Directorate of Airspace Policy

Civil Aviation Authority

CAP 722

Unmanned Aircraft System Operations in UK Airspace – Guidance

www.caa.co.uk

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28 April 2008

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Off-Route Airspace, Directorate of Airspace Policy, CAA House, 45-59 Kingsway, London, WC2B 6TE.

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Revision History

Second Edition 12 November 2004

The major changes in this document are on legal, certification, spectrum and security issues. Details of the CAA Policy on Model Aircraft/Light UAV have also been included.

Third Edition 28 April 2008

1 Introduction

1.1 Following discussions at the CAA Unmanned Aircraft Systems (UAS) Working Group, held on 12 October 2006, it was considered that sufficient progress had been made in many areas of UAS work to warrant a substantial review of CAP 722. In particular, as an upsurge in UAS activity is envisaged over the coming years it is essential that both industry and the CAA, as the regulatory body, clearly recognize the way ahead in terms of policy and regulations and, more importantly, in safety standards

1.2 With an ever increasing number of manufacturers and operators, it is vital that the regulations keep pace with UAS developments, without losing sight of the safety issues involved in the simultaneous operation of manned and unmanned aircraft. As a living document, it is intended that CAP 722 will be under constant review and that it will be revised, where necessary, to take account of advances in technology, feedback from industry, recognised best practice and changes in regulations, which are developed to meet these demands. However, it is recognised that with continual rapid developments there will inevitably be times when Chapter sponsors will have to be approached directly for further guidance.

2 Revisions in this Edition

2.1 The layout of the document has been amended to more clearly separate Civil and Military guidance and as such the Chapters have changed in many areas. In addition, while there are many minor textual changes to the document, a significant revision has been made in many areas and as such it is recommended that those involved in UAS operations review the entire content of the document to ensure that they are fully cognisant with the update.

3 Impending Changes to Regulation

3.1 The CAA is in the process of a consultation with industry over a proposal to amend the Air Navigation Order which will require operators of UAS with a UAV component of less than 7 kg mass to obtain a CAA permission, as is currently the case for UAVs with a mass of 7-20 kg. This proposal intends to ensure public safety by applying operational constraints to UAVs of less than 7 kg mass, as deemed appropriate to the type of operation envisaged and the potential risk to members of the public.

3.2 If the consultation exercise approves the proposal, it is likely that the ANO Amendment will pass into law in December 2008. Potential operators of UAS with a UAV component of less than 7 kg should ascertain, before commencing operations, whether or not they are required to obtain a CAA permission.

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Foreword

1 Aim

1.1 This third edition of CAP 722, "Unmanned Aircraft System Operations in UK Airspace – Guidance", is compiled by the Civil Aviation Authority's Directorate of Airspace Policy (DAP). It is intended to assist those who are involved in the development of UAS to identify the route to certification, in order to ensure that the required standards and practices are met by all UAS operators.

1.2 Overall, the purpose of the document is to highlight the safety requirements that have to be met, in terms of airworthiness and operational standards, before a UAS is allowed to operate in the UK. Whilst UAV flights beyond the limits of visual control (defined herein) are currently restricted to segregated airspace, the ultimate aim is to develop a regulatory framework which will enable the full integration of UAS activities with manned aircraft operations throughout UK airspace.

2 Content

2.1 CAP 722 is wholly dependent on contributions from responsible agencies; however, while it does not replace civil or military regulations, it is intended to draw together independent civil and military guidance, so as to establish best practice for all UAS activities. Wherever possible consolidated guidance will be simplified and harmonised with other European nations.

2.2 It is acknowledged that not all areas of UAS operations have been addressed, thus additional comment is welcomed from industry and government sectors. These should be addressed to DAP ORA4.

Doug Robertson
Lieutenant Commander Royal Navy
DAP ORA4
K6 G3
CAA House
45-59 Kingsway
London
WC2B 6TE

Tel: 020 7453 6544
Fax: 020 7453 6565

E-mail: doug.robertson@caa.co.uk

3 Availability

3.1 In order to ensure a wide distribution and to ensure that subsequent amendments and updates are readily available, CAP 722 is available on-line at www.caa.co.uk/CAP722. Paper copies are available from the CAA's publishers. Please see inside cover for contact details. Contact addresses of those who have contributed to the document are also included at the end of each Chapter to enable readers to raise questions or to provide comments concerning the content of the document.

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Abbreviations and Glossary

1 Abbreviations

ACAS	Airborne Collision Avoidance System
ACL	Autonomous Control Levels
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
ANSP	Air Navigation Service Provider
AOA	Aircraft Operating Authority (Military)
ATEC	Aircraft Test and Evaluation Centre
ATM	Air Traffic Management
ATS	Air Traffic Service
ATC	Air Traffic Control
BMFA	British Model Flying Association
CAA	Civil Aviation Authority
CFT	Certificate for Flight Trials
CPL	Commercial Pilot Licence
DA	Danger Area
DAP	Directorate of Airspace Policy
DE&S	Defence Equipment & Support
DMSD	Design Modification and Support Division
DOSG	Defence Ordnance Safety Group
DSTL	Defence Science and Technology Laboratories
DUO	Designated UAS Operator
EASA	European Aviation Safety Agency
EHS	Enhanced Surveillance
EMC	Electro-Magnetic Compatibility
FRTOL	Flight Radio Telephony Operators' Licence
GCS	Ground Control Station
HALE	High Altitude Long Endurance
HIRF	High Intensity Radiated Field
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
JAA	Joint Aviation Authority
MALE	Medium Altitude Long Endurance
MART	Military Aviation Regulatory Team
MoD	Ministry of Defence
MRCOA	Military Registered Civil-Owned Aircraft
MTOM	Maximum Take-off Mass

MUAVC	Master Unmanned Aerial Vehicle Controller (D/Flying)
RAC	Range Air Controller (D/Flying)
RTS	Release to Service
SARPS	Standards and Recommended Practices
SRG	Safety Regulation Group
SSR	Secondary Surveillance Radar
TAC	Target Air Controller (D/Flying)
TCAS	Traffic Collision Avoidance System
TESD	Test & Evaluation Support Division
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System(s)
UAS Cdr	Unmanned Aircraft System Commander
UAS-p	UAS Pilot
UAV	Unmanned Aerial Vehicle(s)
UAV-p	UAV Pilot
UAVS	Unmanned Air Vehicle System
UCS	UAV Control Station
VFR	Visual Flight Rules

2 Glossary of Terms

2.1 It should be noted that the terminology for describing personnel involved in UAS operations continues to evolve and therefore this Glossary is not exhaustive. However, whilst DAP will continue to recognise legacy terms in the interests of commonality the use of the following terminology is advised:

UAS	An Unmanned Aircraft System (UAS) comprises individual 'System elements' consisting of the unmanned aerial vehicle (UAV), the Ground Control Station (GCS) and any other UAV System Elements necessary to enable flight, such as a Communication Link and Launch and Recovery Element. There may be multiple UAVs, GCS or Launch and Recovery Elements within a UAS.
UAV	An aircraft which is designed to operate with no human pilot on board, as part of a UAS. The acronym UA may be used interchangeably, with the same meaning as UAV.
UAS Commander	A suitably qualified person responsible for the safe operation of a UAS during a particular flight and who has the authority to direct a flight under her/his command.
UAS Operator	The legal entity (organisation) operating a civil UAS
Command and Control (C2)	The exercise of authority and direction by the designated UAS Commander, over UAS under his control, to ensure the safe and efficient conduct of flying operations. The C2 function is accomplished by a combination of planning, personnel, equipment, communications, navigation and technical functions and procedures.
UAV Pilot	The person in direct control of the UAV

2.2 The following are terms used by the UK Military as defined in JSP 550, 553 and 556. These terms are not necessarily applicable to UAS that are subject to civil regulations.

