2 days prior to the operation. No response or approval is required from the School Health and Safety Manager.

D3 Landowner Permission

Documented permission of the landowner (or an approved representative) will always be **required** prior to operating from a particular site.

The permission should, where possible, be in the form of either a printed email attached to the SSA Form or as a written signature obtained from the client captured on the SSA Form (Appendix2).

If this is not possible, a contemporaneous note of verbal consent may be made in the relevant section of the SSA form. If using this method, please ensure that the landowner (or representative) is aware that you are making a record of their consent.

If the Low-Risk Operation Exemption from the full SSA procedure is being applied then a note of the landowner consent may be made on the LROE form (Appendix 4).



D4 Issuing Notifications

D4.1 Air Traffic Control

Although small RPAS with a mass of <7kg are not legally required to obtain an ATC permission to operate in controlled airspace, it is certainly good practice from a safety perspective to inform the appropriate ATC unit of any plans to operate within, or even adjacent to, controlled airspace or within a few miles (typically 5 nm radius) of any aerodrome or airport.

It is therefore **strongly recommended** that any UOE-SoG small RPAS crew operating within controlled airspace or within 5 nm of any aerodrome or airport should notify the appropriate ATC unit of their intentions in advance. Normally (for Edinburgh ATC at least), the ATC unit will request a courtesy call prior to commencing operations, a second call upon completion.

NOTE: Any RPAS >7 kg **must** receive a specific **permission** from the relevant ATC unit prior to flying within controlled airspace; this is the law.

D4.2 Other Aircraft (NOTAM)

Where there is a potential conflict with other airspace users, in particular, for example, in areas of frequent military traffic outside of controlled airspace, it is **strongly recommended** that contact should be made with the CAA Airspace Utilisation Section (CAA-AUS) to discuss the possibility of raising a 'Notice to Airmen' (NOTAM) to cover the planned activities. This should be done as far in advance as possible to allow time for the CAA-AUS to process the application (a few weeks is desirable if possible). Contact details can be found on the CAA website.

NOTAMs are checked by all conventional aircraft pilots (including civil and military crews) prior to flight to identify and avoid any other aerial activity along their flight path, so issuing a NOTAM is a good way to reduce the probability of potential mid-air collision and improve operational safety.

D4.3 Military Aircraft (CANP – Highlands Restricted Area Only)

The Civil Air Notification procedure (CANP) should be used for any operation within the Highlands Restricted Area (HRA), unless a NOTAM has already been raised for the operation. In any case, the RAF's low flying booking cell should be consulted well in advance to arrange permission to operate in this area during any period that it is active.

CANP notifications are similar to NOTAMs, except that only military crews have access to them. Unfortunately we are informed that CANP can now only be issued for RPAS activities within the Highlands Restricted Area, and not in any other airspace. Outside of this airspace, NOTAM should be used, when required, and will also be visible to military crews.

D4.4 Police

If the planned flight operation is to take place in an area where there is likely to be significant public activity, it is **recommended** that the local police are informed in advance via the police non-emergency number. This should avoid any time-wasting challenge or interference during the operation.



D5 Information Sources

D5.1 General Topographic / satellite data etc.:

- Client / project Information
- Google Earth
- [Google Maps](#)
- Ordnance Survey data e.g. [Memory Map](#) (electronic)

D5.2 Aeronautical Charts & Information (UK):

- **Current UK CAA VFR Aeronautical Charts:** Available electronically from [Memory Map](#); paper copies also available from various pilot shops (e.g. Transair, FlightStore etc)
- **ATC contact details (airports):** use the UK IAIP package on the NATS website; go to IAIP tab / [Aerodrome index – Specific](#) then open the list applicable to the aerodrome of interest. Open the 'Textual Data' document, and the ATC contact information will be there under section AD 2.2 (normally the 'watch manager' number is appropriate).
- **Danger / restricted / prohibited area contact details:** use the UK IAIP package on the NATS website; go to IAIP tab / [Enroute Information – ENR Index](#) then open the document under Section ENR 5.1.
- **Aerial sporting / recreational site contact details** (e.g. gliding / microlight sites, parascending etc.): use the UK IAIP package on the NATS website; go to IAIP tab / [Enroute Information – ENR Index](#) then open the document under Section ENR 5.5
- **Military training / intense activity area contact details:** the UK IAIP package on the NATS website; go to IAIP tab / [Enroute Information – ENR Index](#) then open the document under Section ENR 5.2.
- **United Kingdom Airspace and ATC information, general:** [NATS Aeronautical Information Services](#)
- **Online Chart (non-official) / NOTAM data:** [Sky Demon Light](#)

D5.3 Overseas Regulations and Aeronautical Data:

- **Regulatory information:** National Aviation Authority web sites and linked documents
- **Airspace / ATC information:** the national Aeronautical Information Publication (AIP) – find via web search. Note that the general format and structure should be common to most countries, so try the sections identified above in the first instance.
- **Aeronautical charts:** various pilots supplies stores, e.g. [Transair](#), [Flightstore](#), Aircraft Spruce etc. Also consult UoE-AG manager to check whether UoE-AG has any existing charts (electronic/hardcopy).
- **Electronic charts:** Non-official charting is available from [Sky Demon](#)

Crews are encouraged to seek advice from the UoE-AG facility manager whenever required.

