



UNIVERSITY POLICY AND MANAGEMENT PROCEDURE

Unmanned Aircraft Systems

Statement

*This University Policy and Management Procedure was approved and authorised by the Health, Safety and Welfare Committee on **27 October 2015** on behalf of the University of York Council and forms part of the Health and Safety Policy of the University of York.*

This document is University Policy for good health and safety management practice. This University Policy provides Deans of Faculty, Heads of Departments, Heads of College and all managers, staff and students with the necessary information to incorporate healthy and safe practices and relevant procedures into their activities. Divergence from this University Policy may result in Deans of Faculty, Heads of Departments, Heads of College and the University of York being exposed to possible legal proceedings.

The use of this University Policy and the incorporation of its requirements into working practices and activities will ensure that the University of York and its' community achieve compliance with our legal duties with regard to health and safety.

The most recent version of this Management Procedure is available at <https://www.york.ac.uk/admin/hsas/safetynet/atoz.htm>

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POLICY

1. INTRODUCTION

The University of York (University) recognises its' management responsibilities for the risks and hazards associated with work activities involving the use of Unmanned Aircraft Systems (UAS) including Unmanned Aerial Vehicles (UAV/Drones). The University will ensure that all relevant control measures are introduced and implemented to prevent injury or harm to those undertaking work or who may be affected by work activities involving UAS.

The University will NOT operate at the commencement of flight any Small Unmanned Aircraft (SUA) with a combined mass/weight of above 20kgs.

The University will maintain compliance with the Civil Aviation Authority (CAA) guidelines and Civil Aviation Procedures (CAP). The University will also take into account restrictions levied by our Insurance providers. Compliance with this Management Procedure is mandatory.

2. DEFINITIONS

Aircraft

Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the Earth's surface.

Autonomous Aircraft

An unmanned aircraft that does not allow pilot intervention in the management of the flight.

Autonomous Operation

An operation during which an unmanned aircraft is operating without pilot intervention in the management of flight.

Command and Control Link (C2)

The data link between the remotely-piloted aircraft and the remote pilot station for the purposes of managing the flight.

Lost Link

The loss of command and control link contact with the remotely-piloted aircraft such that the remote pilot can no longer manage the aircraft's flight.

Pilot

The person in direct control of the UA (see also 'Remote Pilot').

Remote Pilot

A person charged by the operator with duties essential to the operation of a remotely-piloted aircraft and who manipulates the flight controls, as appropriate, during flight time.

Remotely Piloted Air System

A remotely piloted aircraft, its associated remote pilot station(s), the required command and control links and any other material relevant to the operation of the remotely piloted aircraft system.

Remote Pilot Station (RPS)

The component of the remotely-piloted aircraft system containing the equipment used to pilot the remotely-piloted aircraft.

Small Unmanned Aircraft (SUA)

Any unmanned aircraft, other than a balloon or a kite, having a mass of not more than 20kg without its fuel but including any articles or equipment installed in or attached to the aircraft at the commencement of its flight.

Small Unmanned Surveillance Aircraft (SUSA)

A small unmanned aircraft which is equipped to undertake any form of surveillance or data acquisition.

Unmanned Aircraft (UA)

An aircraft which is intended to operate with no human pilot on board, as part of an Unmanned Aircraft System. Moreover a UA:

- Is capable of sustained flight by aerodynamic means;
- CAA's Civil Aviation Procedure (CAP) – CAP722 Abbreviations and Glossary of Terms (March 2015 Page 20)
- Is remotely piloted and/or capable of degrees of automated or autonomous operation;
- Is reusable; and
- Is not classified as a guided weapon or similar one-shot device designed for the delivery of munitions.

Unmanned Aircraft System (UAS)

An Unmanned Aircraft System comprises individual 'System Elements' consisting of the Unmanned Aircraft (UA) and any other System Elements necessary to enable flight, such as a Remote Pilot Station, Communication Link and Launch and Recovery Element. There may be multiple UAs, RPS or Launch and Recovery Elements within a UAS.