UAV Commander	UAV Cdr is responsible for the conduct and safety of a specific flight and for supervising the person in direct control of the UAV. His duties are equivalent to those of an Aircraft Commander.
Unmanned Air Vehicle System	A UAVS comprises individual UAV System elements consisting of the flight vehicle (UAV), the control station and any other UAV System elements necessary to enable flight, such as a launch and recovery element. There may be multiple UAVs, control stations, or launch and recovery elements within a UAV System.
UAV System Commander	(UAV Sys Cdr) is responsible for the overall command of the entire UAV System and its safe and effective operation. He may be responsible for a number of concurrent UAV flights or missions. This person may be the unit CO, or other designated officer.
UAV-p	The person in direct control of a UAV.
UAV	An aircraft which is designed to operate with no human pilot on board and which does not carry personnel. Moreover a UAV: • is capable of sustained flight by aerodynamic means; • is remotely piloted or automatically flies a pre-programmed flight profile; • is reusable; • is not classified as a guided weapon or similar one-shot device designed for the delivery of munitions.
UCS flight control	Flight controls used by the UAV crew in the UCS to operate the UAV in the semi-automatic mode of control.
UCS	The UAV control station, which is a facility or device from which the UAV is controlled and/or monitored for all phases of flight.
UAV Crew	A UAV crew is made up of one or more qualified people responsible for monitoring and controlling the flightpath and flight status of one or more UAV. Includes the Designated UAV Operator and also all staff responsible for operating on-board systems (e.g. payload).

2.3 Throughout the document the abbreviation ANO is used for CAP 393. This includes the Air Navigation Order 2005 and the Rules of the Air Regulations 2007.

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Section 1 General

Chapter 1 Introduction

1 Policy

1.1 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.

1.2 In consideration of the limited aviation background of some UAS manufacturers and operators, the guidance is comprehensive and necessarily prescriptive. The CAA will supplement this CAP with further written advice when required. Rules for Avoiding Aerial Collisions are set out in the ANO. The term 'See and Avoid' for manned aircraft is referred to as 'Sense and Avoid' for the purpose of UAS operations.

1.3 UAS may not be flown without obtaining the relevant national approvals. (See Section 3, Chapter 1 and Section 4, Chapters 2 and 3).

2 Scope

2.1 The guidance within CAP 722 is focused on UAS, as they are defined in the 'Glossary of Terms.' The Guidance is not geared towards the use of armed UAS, guided weapon systems such as Cruise Missiles or similar one-shot devices designed for the delivery of munitions. Similarly the use of recreational Model Aircraft is not included; however guidance on the operation of Model Aircraft is published in CAP 658 "*Model Aircraft*: *A Guide to* Safe Flying".

3 UAS Classifications

3.1 It is recognised that a need exists to develop a system of UAS classification; however, while the process for developing a group system is ongoing within Europe (EuroCAE[1] Working Group 73) and the USA (RTCA[2]) the process has not yet completed. While the CAA will adopt the WG 73 group system, it is considered, at this stage, that the table below is suitable as interim guidance towards a UAS classification group.

1. European Organization for Civil Aviation Equipment.
2. Radio Technical Commission for Aeronautics.

Weight Classification Group	Civil Category	Weight (Kg)	Broad Military Equivalent	Civil Regulation
1[1]	Small Aircraft	0 – 20	Micro (< 5Kg)	National
			Mini (< 30Kg)	
2	Light UAV	>20 – <150		
			Tactical	
3	UAV	150 or more		EASA (State Aircraft are National)
			MALE	
			HALE	

1. See Revision History, Third edition, Paragraph 3.

4 Point of Contact

DAP ORA4
K6 G3
CAA House
45-59 Kingsway
London
WC2B 6TE

Tel: 020 7453 6544
Fax: 020 7453 6565

E-mail: doug.robertson@caa.co.uk

Chapter 2 Legal Considerations

1 Policy

1.1 The Chicago Convention

1.1.1 As a signatory to the Chicago Convention and a member of ICAO, the United Kingdom undertakes to comply with the provisions of the Convention and Standards contained in Annexes to the Convention save where it has filed a Difference to any of those standards.

1.1.2 Article 3 of the Convention provides that the Convention applies only to civil aircraft and not to State aircraft. State aircraft are defined as being aircraft used in military, customs and police services. No State aircraft may fly over the territory of another State without authorisation. Contracting States undertake when issuing Regulations for their State aircraft that they will have due regard for the safety of navigation of civil aircraft.

1.1.3 Article 8 of the Convention provides that no aircraft capable of being flown without a pilot shall be flown without a pilot over the territory of a Contracting State without special authorisation by that State.

1.1.4 Article 8 of the Convention also requires that "each contracting State undertake to ensure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft".

2 Law

2.1 European Regulation

2.1.1 EC Regulation 1592/2002 (the EASA Regulation) establishes the European Aviation Safety Agency and makes provision for Implementing Rules dealing with airworthiness certification and continuing airworthiness. Detailed requirements for airworthiness certification and continuing airworthiness are set out in two Implementing Rules.

2.1.2 Neither the EASA Regulation nor the Implementing Rules apply to aircraft engaged in military, customs, police or similar services (State aircraft). EU Member States must, however, ensure that such services have due regard as far as practicable to the objectives of the EASA Regulation.

2.1.3 Certain categories of civil aircraft are also exempt from the need to comply with the EASA Regulation and its Implementing Rules. These exempt categories are listed in Annex II to the EASA Regulation. The exempt categories, which are of relevance for UAS, are:

- aircraft specifically designed or modified for research, experimental or scientific purposes and likely to be produced in very limited numbers;
- aircraft whose initial design was intended for military purposes only; and
- unmanned aircraft with an operating mass of less than 150 kg.

2.1.4 Any aircraft which is subject to the EASA Regulation and Implementing Rules (e .g. an unmanned aircraft more than 150 kg which is neither experimental nor used for State purposes) will be required to have an EASA airworthiness certificate.

2.1.5 An aircraft, which is not required to comply with the EASA Regulation, either because it is a State aircraft or because it comes within one of the exempt categories, remains subject to national regulation so far as airworthiness certification and continuing airworthiness are concerned.

2.1.6 Equipment requirements, operational rules, personnel licensing, aerodrome regulation and regulation of air traffic services are not (yet) dealt with by European Regulations and so are all a matter for national regulation for all categories of aircraft.

2.1.7 In the case of the United Kingdom, the National Regulations are as described in paragraph 2.2 below.

2.2 National Regulation

2.2.1 Civil and Military Regulations

2.2.1.1 In the United Kingdom, there are two regulatory regimes: civil and military. Military requirements are a matter for the Ministry of Defence. A military aircraft for this purpose includes any aircraft which the Secretary of State for Defence certifies should be treated as a military aircraft.

2.2.1.2 Any aircraft which is not a military aircraft must, under United Kingdom aviation safety legislation, comply with civil requirements. There is no special provision for aircraft used in police, customs or other similar services.

2.2.2 The Air Navigation Order 2005 and the Rules of the Air Regulations 2007

2.2.2.1 The main civil requirements are set out in the ANO.

2.2.2.2 The provisions in the ANO and Rules of the Air concerning equipment requirements, operational rules, personnel licensing, aerodrome regulation and regulation of air traffic services apply to all non-military aircraft, organisations, individuals and facilities.