D5.4 Weather Information (Long Range):



- Any reputable weather forecasting service (e.g. Met Office, BBC etc)

D5.5 Weather Information (Short Range)

All larger airports are provided with an excellent short range weather forecasting service known as TAF, and real time observations known as METARS. These can provide very detailed high quality local weather information, if operating RPAS within a reasonable distance of the airport, including temperature, wind speed and direction, gusts etc. TAFs are normally issued for 24 hrs periods, but generally the best information is within the first 9 hrs or so of the forecast. They are updated at regular intervals (typically 3 hourly).

It is **recommended** that RPAS crews obtain any local TAFs and METARs as part of their on-site survey process.

TAFs and METARs are available from the Met Office aviation website [here](#) (requires a FREE login).

Alternatively, and probably better for RPAS users, there are various apps available for iOS and Android to allow searching for aviation weather; these will normally include a 'decoded', plain text, summary of the bulletin. For example, AeroWeatherPro is a good app for iOS.

In any case, it is **strongly recommended** that local weather conditions, in particular wind speed and direction, are measured and recorded pre-flight.

D5.6 Other Aerial Activities (NOTAMs)

It is **required** that the PIC should self-brief regarding any other local air activity on the day of planned flight operations; this can be done by checking the published Notices To Airmen (NOTAMs). This can be done in advance, but should also be checked on the day itself in case of any short notice informatio



OM Part E – Operating Procedures

E1 On-Site Survey

Upon arrival at the operating site location, it is **required** that the Pilot-In-Command will carry out an On-Site Survey (see section D1 Above) to familiarise themselves with the local geography of the site and to identify and mitigate any unforeseen hazards. This should normally involve physically walking around the area in question. Any findings should be recorded using the On-Site Survey Form.

If the Pilot-In-Command feels confident that the proposed flight operations can be safely carried out then the operation can progress to the next stage.

E2 Take-off / Landing Zone and Alternate Selection

The Pilot-In-Command should select a Take-off and Landing zone based on the following criteria. An alternative or emergency landing zone should also be selected - this area should be available to land in if the first location becomes inaccessible. Selection criteria should include:

- Full visual coverage of the operating site.
- Position in relation to the sun to avoid visual impairment.
- Physical obstacles such as overhanging trees, rocks, buildings, power lines etc.
- Terrain topography, avoid steep slopes or uneven ground.
- Consider effects such as wind shear from nearby trees, buildings etc.
- All buildings and persons not under the control of the Pilot-In-Command must remain 30 metres away from the aircraft for Take-Off and 50 metres in flight.

E3 Meteorological Checks

The PIC for the operation should assess the local weather conditions and ensure that they are within limits for the operation, and the type of aircraft employed. It is **strongly recommended** that as a minimum the average and peak wind velocities, and direction, are measured directly (e.g. hand held anemometer), and local weather forecasts and reports (including aeronautical TAFs and METARs) should be consulted when available.

E4 Crew Briefing

The PIC should provide a thorough briefing outlining the planned operation and individual roles and responsibilities for any additional crew. Such a briefing is a **requirement** for safety purposes. This briefing must be carried out before any flight operations take place. It is **recommended** that, if possible, a Pre-Operation crew briefing should be given on the day before a flight operation is to take place so that all crew members can be prepared on the day.

It is also **recommended** that, upon completion of any RPAS operation, the PIC and crew debrief and identify any areas of good practice, as well as any areas that can be improved, and document this in the space provided on the On-Site Survey form.

E5 Cordon Procedure

The Pilot-In-Command will confirm once on site what level of cordon is appropriate; this will normally also be considered at the SSA planning stage and documented accordingly. Implementation of a cordon



procedure of some type is **recommended** for all operations, and **required** where there is any potential for public incursion within the operating area.

If large numbers of the public are expected then a cordon should be established fifty metres around the planned flight path and should include:

- Hi-visibility cones and / or safety tape
- Signs advising members of the public that RPAS flight operations are in progress.
- Extra spotters may be positioned at gates or on public footpaths to advise members of the public about the dangers of entering the area.
- Gates may be closed, access may be restricted but spotters may not detain any members of the public or prevent them from accessing public rights of way.

Note: The role of the spotters is to advise on the dangers of entering the operating area and to advise the PIC about public encroachments.