Visual Line-Of-Sight (VLOS) Operation

An operation in which the remote pilot or RPA observer maintains direct unaided visual contact with the remotely-piloted aircraft.

3. CIVIL AVIATION AUTHORITY (CAA)

It is CAA Policy that UAS operating in the UK must meet at least the same safety and operational standards as manned aircraft. Thus, UAS operations must be as safe as manned

aircraft insofar as they must not present or create a greater hazard to persons, property, vehicles or vessels, whilst in the air or on the ground, than that attributable to the operations of manned aircraft of equivalent class or category.

In consideration of the limited aviation background of some UAS manufacturers and operators, the guidance contained herein is necessarily prescriptive. The CAA will supplement CAP722 with further written guidance when required. Rules for Avoiding Aerial Collisions are set out in the Rules of the Air Regulations. For the purpose of UAS operations, the 'See and Avoid' principle employed in manned aircraft is referred to as 'Detect and Avoid'.

Edition 6 of CAP722 introduces a Concept of Operations (ConOps) approach for UAS and moves away from a mass centric classification approach. In doing so it describes how UAS operations should be approached so that all functional areas of the operations are considered.

3.1 Operations

Operating within Visual Line of Sight (VLOS) means that the Remote Pilot is able to maintain direct, unaided (other than corrective lenses) visual contact with the UA which is sufficient to monitor its flight path in relation to other aircraft, persons, vessels, vehicles and structures for the purpose of avoiding collisions. Within the UK, VLOS operations are normally accepted out to a maximum distance of 500m horizontally and 400ft vertically from the Remote Pilot. Operations at a greater distance from the Remote Pilot may be permitted if an acceptable safety case is submitted. For example, if the aircraft is large it may be justifiable that its flight path can be monitored visually at a greater distance than 500m. Conversely, for some small aircraft, operations out to a distance of 500m may mean it is not possible to assure or maintain adequate visual contact.

3.2 Small Unmanned Aircraft Systems in Congested Areas

The Air Navigation Order (ANO) 2009 Article 255 defines the meaning of 'Congested Areas'. The definition states that a 'Congested Area' means any area in relation to a city, town or settlement which is substantially used for residential, industrial, commercial or recreational purposes. Operations of SUA within congested areas may be permitted in specific locations on the basis of a UAS OSC being submitted as part of an application for aerial work. Separation distances from persons, vessels, vehicles and structures (dependent on whether or not they are under the control of the Remote Pilot) must be specified in the UAS OSC.

3.3 Protection of Third Parties

Under ANO 2009 Article 138, operators of SUA must not recklessly or CAP722 Approval to Operate negligently causes or permits their aircraft to endanger any person or property. SUA flights within the densely-populated urban environment have a high probability of causing endangerment unless conditions are put on their use so that they

reduce the risk to third parties, students, contractors or the general public. SUA do not currently have any recognised design, certification or other airworthiness standards and therefore operational restrictions have been established that limit the circumstances and locations at which the aircraft can be operated. Each specific limitation can only be varied or exempted in accordance with a permission or exemption granted by the CAA. For operations in congested areas, a SUA operator will need to apply to the CAA for permission to fly a camera-equipped SUA (i.e. a SUSAs):

- Over or within 150 metres of any congested area.
- Over or within 150 metres of an organised open-air assembly of more than 1,000 persons.
- When not engaged in take-off or landing, within 50 metres of any person, vessel, vehicle or structure which is not under the control of the person in charge of the aircraft (during take-off or landing this may be reduced to 30 metres or less if attendant persons are under the control of the person in charge of the aircraft).

Such a permission would be suitable for those SUA operators that find they are frequently engaged in towns and cities to carry out work for film and TV productions, advertising agencies, marketing or other publicity events, photographic work for large property developments or survey or infrastructure inspections at industrial sites, etc. There is no guarantee that permission can be granted to reduce these distances.

3.4 Standard Permissions

The standard CAA permission for SUA/SUSA in the 7kg or less category allows flight in congested areas to within 50 metres of persons, structures etc. (or within 30 metres if the persons are under the control of the person in charge of the aircraft). This category of SUA/SUSA cannot fly within 150 metres of open-air assemblies of 1,000 people or more where only a standard permission has been granted.