2.2.2.3 As explained above, insofar as these national requirements concern airworthiness certification or continuing airworthiness they will only apply to non-military aircraft which come within one of the exempt categories listed in Annex II to the EASA Regulation. Such aircraft are exempt from the need to comply with the EASA Regulation and Implementing Rules and thus remain subject to national regulation.

2.2.2.4 A non-military aircraft registered in the United Kingdom which is outside the EASA Regulation and Implementing Rules must have a certificate of airworthiness or a permit to fly issued by CAA (or be operating under A or B Conditions) under the ANO, unless it is a "small aircraft" as defined in the ANO.

2.2.2.5 A small aircraft is defined in the ANO as any unmanned aircraft weighing not more than 20 kg. None of the above main requirements apply to such small aircraft. Instead, a set of conditions are included at Article 98 of the ANO subject to which small aircraft may be flown without complying with airworthiness or flight crew licensing requirements or with the Rules of the Air. These conditions include a prohibition on flight in controlled airspace or within an aerodrome traffic zone unless in either case the permission of the air traffic control unit has been obtained, a normal maximum height of 400 ft above the surface and a prohibition on flight for the purposes of aerial work without the specific permission of CAA.

2.3 Exemptions and Permissions granted by the CAA

2.3.1 A UAV which is subject to national regulations and which weighs more than 20 kg is not a 'small aircraft' for the purposes of the ANO so that all the requirements referred to above (certificate of airworthiness or permit to fly, licensed flight crew, Rules of the Air) must be complied with. If a UAV cannot comply with all of these requirements the CAA may be prepared to issue an Exemption under Article 153 of the ANO. To

operate a UAV, which weighs less than 20 kg but more than 7 kg[1] for aerial work purposes, a CAA Permission is also required as described in ANO Article 98.

2.3.2 The CAA has permitted a small number of light UAVs weighing more than 20 kg, which were granted exemptions to allow them to fly before the current requirement for a recommendation from an accredited body came into force, to continue to fly without such a recommendation. It is the CAA's intention that with effect from 1 August 2008 these 'grandfather rights' will cease and a recommendation from a suitable accredited body will be required for all light UAVs.

2.4 Insurance

2.4.1 EC Regulation 785/2004 came into force on 30th April 2005 requiring most operators of aircraft, irrespective of the purposes for which they fly, to hold adequate levels of insurance in order to meet their liabilities in the event of an accident. This EC Regulation specifies amongst other things the minimum levels of third party accident and war risk insurance for aircraft operating into, over or within the EU (including UAVs) depending on their MTOM. Details of the insurance requirements can be found on the CAA website[2] under "Mandatory Insurance Requirements".

2.4.2 UK legislation which details insurance requirements is set out in Civil Aviation (Insurance) Regulations 2005[3].

2.4.3 The Insurance Regulation does not apply to State aircraft or to model aircraft of less than 20 kg.

3 Lead Agency

- European Aviation Safety Agency – for civil aircraft, which are not exempt from the EASA Regulation.
- Civil Aviation Authority – for civil aircraft, which are exempt from the EASA Regulation.
- Ministry of Defence – for United Kingdom military aircraft.
- Department for Transport – for insurance matters.

4 Point of Contact

CAA Legal Department
CAA House
45-59 Kingsway
London
WC2B 6TE

Tel: 020 7453 6161
Fax: 0207 453 6163

E-mail: robin.allan@caa.co.uk

1. See Revision History, Third edition, paragraph 3.
2. http://www.caa.co.uk/default.aspx?catid=122&pagetype=90&pageid=4510
3. http://www.opsi.gov.uk/si/si2005/20051089.htm

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Section 2 Policy

Chapter 1 UAS Operating Principles

1 Introduction

1.1 The purpose of this Chapter is to outline the operating principles associated with UAS activities, within UK airspace, and to highlight some of the airspace issues that need to be addressed. Whilst the segregation of UAS from other airspace users provides a safe operating environment, the process for establishing such airspace reduces the flexibility of operation sought by the user community. It is therefore important to establish what can be achieved outside of segregated airspace and to identify the associated constraints on UAS operations.

1.2 It should be noted that the use of Danger Areas (DA) for the segregation of UAS activities might be subject to specific regulations pertinent to the DA. Information on airspace regulation within DAs should therefore be sought from the relevant Danger Area authority. DAP will assist in identifying the appropriate authority if required.

2 Scope

2.1 The guidance below details the operating principles associated with UAS flights both within and outside of segregated airspace. Specific regulations for model aircraft are detailed in CAP 658, Model Aircraft: A Guide to Safe Flying.

3 Lead Agency

3.1 CAA – Directorate of Airspace Policy (DAP).

4 Policy

4.1 The legal constraints on flying operations, including UAS, within UK airspace are contained within the ANO. The guidance contained within this Chapter is designed to draw the attention of operators to the policies, constraints and regulations that are to be adhered to when conducting UAS operations.

4.2 The European legislation (Regulation 1592/2002) specifically excludes unmanned aircraft under 150 kg from its scope. Therefore UAVs of less than 150 kg remain under national legislation, which in the UK is set out in the ANO.

4.3 There is no lower weight limit below which the ANO does not apply; however, the extent to which the regulations apply depends on the mass of the aircraft. ANO Article 98 defines constraints that are unique to small aircraft[1], some of which are dependent upon whether the aircraft exceeds 7 kg[2] or if it is used for the purpose of Aerial Work. However, ANO Article 74 applies to all weight categories and stipulates that any person operating an aircraft shall not recklessly or negligently cause or permit an aircraft to endanger any person or property, (which includes other aircraft and their occupants). If the CAA believes that danger may be caused, then the CAA may direct that the aircraft shall not be flown (ANO Article 144).

1. The small aircraft definition is 20 kg without fuel.
2. See Revision History, Third edition, paragraph 3.

5 Airspace Principles for UAS Operations in the UK

5.1 UK aviation legislation is designed to enable the safe and efficient operation of manned aircraft in all classes of airspace. UAS operators must work within the same regulatory framework.

5.2 UAS do not have an automatic right to airspace use if safety provision cannot be made, or if such operations would have an unreasonably negative effect on other airspace users. In order to integrate with other airspace users, UAS operators must ensure that their aircraft can demonstrate an equivalent level of compliance with the rules and procedures that apply to manned aircraft.

5.3 UAS operators should recognise the expectations of other airspace users. As such, the routine flight of any UAS outside a UK Danger Area or segregated airspace cannot be permitted to increase the risk to existing users and should not deny airspace to them.

5.4 Until UAS can comply with the current requirements of the ANO, including the Rules of the Air, one-off or occasional UAS flights outside of Danger Areas may be accommodated through the establishment of Restricted Area (Temporary) (RA(T)). As this will afford the exclusive use of that airspace to the UAS operator, then sufficient time must be allowed to consult with other airspace users and to complete the planning process before airspace submissions are made. This requires a minimum lead in time of 90 days to allow the legal cycle to be completed. It should be noted that the establishment of a RA(T) will deny access to the associated airspace for legitimate airspace users and, as such, it is not an acceptable method for enabling the routine operation of UAS. All applications will therefore be closely scrutinised to ensure the most efficient use of the airspace concerned.

5.5 Unless special provision is made with the Air Traffic Service Unit (ATSU) handling the UAS activity, the provision of an Air Traffic Service (ATS) to a UAV must be transparent to the Aircraft Controller[1]. In other words, the controller must not have to do anything different using RT or landlines than he would for other aircraft under his control nor should he have to apply different rules or work to different criteria. The following points are of note:

- UAS must be able to comply with instructions from the ATS provider and with equipment requirements applicable to the class of airspace within which they intend to operate.
- All UAS callsigns shall include the word "UNMANNED", on first contact with the ATS provider, to ensure that air traffic controllers are fully aware that they are dealing with a UAS flight.
- If "special provisions" are made with the associated ATSU, it is essential that this does not reduce the situational awareness of other airspace users.