If the location is set in a more remote area then a local cordon around the take-off and landing zone may be utilised, this can be as little as four cones set out into a five metre square.

Examples of cordon signs are provided in Appendix 7.

E6 Pre-Flight Checks

Pre-flight checks provide an essential opportunity to ensure that the aircraft is fully ready and fit to fly; this is a legal responsibility on the Pilot-in-Command, and such checks are therefore required under this operations manual.

In many cases the manufacturer's manual will include appropriate checklists, which may be sufficient. In other cases it may be necessary to draw up an appropriate checklist, which is recommended to be included in a 'Flight Reference Card' for the aircraft (see Appendix 6 for an example template).

In any case the pre-flight checklist should cover the following areas as may be applicable to the specific type:

- R/C Range checks
- Telemetry communication checks
- GPS satellite reception checks
- Correct attachment of scientific payload
- Correct balance of scientific payload
- Checking of critical power / signal connections, solder joints etc.
- Checking security of fasteners / fixings
- Checking of mission upload integrity
- Any pre-flight IMU & compass calibrations / checks

E7 Minimum Separation Requirements

The PIC will be responsible for ensuring that the minimum separation **requirements** outlined below are maintained throughout the flight operation. These separation minima are established under UK law for any small RPA that carries any form of 'surveillance or data acquisition' equipment (called Small Unmanned Surveillance Aircraft, or SUSAs), which can be taken to include virtually any scientific payload; thus for any instrumented RPA these minima are **required**.

The same minima are **strongly recommended** to be applied to ALL RPAS operations, irrespective of whether the aircraft is instrumented (for example purely training platforms with no camera).

For OVERSEAS operations, it is **required** that the local national regulations must be complied with in all cases; it is **recommended** however that, if more restrictive, the UK regulations still be applied.

UK Minima:

- **Take-Off and Landing:** Not less than 30 m from any person, vehicle, vessel or structure not under the direct control of the PIC
- **In-Flight:** Not less than 50 m from any person, vehicle, vessel or structure not under the direct control of the PIC
- **At all times:** Not less than 150 m from any congested area or gathering of 1000 persons or more

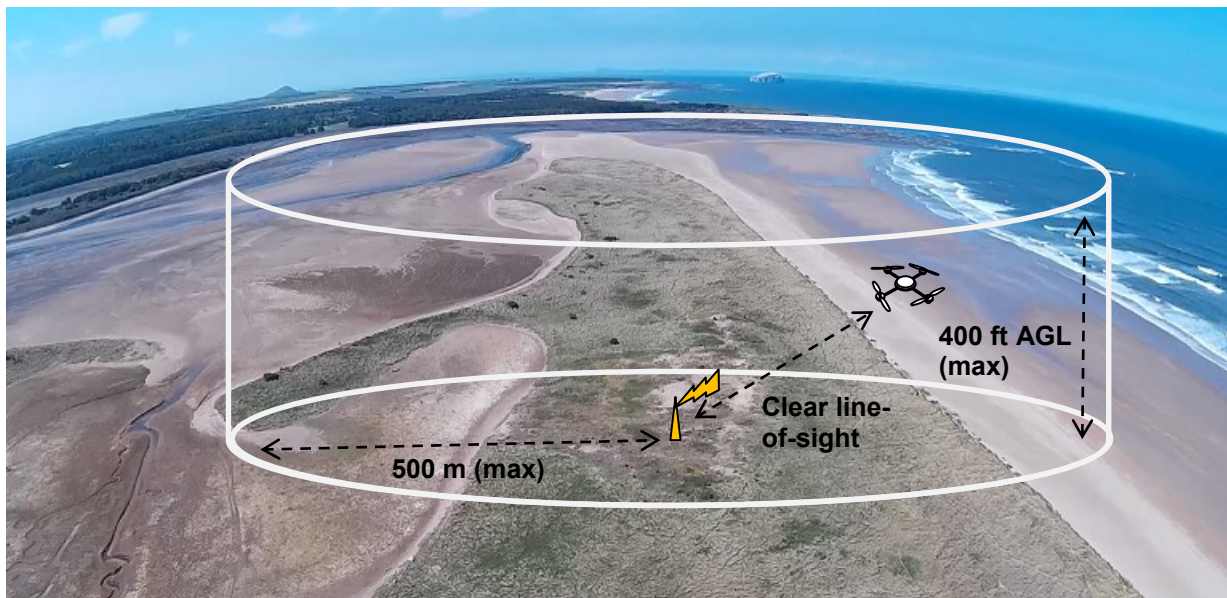
E8 Maximum Range Limitations ('Visual Line Of Sight', VLOS)

The PIC will be responsible for ensuring that the maximum range **requirements** for visual line of sight outlined below are complied with throughout the flight operation. These limitations are established in UK law for all small RPAS operations (unless a specific permission is obtained from the CAA to operate at extended ranges).