The standard CAA permission for SUA/SUSA in the mass category of above 7kg but not exceeding 20 kg does not normally allow flight within congested areas. An operator may apply, utilising the UAS OSC, to the CAA to have their existing permission varied.

In any circumstances or mass category, it must be noted that flights directly overhead persons and vehicles will not be allowed at any height in a congested area, or otherwise, unless these vehicles and persons are under the control of the person in charge of the aircraft.

3.5 Persons Under the Control of the Person in Charge

Persons under the control of the person in charge of the aircraft can generally be defined as:

- Persons solely present for the purpose of participating in the SUA flight operation.
- Persons under the control of the event or site manager who can reasonably be

expected to follow directions and safety precautions to avoid unplanned interactions with the SUA. Such persons could include building-site or other industrial workers, film and TV production staff and any other pre-briefed, nominated individuals with an essential task to perform in relation to the event.

Spectators or other persons gathered for sports or other mass public events that have not been specifically established for the purpose of the SUA operation are not regarded as being 'under the control of the person in charge of the aircraft'.

In principle, persons under the control of the person in charge of the aircraft at a mass public event must be able to:

- Elect to participate or not to participate with the SUA flight operations
- Understand the risk posed to them inherent in the SUA flight operations
- Have reasonable safeguards instituted for them by the site manager and SUA operator during the period of SUA flight operations;
- Not have restrictions placed on their engagement with the purpose of the event or activity for which they are present if they do not elect to participate with the SUA operation.

Note:

As an example, it is not sufficient for persons at a public event to have been informed of the operations of the SUA via such means as public address systems, website publishing, e-mail, text and electronic or other means of ticketing, etc. without being also able to satisfy the points above. Permissions have, however, occasionally been granted for SUA flights at public events and these involved a segregated take-off site within the main event, with the SUA operating only vertically within strict lateral limits that keep it directly overhead the take-off site. Such flights were also limited by a height restriction and the tolerance of the SUA to wind effects and battery endurance.

3.6 Small UAS – Pilot Competency

The CAA has identified three critical elements which, taken together, constitute acceptable evidence of pilot competency. These three elements are:

- Adequate theoretical knowledge/general airmanship
- Successful completion of a practical flight assessment on the class of SUA that is being applied for; and
- A minimum amount of recent flying experience on the class of SUA that is being applied for.

Although completion of all three elements constitutes acceptable evidence of pilot competency, the CAA also requires the submission and acceptance of an operations manual in each case before the Permission itself can be granted.

The CAA accepts recommendations from approved NQEs in order to grant a 'standard' Permission for aerial work. The traditional NQE route allows an individual with no formal pilot qualifications or experience to undertake a course which can lead to a recommendation to the CAA for a grant of a CAA Permission. The courses cover all of the critical elements mentioned above plus an assessment of the student's operational procedures as set out in their operations manual (Vol 1 of the UAS OSC). On successful completion of the course, the applicant will be granted a certificate by the NQE (typically the Basic National UAS Certificate Small (BNUC-S™)/Remote Pilot Qualification (RPQ), etc). The Permission applicant is then able to apply through the NQE or directly to the CAA for the grant of a CAA Permission that will allow aerial work.

3.7 Aircraft Classification Below 20kg

For this class of aircraft, if conducting aerial work or operating close to third parties or property, the approach is that no airworthiness/certification of the aircraft is required provided that the pilot is capable to safely fly the aircraft, the type of operation can be undertaken within VLOS, within the defined areas of segregation (400ft altitude, 500m radius) and an operating permission is obtained from the CAA. For SUA with a mass of 7kg or less, a full OSC is not normally required for a "standard" permission to operate at least 50m clear of third parties.

Where aircraft of less than 20kg are used purely for recreational purposes, away from third party people or property, the CAA does not impose any regulatory burden. However, whether conducting aerial work or operating for recreational purposes, it is always the responsibility of the pilot to ensure that the use of the aircraft does not pose a threat to any other person, property or aircraft.