6 General Principles for UAV Operations Outside of Segregated Airspace

6.1 For all flights outside of Danger Areas or segregated (exclusive use) airspace, the aircraft performance and all communications with the ATS provider must be continuously monitored by the UAS Cdr and/or the UAV-p. To comply with ATS instructions in a timescale comparable with that of a manned aircraft, it is imperative that the capability of taking immediate active control of the UAV exists at all times.

1. Includes Air Traffic Controllers and Tactical Controllers.

6.2 Special equipment (e.g. SSR Transponder) mandated for manned aircraft in certain classifications of airspace shall also be mandated as a minimum requirement for UAS intending to fly in such airspace.

6.3 **Sense and Avoid**

6.3.1 An approved method of aerial collision avoidance is required and, therefore, UAS operations will not be permitted in the United Kingdom in non-segregated airspace, outside the direct line-of-sight of the UAV-p, without an acceptable sense and avoid system. Details on how sense and avoid criteria may be arrived at can be found at Section 2, Chapter 2.

6.3.2 In the absence of an approved Sense and Avoid system, UAV operations outside of segregated airspace are to be constrained as detailed at paragraph 6.7.

6.4 An approved method of assuring terrain clearance is required.

6.5 Standard Operating Procedures are required; these would normally be contained within an organisation's UAS Operations Manual. Amongst other things the following procedures should be covered:

- Take-off and landing procedures;
- En-route procedures;
- Loss of control data link;
- Abort procedures following critical system failure.

6.6 UAS must comply with the Instrument or Visual Flight Rules (IFR or VFR) as they affect manned aircraft.

6.7 If the System does not have an approved Sense and Avoid capability, the restrictions detailed below will normally be applied to UAV operations outside of segregated airspace as part of the CAA permissions and exemptions process. The aircraft shall not be flown:

- in controlled airspace, except with the permission of the appropriate air traffic control unit;
- in any aerodrome traffic zone except with the permission either of the appropriate air traffic control unit or the person in charge of the aerodrome;
- at a height exceeding 400 feet above the surface;
- at a distance beyond the visual range of the operator(s) of the said aircraft, or a maximum range of 500 metres, whichever is less;
- at night;[1]
- 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 aircraft operator except that during the take-off or landing an aircraft to which this subparagraph applies shall not fly within 30 metres of any person other than the person in charge of the said aircraft or a person in charge of any other small aircraft or a person necessarily present in connection with the operation of such an aircraft.

6.8 Additional safety requirements that will be considered under permissions and exemptions may include that the aircraft shall not be flown:

1. Night is taken as 30mins after sunset to 30mins before sunrise.

- unless it is equipped with a mechanism that will cause the said aircraft 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 said aircraft has satisfied himself that such mechanism is in working order before the aircraft commences its flight;
- unless the person in charge of the said aircraft has reasonably satisfied himself that any load carried by the aircraft is properly secured, that the said aircraft is in an airworthy condition and that the flight can safely be made.

7 General Principles for UAV Operations Inside Segregated Airspace

7.1 For flights within segregated airspace, whilst some of the restrictions detailed at paragraph 6.7 may still apply, generally the UAV will be given freedom of operation within the bounds of the allocated airspace, subject to any agreed procedures and safety requirements. An approval to operate will take into account the risks associated with any unintended excursion from the allocated airspace and it will also consider the possibility of airspace infringements. In addition, measures that may be put in place to enhance the safety of UAS activities will also be considered in the approval process.

7.2 While segregated airspace, by its nature, provides exclusive use of that airspace to the UAV activity, boundaries are not impervious to aircraft infringements. In order to enhance the safety of UAV operations the following constraints may be imposed:

- Where available, the UAV operator is to make use of an air traffic service to monitor UAV flights and to provide a service to the UAV and to other aircraft operating in the vicinity of the segregated airspace;
- Communications are to be maintained between the ATS provider and the UAV-p/ UAV Commander;
- Procedures are to be put in place for, amongst others, emergency recovery, loss of control link and for the avoidance of infringing aircraft.

8 Source Documents

[1] CAP 393 Air Navigation: the Order and the Regulations.

[2] JSP 550 Military Aviation Policy, Regulations and Directives.

[3] JSP 552 Military Air Traffic Services.

[4] UK AIP Integrated Aeronautical Information Publication.

9 Point of Contact

ORA 4
K6 G3
CAA House
45-59 Kingsway
London
WC2B 6TE

Tel: 020 7453 6544
Fax: 020 7453 6565

E-mail: doug.robertson@caa.co.uk

Chapter 2 CAA Policy on Sense and Avoid

1 Scope

1.1 This Chapter offers guidance to industry on how to satisfy the requirements for a Sense and Avoid function.

2 Lead Agency

2.1 CAA – Safety Regulation Group (SRG).

3 Introduction

3.1 A significant increase in both civil and military UAS flying is anticipated, most of which will require access to all classes of airspace if it is to be both operationally effective and/or commercially viable. To achieve this, UAS will have to be able to meet all existing safety standards applicable to equivalent manned aircraft types, appropriate to the class (or classes) of airspace within which they are intended to be operated.

4 Aim

4.1 The aim of this policy statement is to clarify the position of the CAA in respect of its role in assisting the UAS industry to find a solution to achieving a capability and level of safety which is equivalent to the existing 'see and avoid' concept. It is also recognised that Sense and Avoid is only one of a number of requirements that will need to be addressed for safe operation of UAS.

5 Policy

5.1 The CAA policy on UAS Sense and Avoid is as detailed below.

5.1.1 The overriding principle when assessing if a proposed UAS Sense and Avoid function is acceptable is that it should not introduce a greater hazard than currently exists. Any proposed function must demonstrate at least equivalence with manned aircraft safety standards and, where these standards exist, the UAS must comply with the rules and obligations that apply to manned aircraft including those applicable to separation and collision avoidance.

5.1.2 The separation and collision avoidance capabilities must be able to:

- Detect and avoid traffic (air and ground operations) iaw Rules of the Air;
- Detect and avoid all airborne objects, including gliders, hang-gliders, paragliders, microlights, balloons, parachutists etc;
- Avoid hazardous weather;
- Detect and avoid terrain and other obstacles;
- Perform equivalent functions, such as maintaining separation, spacing and sequencing that would be done visually in a manned aircraft.

5.2 It is not the role of the CAA to carry out such research and development; this must be performed by the UAS industry. The CAA considers that the way forward is for the UAS industry to investigate potential solutions and for the research and development process to include full and open consultation with the CAA at appropriate stages so that the CAA can provide guidance to the UAS industry on the appropriate interpretation of the applicable rules and regulations.

5.2.1 The CAA strongly recommends that any parties developing Sense and Avoid technology for the use of UAS in non-segregated airspace should set up a programme of regular discussion and review of their research and development activity with the CAA by making contact at an early stage with the Aircraft Certification Department (ACD) of the CAA Safety Regulation Group. This will ensure that system developers will have access to the best advice on the applicable regulations, thereby increasing the likelihood of the ultimate acceptance of any Sense and Avoid system by the civil authorities.