Note that national regulations DO vary and local regulations must be checked and complied with if operating overseas.

UK Limitations:

- Maximum 500 m horizontal distance from the operator (less if visibility/controllability will be impaired)
- Maximum of 400 ft vertically above the ground (again, less if visibility/controllability will be impaired)
- A clear line of sight must be maintained at all times (i.e. RPA must not pass behind obstacles)



E9 Normal Checklists

It is **strongly recommended** that checklists be utilised for normal flight operations, covering the preparation, start-up, take-off, in-flight, recovery and shutdown phases. In some cases the manufacturer



of the RPA will provide suitable checklists/procedures, but where this information is incomplete or unavailable it may be necessary to draw up procedures and checklists locally; in such cases it is **recommended** that they form part of a 'Flight Reference Card' for that type of RPA.

For larger and more complex types, failure to follow proper procedures may represent a hazard, and for such types the use of checklists through all stages of flight should be considered a **requirement**.

The use of such checklists greatly enhances efficiency and reliability in the field, as well as promoting safe and standardised practice. Ultimately an operation is much more likely to deliver good scientific results if conducted according to pre-planned, professional operating standards.

E10 Emergency Checklists

It is **required** that checklists be available covering all main potential failure modes of the particular type. In some cases the manufacturer of the RPA will provide suitable checklists/procedures, but where this information is incomplete or unavailable it may be necessary to draw up procedures and checklists locally; in such cases it is **recommended** that they form part of a 'Flight Reference Card' for that type of RPA. The PIC should always be familiar with the potential failure modes and appropriate actions for the type of RPA which they are operating.



OM Part F - Handling of LiPo Batteries

The Pilot-In-Command is responsible for charging and fitting flight battery packs to the aircraft.

It is **recommended** that all battery packs should be identified by a unique specific identification number applied to the battery pack, and all relevant information recorded in a Battery Charge Logbook.

The following safety precautions must be observed while charging:

- Batteries must be charged in “[Lipo-Safe](#)” protective bags using the correct specific battery charger in line with the manufacturer’s guidelines.
- Charging must be undertaken on a fire resistant surface.
- A safe exit route must be maintained throughout charging (e.g. do not charge next to the only available exit of a room).
- Batteries must never be left unattended whilst charging.
- A fire extinguisher, and if practical, a bucket of dry sand, must be present when charging battery packs.
- All LiPo batteries will be stored in a storage box marked “LiPO Batteries” (see Appendix 7 for example labels)
- Any battery packs showing anomalies will not be used and must be disposed of through the recognised battery disposal area at the council refuse site.

Before any battery is to be used the voltage should be checked using a battery voltage monitor and checked for any anomalous / faulty cell indications; these may indicate damage and should warrant further checks and probably disposal of the battery. It is recommended that all relevant data be recorded in a battery charge logbook.

If a battery pack is not used in any three month period it must be checked and charged if required.

See this Guide for further Details – [4 Max Lithium Polymer Battery Guide](#)



OM Part G - Indoor Training Operations

Indoor training using small, ultra-lightweight multi-rotor aircraft (e.g. Syma X5C or similar) can provide very useful basic handling practice and overcome some of the initial training objectives of flight control under various orientations etc. without the need to deploy to the field and wait for good weather.

When conducting such operations, no specific risk assessment is required as long as the following simple **requirements** are met:

- Multi-rotor aircraft only
- Maximum mass ~ 500 g
- Propeller guards to be fitted at all times
- No personnel should be in the room who are not directly involved in the training operation.
- The door to the room is to be closed and a sign placed on the outside indicating that indoor RPA flights are taking place and instructing anyone outside to knock and await positive response prior to entering (see Appendix 7 for example signage)
- All surfaces are to be cleared of loose articles and no potentially dangerous articles / substances exposed within the room
- The aircraft should be kept well clear of all persons in the room



OM Part H - Incident & Accident Reporting

H1 Internal Procedures

The School's existing reporting procedures are to be applied to any accidents or incidents occurring during RPAS operations. RPAS crews are **required** to familiarise themselves with the internal reporting system and its application. Please see the School's Health and Safety web pages for more details.

This system will feed back into this Operations Manual via the School's Health and Safety Manager.

H2 Mandatory Occurrence Reporting

In addition to the internal procedures, which provide compliance with general Health and Safety requirements, there exist within the aviation environment specific legal **requirements** for accident and incident reporting.

Mandatory Occurrence Reporting will be completed as required by the National Aviation Authority for the particular country of operation. For example, when operating in the United Kingdom [CAP382](#) will be the compliance document and reporting will be carried out utilising the form [SRG 1601](#).

The UK Air Navigation Order states *"Any incident which endangers or which, if not corrected, would endanger an aircraft, its occupants or any other person"* is a reportable occurrence.