ARRANGEMENTS

4. RISK ASSESSMENT

In order to fly a SUA in a congested area, the University will ensure that SUA operators must establish safety and operational control measures that prevent the SUA from endangering the general public. Operators are advised to ensure that their existing risk assessment and operating procedures address the enhanced measures required for congested areas. The procedures must address all relevant aspects of the congested areas they intend to operate within, taking into account any special circumstances or local conditions. Such measures may include but not be limited to the following:

4.1 Segregation

Segregating the activities from public interference by placing physical barriers and cordons; or using other built/natural features that effectively separate the SUA operation from the general public.

4.2 Crowd Control

Marshalling or other active crowd control measures that restrict access to the area within which the SUA is operating.

4.3 Utilisation of Other Agencies

Liaising with the Police, local authorities and other controlling agencies/organisation to gain official road closures, traffic cessation or site access restrictions.

Note:

These measures will ideally be proportionate to the risk posed by the SUA, bearing in mind the limited flight times and size and weight of the aircraft. Temporary restrictions may suffice in some cases. Restrictions that would be suitable for a full-size aircraft such as a helicopter in most cases would not be applicable to a SUA.

4.4 Wind and Turbulence

Taking account of any changes of wind strength and direction at varying heights, above surface level. Windshear, 'rotor' and 'curl-over' effects may be present at any point on the planned flight path caused by interactions between buildings and strong winds or when transitioning from flight over land to over water.

4.5 Radio Frequency (RF) Interference

Pilots must take account of the possible reduction in operating range in an urban environment due to the heavy use of communications equipment (mobile telephone, Wi-Fi etc.) and other sources of electromagnetic spectrum/RF interference. Mitigation for the consequences of weak or lost GPS signal due to masking by buildings must be considered along with the general RF saturation level. The use of a spectrum analyser is recommended to assist in assessing the level of local electromagnetic and RF congestion in the 2.4 GHz or 35 MHz frequency range.

4.6 Emergency Procedures

SUA emergency procedures planned to be implemented during controller/transmitter/loss of GPS guidance failure modes must be able to be put into effect without breaching the minimum separation distances or flying directly overhead persons/vehicles. An automatic 'Return-to-Base' feature must not cause a hazard to anyone off the nominal flight path; this may limit the SUA to mainly vertical flight paths directly above the launch point.

4.7 Test Flights

It is desirable to conduct limited test flights (hover controllability check) and other systems tests at the launch point before committing to the full flight profile. The integration and correct set-up of the camera and gimbal-mounted mount will also be checked at this time to avoid unnecessary calibration flights.

4.8 Site Survey

The use of non-established sites for flying UA requires an assessment of the suitability of that site to be made prior to commencing operations. Such an assessment must be made using a site visit and available information from at least the aeronautical charts, as well as other sources of information such as the UK Aeronautical Information Service (www.ais.org.uk), digital imagery (Google Earth/ Maps etc.), Ordnance Survey maps etc.

Typical elements of an assessment that could affect the safety of the flight would include:

- the type of airspace and specific provisions (e.g. Controlled Airspace)
- other aircraft operations (local aerodromes or operating sites)
- hazards associated with industrial sites or such activities as live firing, gas venting, high-intensity radio transmissions etc.
- local by-laws
- obstructions (wires, masts, buildings etc.)
- extraordinary restrictions such as segregated airspace around prisons, nuclear establishments etc. (suitable permission may be needed) habitation and recreational activities
- public access
- permission from landowner
- likely operating site and alternative sites
- weather conditions for the planned flight
- minimum separation distances from persons, vessels, vehicles and structures.

4.9 Overflight of People

In the absence of airworthiness certification, the overflight of persons not under the control of the pilot is restricted and described in the conditions of the Permission issued by the CAA. For UA of 20 kg and below, ANO 2009 Articles 166 and 167 define the separation distances that must be applied. For UA operations over 20kg, the overflight of persons may be allowed subject to the assessment of the UAS Operating Safety Case and/or airworthiness certification and appropriate operational procedures such as Ballistic Recovery Systems (BRS) (e.g. parachutes).