5.3 If the UAS industry is to produce UAS capable of operating in all classes of airspace, it is essential that Sense and Avoid issues are addressed and that they demonstrate equivalence[1] to the regulatory and airworthiness standards that are set for manned aircraft. In order for the Sense and Avoid function to provide the required level of safety, standards will need to be developed for the various component functions which include threat detection, assessment of the collision threat, selection of an appropriate avoidance manoeuvre and execution of a manoeuvre compatible with the aircraft's performance capabilities and airspace environment. UAS designers will need to demonstrate that they can meet these standards.

6 Factors for Consideration when Developing a Sense and Avoid for UAS

6.1 The CAA Safety Regulation Group does not define the matters to be taken into account for the design of aircraft or their systems. However, for the guidance of those engaged in the development of Sense and Avoid systems, some of the factors that the CAA believes may need to be considered are listed below.

- Ability to comply with the Rules of the Air.
- Airworthiness.
- Control method, controllability and manoeuvrability.
- Flight performance.
- Communications procedures and associated links.
- Security.
- Emergency actions, reversionary or failure modes in the event of degradation of any part of the UAS and its associated Control and/or Relay Stations.
- Actions in the event of lost communications and/or failure of onboard sense and avoid equipment.
- Ability to determine real-time meteorological conditions and type of terrain being overflown.
- Nature of task and/or payload.
- Autonomy of operation and control.

1. EASA policy is that the regulatory airworthiness standards should be set to be no less demanding than those currently applied to comparable manned aircraft nor should they penalise UAV Systems by requiring compliance with higher standards simply because technology permits. This line is accepted by the CAA.

- Method of sensing other airborne objects.
- UAS-pilot level of competence.
- Communications with ATS providers, procedures and links with control station.
- Means of launch/take-off and recovery/landing.
- Reaction logic to other airspace objects.
- Flight termination.
- Description of the operation and classification of the airspace in which it is planned to be flown.
- Transaction times (e.g. including delays introduced by satellite links)
- Address both cooperative and non-cooperative air traffic

This list is not exhaustive.

7 Point of Contact

7.1 For enquiries relating to CAA UAS Sense and Avoid standards:

Head of Aircraft Certification Department
Airworthiness Division
Safety Regulation Group
Civil Aviation Authority
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR
UK

Tel: 01293 573293
Fax: 01293 573975

E-mail: Department.Certification@caa.co.uk

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Chapter 3 Spectrum Issues

1 Scope

1.1 This chapter provides:

- guidance to industry on the CAA policy on the use of frequencies to support UAS operations;
- guidance to industry on the assignment of frequencies in the absence of specifically identified UAS spectrum;
- guidance to industry with respect to current activities to progress the allocation of dedicated spectrum to support safety critical UAS functionality (Command and Control / Sense and Avoid) through the relevant International Telecommunication Union (ITU) processes.

2 Lead Agency

2.1 CAA – Directorate of Airspace Policy (DAP).

3 Introduction

3.1 The provision of a number of radiocommunication systems is essential to the safe and expeditious operation of UAS. The number and type of these radiocommunication systems vary according to the UAS application. A number of the safety critical applications are already supported by existing aeronautical systems that operate in dedicated spectrum that ensures the appropriate level of protection.

3.2 There are, however, a number of UAS safety critical systems, such as Command and Control, for which no dedicated spectrum has yet been identified. These systems currently rely on the use of ad-hoc frequency assignments which are invariably assigned by States and vary from region to region and even State to State.

3.3 The identification of dedicated spectrum for use by UAS systems is currently being studied by the ITU with a decision due to be taken at the next World Radiocommunications Conference. This decision will be based on studies undertaken within the ITU prior to that conference. For the UK to contribute and influence that process the UAS industry within the UK will have to provide information and support to identify and substantiate their spectrum requirements.

4 Aim

4.1 The aim of this policy statement is to clarify the position of the CAA in respect of how it expects the UAS industry to use spectrum and how it is prepared to assist in obtaining access to dedicated spectrum for safety critical systems.

5 Policy

5.1 The CAA policy is:

- to ensure that frequencies used to support safety critical UAS functionality meet both international and national regulations/legislation;
- to ensure that all frequencies used to support safety critical UAS functionality have been co-ordinated and licensed in accordance with the appropriate licensing regime;
- to ensure that any such license obtained provides suitable protection to the use of that frequency appropriate to the functionality and safety criticality of the systems being supported and the area of operation;
- to assist in the identification of suitable dedicated spectrum to support UAS safety critical functionality.

6 Assignment of Frequencies

6.1 The assignment of frequencies within the UK is the responsibility of Ofcom; however, in the bands below that responsibility is undertaken by the CAA on behalf of Ofcom:

255 - 526.5 kHz	Radionavigation
108 – 137 MHz	Radionavigation/Radiocommunications
328.6 – 335.4 MHz	Radionavigation
960 – 1 350 MHz	Radionavigation/Radar
2 700 – 3 100 MHz	Radar
4 200 – 4 400 MHz	Radionavigation
5 000 – 5 150 MHz	Radionavigation
9 000 – 9 200 MHz	Radar
9 300 – 9 500 MHz	Radar

6.2 Applications for the assignment of frequencies within the bands identified above should be addressed to the CAA contact given in section 8. Applications for the use of frequency other than those listed above should be addressed to Ofcom and a contact point is given in section 8. Of additional note is that any aircraft system transmitting on 1030MHz, as may typically be used in collision warning or sense-and-avoid systems, shall not be operated without an approval from the National IFF and SSR Committee (NISC) (contactable via S&SM, DAP).

7 Allocation of Spectrum

7.1 The CAA support Ofcom by providing the UK lead on issues related to aeronautical spectrum including UAS. For information on how to participate in the process for the identification and allocation of spectrum that can be used to support UAS operations contact the CAA.

8 Points of Contact

8.1 For enquiries relating to the allocation of spectrum and the allocation of frequencies within dedicated aeronautical bands:

Spectrum & Surveillance Management
K6 G6
CAA House
45-59 Kingsway
London
WC2B 6TE

Primary: John Mettrop
Tel: 020 7453 6531
E-mail: john.mettrop@caa.co.uk

Alternate: Nicholas Hall
Tel: 020 7453 6529
E-mail: nick.hall@caa.co.uk

8.2 For enquiries related to the allocation of frequencies outside of dedicated aeronautical bands:

Ofcom
Riverside House
2a Southwark Bridge Road
London
SE1 9HA

Tel: 020 7981 3131

Website: www.ofcom.org.uk/licensing

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Chapter 4 Radar Surveillance Policy

1 Scope

1.1 There have been no previous CAA regulations governing the surveillance requirements for civil or military registered UAS in UK airspace. All civil aircraft fly subject to the legislation of the ANO. However, in accordance with its powers under Article 153 of the ANO, the CAA may exempt UAS operators from the provisions of the ANO and the Rules of the Air, depending on the UAV's potential to inflict damage and injury (see Section 3, Chapter 1 – Approval To Operate). This policy is applicable to all civil UAS (The policy of exemption – does not apply to military – see Article 152 (5)) operating within the UK FIR and UIR, regardless of origin.

2 Lead Agency

2.1 CAA – Directorate of Airspace Policy.

3 Policy

3.1 This surveillance policy is complimentary to the Sense and Avoid guidance contained in Section 2, Chapter 2. In broad terms, UAS shall be able to interact with all other airspace users, regardless of the airspace or UAV flight profile, in a manner that is transparent to all other airspace users and ANSPs, when compared to manned aircraft. UAVs shall be interoperable with all surveillance systems without any additional workload for Aircraft Controllers[1], surveillance systems, manned aircraft pilots or other UAV pilots. UAVs shall carry suitable equipment so as to be able to interact with aircraft equipped with mandated Airborne Collision Avoidance System (ACAS) such as TCAS II. It must be noted that, where a UAV employs a collision avoidance system with reactive logic, any manoeuvre resulting from a perceived threat from another aircraft shall not reduce the effectiveness of a TCAS II resolution advisory manoeuvre from that aircraft.