The safety case for the overflight of people must include an assessment of the Kinetic Energy Limits and the method of flight termination (e.g. BRS). Two crash scenarios must be considered in determining the impact kinetic energy of the UA, as follows:

- A free-fall from 400ft for all UA
- Additionally for a UA capable of high forward speed, a maximum impact speed (set as 1.4 x maximum achievable steady speed in level flight).

Assuming negligible aerodynamic drag, an object dropped from 400ft will hit the surface

at 95kt and the kinetic energy at impact will be 95kJ if the mass of the object is 80kg. If the object exhibits significant aerodynamic drag (without reliance upon any on-board parachute deployment system), the impact velocity will be less and a higher mass may be permissible without exceeding a calculated 95kJ.

In the second scenario and with a maximum speed of 70kt, 95kJ equates to a mass of 75kg. The mass can be increased up to a maximum of 150kg, provided the maximum achievable steady level flight speed is sufficiently low that the energy limit is not exceeded (e.g. at 150kg a maximum speed of 49kt is permitted).

4.10 Operational Limitations

A permission or exemption for UA conducting aerial work or equipped to undertake any form of surveillance or data acquisition will include a number of operational limitations.

For SUAs, these limitations will normally include a prohibition on flight:

- At a height exceeding 400 feet above ground level
- At a distance beyond the visual range of the Remote Pilot, or a maximum range of 500 metres
- Over, or within 150 metres of, any congested area of a city, town or settlement
- Within 50 metres of any person, vessel, vehicle or structure not under the control of the person in charge except that during the take-off or landing the SUA must not fly within 30 metres of any person other than the person in charge of the SUA or a person in charge of any other SUA or a person necessarily present in connection with the operation of such a UA
- Unless it is equipped with a mechanism that will cause the SUA to land in the event of disruption to or a failure of any of its control systems, including the radio link, and the person in charge of the SUA has satisfied himself that such mechanism is in working order before the UA commences its flight
- Unless the person in charge of the SUA has reasonably satisfied himself that any load carried by the UA is properly secured, that the SUA is in an airworthy condition and that the flight can safely be made taking into account the wind and other significant weather conditions
- Unless the operator maintains records of each flight made pursuant to the permission and makes such records available to the CAA on request
- Unless a site safety assessment has been completed by the operator and these site safety assessments are made available to the CAA on request
- Unless the permission of the landowner on whose land the SUA is intended to take off and land has been obtained
- Unless in accordance with the operations manual submitted to the CAA.

SUAs with a mass of more than 7kg may be subject to additional operational limitations

to those stated above, in accordance with ANO 2009 Article 166(4); these operational limitations will normally include a prohibition on flight.

The CAA may also impose additional limitations as it thinks fit; such limitations will normally include a prohibition on:

- Flights that have not been notified to the local Police prior to the flights taking place
- Flights where the maximum achievable steady speed in level flight is greater than 70 knots
- Aerobatic flight
- Tasks that involve aerial inspection of, or flight close to, any object or installation that would present a risk to safety in the event of damage due to any impact by the UA (e.g. chemical/gas storage areas)
- Participation in any public flying display (except with the written permission of the CAA).

4.11 UK-CAA Policy for Light UAV Systems

To address civil light UAV Systems, the UK CAA has developed a new policy, and it is this policy that is the subject of this paper. The UK Light UAV Systems Policy will ensure that acceptable safety standards are maintained whilst providing a route for the routine operation of light civil UAV Systems. Exemptions to UK national regulations may be granted to civil UAV Systems that can demonstrate compliance with the policy and show equivalence in terms of safety risk to existing model aircraft. Not all civil UAVs below 150kg will meet the applicability criteria or qualify for an exemption under the Light UAV Systems policy. For those UAVs, the general policy contained in CAP722 will still apply.

Additional information is available at:

<https://www.caa.co.uk/default.aspx?catid=1995>

<http://www.york.ac.uk/admin/>

[hsas/safetynet/Insurance/uav.htm](https://www.york.ac.uk/admin/hsas/safetynet/Insurance/uav.htm)