3.2 It is recognised that the Radar Cross Section (RCS) and size of certain categories of UAV will make detection by non-cooperative[2] surveillance systems difficult, especially at low-level. Consequently, cooperative ground and/or air based surveillance systems[3] are traditionally deployed by ANSPs to compliment coverage of non-cooperative systems, especially in controlled airspace.

3.3 The primary means of cooperative surveillance within the UK is SSR Mode Select Elementary Surveillance (Mode S ELS). However, within certain areas of UK airspace, the carriage of an SSR transponder is not mandatory (see UK AIP Gen 1.5.3). In such airspace, where an Air Traffic Radar service is not mandatory, non-transponder equipped aircraft will not be 'visible' to ACAS. Consequently, in these areas 'see and avoid' is often the primary means of separation of aircraft. Therefore, until UAVs can comply with the 'Sense and Avoid' capabilities described in Section 2, Chapter 2 and the SSR carriage policy for such platforms can be reviewed, if necessary on a case-by case basis, all UAVs operating outside of segregated airspace that has been activated and reserved solely for use by UAVs, shall be equipped with, and be able to

1. Includes Air Traffic Controllers and Tactical Controllers.
2. Primary Surveillance Radar (PSR).
3. Secondary Surveillance Radar (SSR).

operate, a SSR Mode S transponder in accordance with UK AIP GEN 1.5.3. The only exception to this rule is for Light UAVs operating within Line of Sight of the operator and staying below 400ft for which a transponder is not required.

NOTE: Once compliant with Section 2, Chapter 2, further information on Mode S can be found on the CAA website (www.caa.co.uk/modes).

4 Source Documents

4.1 UK AIP GEN 1.5.3.

ANO

ICAO Annex 10 SARPS

5 Point of Contact

5.1 Head Surveillance and Spectrum Management
Directorate of Airspace Policy
K6 G6
CAA House
45-59 Kingsway
London
WC2B 6TE

Tel: 020 7453 6530
Fax: 020 7453 6565

E-mail: andrew.knill@caa.co.uk

Chapter 5 Civil Operator Qualifications

1 Scope

1.1 This Chapter applies to all UAS operations in United Kingdom airspace except those by military UAS. State operated UAS are expected to comply with this Chapter, unless otherwise directed by the authority of the State of the United Kingdom.

1.2 Excluded operations are expected to conform to the relevant regulations such as MARDS and JSP550 Regulation 320, in the case of military UAS, and AvP67 for military contractors.

1.3 UAS operations conducted for the purposes of testing or development under Design, Production or Maintenance approvals are expected to comply with this Chapter as far as practicable. However, qualification requirements for UAS pilots engaged in such operations will be assessed by CAA Personnel Licensing Department, at the request of CAA Airworthiness Division, to which all requests for such approvals should first be submitted.

2 Lead Agency

2.1 CAA, Safety Regulation Group, Personnel Licensing Department.

3 Definitions

3.1 Definitions of UAS flight crew used are as defined in the JAA/Eurocontrol Joint UAS Task Force Final Report and in the glossary of this publication.

4 Policy

4.1 The requirements for the licensing and training of United Kingdom civil UAS pilots and commanders have not yet been fully developed. It is expected that United Kingdom requirements will ultimately be determined by European Aviation Safety Agency (EASA) regulations and these are expected to comply with the principles of equivalence and transparency established in the JAA/Eurocontrol Joint UAV Task Force Final Report.

4.2 The fundamental principles of equivalence and transparency have been established to ensure that operation of UAS does not constitute a greater risk to flight safety, the safety of other airspace users and the safety of third parties than current manned aircraft operations. The qualification requirements for pilots and commanders of UAS must abide by these principles, and the development of United Kingdom UAS pilot and commander licensing requirements will seek to ensure this.

4.3 The guidance provided in this Chapter has been formulated with regard to anticipated EASA requirements for UAS pilot and commander qualification, for civil commercial UAS operations in non-segregated airspace with acceptable Sense and Avoid capability. Whilst the guidance offered in this Chapter has been formulated for this most demanding case, it should also be considered for other UAS operations, such as those in segregated airspace, and for non-civil UAS operations.

4.4 Until such time as formal UAS pilot and commander licensing requirements have been implemented, CAA Personnel Licensing Department will determine the relevant requirements on an individual case-by-case basis, in consultation with other CAA departments. In determining whether to permit a person to act as pilot or commander of a UAS, CAA Personnel Licensing Department will consider a number of factors such as pilot experience, maximum air vehicle mass, flight control mode, operational control and safety risk assessment.

4.5 UAS present particular difficulties in the determination of qualification requirements for their crews. Manned aircraft, regardless of the level of flight control automation available, have a common manned flight control mode, for which common pilot qualifications have been formulated. UAS have a number of different flight control modes with differing levels of manual intervention capability, engendering a much higher level of complexity to the determination of UAS pilot and commander qualification requirements. To determine UAS pilot and commander qualification requirements on the same basis as manned aircraft may yield requirements that are too inflexible, too onerous and inappropriate for UAS operations. It may be more appropriate to consider requirements sufficient to mitigate risk to other airspace users and third parties, particularly where that risk may have been reduced by other measures such as airspace segregation.

4.6 Further consideration of the factors that may mitigate risk to other airspace users and third parties indicates that UAS pilot and commander qualification requirements may be resolved into two broad categories. The first is where risk to other airspace users and third parties is reduced through measures such as airspace segregation, line-of-sight operation or low aerial vehicle mass, and the second is where there are no such defined risk mitigating measures. In the first case, CAA Personnel Licensing Department may adopt a flexible approach to UAS pilot and commander qualification requirements, but in the second case the principles of equivalence and transparency will demand a more rigorous approach, similar to existing manned commercial or air transport pilot licensing requirements. For ease of reference the two licensing regimes will be referred to as:

UAS Pilot and Commander Licensing Regimes	
Regime:	**Explanation:**
Case 0	One or more risk mitigating factors apply, therefore reduced or flexible UAS pilot and commander qualification requirements apply.
Case 1	No risk mitigating factors apply, therefore equivalent UAS pilot and commander qualification requirements apply.

NOTE: An acceptable sense and avoid system is not considered a risk mitigation factor, but a pre-requisite for Case 1 operations. Consequently, all civil UAS operations without an acceptable sense and avoid system, including those undertaken for the development of UAS, are by definition Case 0 operations.

Table 1 Table of Risk Mitigating Factors in UAS Operations

Risk Mitigating Factors in UAS Operations	
Factor:	**Effect:**
Airspace Segregation	Airspace segregation ensures separation of the UAS operation from other airspace users and third parties. Risk of collision, airprox or separation infringement is eliminated, except in the case of incursion by other airspace users into segregated airspace, or uncommanded excursion by the UAV.
Visual Line-of-Sight Operation	Operation within the unassisted direct line-of-sight of the UAV pilot (accepted as within 500 metres horizontally and at a height not exceeding 400 feet vertically above the surface) permits the UAS pilot to respond to and avoid other airspace users.
Low Aerial Vehicle Mass	Aerial vehicle mass below a specified limit reduces risk to other airspace users and third parties, by reducing maximum kinetic energy damage potential below a significant level. This mass limit is determined by CAA Airworthiness Division.

4.7 Maximum Operating Mass

4.7.1 The certification basis of any aircraft has some bearing on the flight crew qualification requirements for that aircraft, and UAS are no exception. UAS are certificated in 4 categories relating to UAV mass, and the flight crew qualification requirements are related to these. The following table states the anticipated qualification level requirement for pilots and commanders of UAS in the relevant mass category.

Aerial Vehicle Mass Related Licensing Requirements		
OM(max)	**Case 0**	**Case 1**
Less than 7 kg[1]	None, or, BMFA A Certificate, Industry Code of Practice or equivalent	BMFA B Certificate, Industry Code of Practice, or equivalent
7 kg to 20 kg	BMFA B Certificate, Industry Code of Practice or equivalent	CPL(U) or equivalent
20 kg to 150 kg	BMFA B Certificate Industry Code of Practice or equivalent	CPL(U) or equivalent
More than 150 kg	Industry Code of Practice, CPL(U) or ATPL(U) or equivalent	CPL(U) or ATPL(U) or equivalent

1. See Revision History, Third edition, paragraph 3.

UAS pilot and commander qualification requirements for Case 1 operations are formulated with particular regard to the principles of equivalence and transparency. For commercial manned aircraft operations at least a CPL level qualification is required. Commercially operated UAS that share the same airspace with, and pose the same risk as, manned aircraft, should require similar level of qualification of the flight crew. However, the requirement for CPL or ATPL level qualification should not be read to imply that UAS pilots and commanders will require manned aircraft piloting experience to qualify.

4.8 UAS Flight Control Mode

4.8.1 UAS pilots and commanders will also be required to meet training and testing requirements for each class or type of UAS they will operate. UAS type or class ratings may be determined on the basis of individual type in the case of larger UAV, or by class for smaller UAVs. In seeking to determine whether a particular UAS should be rated according to type or class, CAA Personnel Licensing Department will take into consideration the certification of the UAS, and whether the UAS will be flown by pilots dedicated to the type.

4.8.2 For UAS expected to be flown by pilots operating more than one type, UAS may be rated as a class rather than a specific type. In determination of the basis of class rating, CAA Personnel Licensing Department considers the flight control mode of the UAS to be the most appropriate means of classifying such systems. Classification of UAS according to flight control mode permits the degree of automation or autonomy of a UAS to be considered when formulating requirements for UAS pilot and commander qualification. Provisional categories of UAS flight control modes are indicated in the following table. The provisional flight control mode categories in the table are arranged in order of increasing automation or autonomy, and decreasing requirement for traditional manned aircraft piloting competence. Each flight control mode listed in the table is based on a broad description of flight control mode capability, and gives an analogous manned aircraft autopilot mode as a comparison.

4.8.3 For UAS type certificated as a specific type, type-rating training should include training in all the flight control modes under which the UAS type is capable of operating.

For UAS type certificated as a member of a flight control mode class (or classes), class rating training should be undertaken for all flight control modes under which the UAS type is capable of operating. Flight control mode class rating training for one class should be valid for all UAS types within the same flight control mode class.

Flight Control Modes for UAS Class Ratings		
Class:	**Flight Control Mode Class Name:**	**Example Type:**
Class 0	Reference Class – Manned Aircraft	Airbus 320, EH101
Class 1	Direct Command – Remote Pilot	Jindivik, RMA
Class 2	Attitude Command – 'Control Wheel' Steering	
Class 3	Flight Parameter Command – 3-Axis Autopilot	Mirach
Class 4*	Stored Flight Profile Command – Autopilot +FMC	Global Hawk
Class 5*	Sensor Command – Autopilot + FMC + Sensors	BGM-109
Class 6*	Autonomous Command – Intelligent UAV	AI UAV

*Please note that Classes 4, 5 and 6 will require or command override intervention capability.

4.9 Other Factors

4.9.1 Prior to the implementation of formal UAS pilot and commander licensing requirements, CAA Personnel Licensing Department will consider factors such as the arrangements for operational control of a UAS, and the safety risk assessment of a proposed UAS operation, when considering whether to permit an application for a person to act as UAS pilot.

5 Flight Radio Telephony Operators' Licence

5.1 UAS pilots and commanders intending to use radiotelephony must ensure that they hold a Flight Radio Telephony Operators' Licence (FRTOL) valid for the privileges intended to be exercised.

6 UAS Pilot and Commander Training Courses

6.1 Currently there are no approved training courses for UAS flight crew, for either the issue of a licence or the issue of type or class ratings. All enquiries relating to such UAS flight crew training should be made to the point of contact listed below.

7 Point of Contact

7.1 All enquiries and applications should initially be made through the CAA UAS point of contact:

Personnel Licensing Policy
Civil Aviation Authority
Aviation House
Gatwick Airport South
West Sussex
England
RH6 0YR

Tel: 01293 573850
Fax: 01293 573996

E-mail: stephen.williams@caa.co.uk

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Chapter 6 Cross Border Operations

1 Scope

1.1 For the purposes of this guide, International boundaries are considered to be coincident with FIR/UIR divisions.

2 Lead Agency

2.1 CAA – Directorate of Airspace Policy (DAP).

3 Policy

3.1 UAS operators who wish to cross an international FIR/UIR boundary to another country must comply with the Regulatory and ATM procedures applicable to the territory over which the UAS is flown, which may differ from UK regulations. While DAP will provide guidance on cross border ATC procedures, guidance on foreign national procedures should be sought from the appropriate State CAA/MoD.

3.2 Article 8 of the Convention on International Civil Aviation ('Chicago Convention') states that:

> "No aircraft capable of being flown without a pilot shall be flown over the territory of a contracting State without special authorisation by that State and in accordance with the terms of such an authorisation. Each contracting State undertakes to insure [*sic*[1]] that the flight of such an aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft"

3.3 For the purposes of the Convention the territory of a State shall be deemed to be the land areas and territorial waters adjacent thereto under the sovereignty, suzerainty, protection or mandate of such state (Chicago Convention Article 2).

4 Point of Contact

ORA4
K6 G3
CAA House
45-59 Kingsway
London
WC2B 6TE

Tel: 020 7453 6544
Fax: 020 7453 6565

E-mail: doug.robertson@caa.co.uk

1. ICAO use of "insure" should read "ensure".

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Chapter 7 UAS Autonomy

1 Scope

1.1 This guidance relates to the autonomy of civil unmanned aircraft systems.

2 Lead Agency

2.1 The lead agencies are as for Section 3, Chapter 2, Certification.

3 Introduction

3.1 The concept of an autonomous UAS is a system that will do everything for itself. It will be able to follow the planned route, communicate with Aircraft Controllers and other airspace users, detect, diagnose and recover from faults, and operate at least as safely as a system with continuous human involvement and control.

3.2 Definition of Autonomy

3.2.1 Autonomy is the capability of the system to make decisions based upon an evaluation of the current situation (often referred to as situation awareness). The system must take account of situational awareness data that is pertinent to the decision about to be made. Autonomous systems should make a rational evaluation of the choices available and the possible courses of action that could be taken, in light of this situation awareness in order to make its decision. We expect such a rational system to then make "good" decisions in terms of a human's assessment of those available choices.

3.2.2 To perform in this way, an autonomous system will accept sensor and user inputs as an automatic system would. However, it will operate with more abstract concepts, rather than reacting only to inputs in a fixed manner irrespective of the current situation. As with humans, an autonomous, or decision-making, system should be able to act in a proactive (or goal-directed) or reactive (or responsive) manner when making its decisions.

3.3 Definition of an Autonomous System

3.3.1 An autonomous system is one that perceives its environment and determines if this affects its goal(s), and it takes action to ensure as far as practicable (and safe) that its goals will be achieved. It reasons about its course of action from a number of alternatives, to achieve these goal(s) without recourse to human oversight and control.

3.3.2 An autonomous system goal is multi-faceted and more abstract than a task or script executed in an automated system. A task is likely to be a list of actions to be executed in a fixed order. A goal is expressed at a higher level of abstraction.

3.4 Decision-making by Autonomous Systems

3.4.1 The decisions made by an autonomous system are made on a rational basis. In addition, to ensure consistent behaviour that will encourage human trust the system's decision-making should be repeatable. That is, the system should exhibit the same behaviour each time it is exposed to identical circumstances and it should not produce large changes in behaviour for small changes in inputs. An obvious exception to this is where the input to the system results in a "yes/no" decision, such

as a point of no return (e.g. deciding to return to the departure airfield instead of continuing to the destination due to a very small difference in the amount of fuel remaining). Such behaviours can be evaluated using sensitivity analysis, relating system inputs to output.

3.5 Delegation to an Autonomous System

3.5.1 The autonomy concept encompasses systems ranging in capability from those that can operate without human control or direct oversight ("fully autonomous"), through "semi-autonomous" systems that are subordinate to a certain level of human authority, to systems that simply provide timely advice and leave the human to make all the decisions and execute the appropriate actions.

3.5.2 It is envisaged that the most cost-effective combination will be one where the human pilot (UAS-p) and the autonomous system work together as a team, with the human as the ultimate authority. If command and control communications between the UAS-p and UAV is lost the system has to be able to reason independently of the UAS-p and must revert to a pre-determined safe scope of operation.

3.6 Sub-systems and Autonomous Capability

3.6.1 An autonomous system can be comprised of various decision-making sub-systems, each responsible for its domain of authority, and overseen by an autonomous management system. This approach addresses the inherent complexity of autonomous operations by decomposing the autonomous capability into smaller, more easily designed and managed components that can be treated – and assessed – as individual systems in their own right. Consequently autonomous capability may be made up from autonomous flight management, sense & avoid, route management, power management and prognostic health management systems for example, collaborating with the human UAS-p.

3.7 Learning Systems

3.7.1 A learning system is one that is able to monitor its own behaviour and modify or change its responses to situations, and so optimise its behaviour in future occurrences of those situations.

3.7.2 It is expected that systems with a learning capability will only be able to meet the requirements for repeatability described in 3.4 if the learnt behaviours have been independently evaluated prior to their creation and subsequent execution by the system.

3.8 Systems Exhibiting Unexpected or Emergent Behaviours

3.8.1 Systems that exhibit decision-making or behaviours that are not consistent and repeatable would not be able to be certificated under the assumptions described above.

3.9 UAS Autonomy

3.9.1 An industry objective is that eventually autonomous UAS will be able to operate without human intervention across all flight sectors:

- Ground manoeuvring, including ground collision avoidance;
- Take-off and climb;
- En-route;
- Descent and landing;
- Ground operation at the destination; and
- Handling of emergencies in any of these sectors.

4 Policy

4.1 General

4.1.1 All past and current civil aircraft operations and standards have an inherent assumption that a competent human is able to intervene and take direct control within a few seconds at any stage, and that the human will have been presented with enough information to have continuous situational awareness. It should be expected that, for the foreseeable future, the civil aviation authorities would require this human intervention facility to be available for all UAS, regardless of their level of autonomy.

4.2 Human Authority Over Autonomous UAS

4.2.1 CAA policy (Section 2, Chapter 5) is that all UAS must be under control of a UAS Commander. Dependent on the level of autonomy a UAS Commander may simultaneously assume responsibility for more than one UAS, particularly when this can be accomplished safely by directing activities of one or more UAS-p.

4.3 Safe Operation with Other Airspace Users

4.3.1 Consistent with Section 2, Chapter 1, paragraph 5, autonomous UAS must demonstrate an equivalent level of compliance with the rules and procedures that apply to manned aircraft. It is expected that this will require the inclusion of an approved sense and avoid capability.

4.4 Compliance with Air Traffic Management Requirements

4.4.1 Consistent with Section 2, Chapter 1, paragraph 5.5, autonomous UAS operation is expected to be transparent to Air Traffic Management (ATM) providers and other airspace users. The autonomous UAS will be required to comply with any valid air traffic control instruction or a request for information made by an ATM unit in the same way and within the same timeframe that the pilot of a manned aircraft would. These instructions may take a variety of forms and, for example, may be to follow another aircraft or to confirm that another aircraft is in sight.

4.5 Emergencies

4.5.1 The decision-making function of any autonomous UAS must be capable of handling the same range of exceptional and emergency conditions as a manned aircraft, as well as ensuring that failure of the decision making function itself does not cause a reduction in safety. Ultimately this would require referral to the UAS-p where available.

5 Factors for Consideration when Certificating Autonomous Systems

5.1 Data Integrity

5.1.1 An autonomous system bases its reasoning on its view of the world, and this view comes from sensors measuring aspects of the environment (e.g. airspeed), data stored on board in databases (e.g. a flight plan or waypoints database) or as a result of information arriving across a communications network with which the system is communicating (e.g. ATM datalink).

5.1.2 In a manned aircraft the pilot is presented with sensor data (airspeed, altitude, rate of climb/descent) and the human interprets the data and its credibility before taking action. Unlike a piloted aircraft, the autonomous system is part of the overall flight management system, and obtains this data direct from sensors, databases or messages without the critical human oversight provided by the pilot. Consequently UAS are vulnerable to incorrect or corrupted data.

5.1.3 There are two approaches to addressing this risk: ensuring that data quality assurance is part of the certification process, or providing the autonomy system with the capability to reason about the data it receives in order to detect and discard what is inconsistent or incorrect.

5.2 Security

5.2.1 An autonomous system must be demonstrated to be protected from accepting unauthorised commands, or from being "spoofed" by false or misleading data. Consequently, autonomous systems have a high degree of dependence on secure communications, even if they are able to reason about false or misleading commands.

6 Points of Contact

6.1 Civil Aviation Authority

For enquiries relating to CAA UAS design standards:

Head of Aircraft Certification Department
Airworthiness Division
Safety Regulation Group
Civil Aviation Authority
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR
UK

Tel: 01293 573293
Fax: 01293 573975

E-mail: Department.Certification@caa.co.uk

6.2 EASA

6.2.1 For EASA contact details, see the EASA web site www.easa.europa.eu

Section 3 Civil Operations

Chapter 1 Approval to Operate

1 Lead Agency

1.1 CAA – Safety Regulation Group (SRG), Flight Operations Policy Department (FOPD).

2 Introduction

2.1 All civil aircraft fly subject to the legislation of the Air Navigation Order 2005 and the associated Rules of the Air Regulations 2007. However, in accordance with its powers under Article 153 of the ANO, the CAA may exempt UAS operators from the provisions of the ANO and the Rules of the Air, depending on the UAV's potential to inflict damage and injury.

3 Policy

3.1 The table below summarises current CAA policy for UAVs to fly in UK airspace and identifies the operating constraints that would normally be applied.

3.2 The CAA may issue an exemption or permission for light UAVs to operate if the applicability criteria detailed below are met and the CAA is satisfied that the light UAS will be operated within the constraints stipulated. If a light UAV is intended for operation outside of these constraints, the applicant should discuss these issues directly with the CAA at the earliest opportunity to determine whether equivalent safety measures can be applied that would allow an exemption or permission to be issued.

UAV Mass	Commercial Use (Aerial Work)
<7 kg	'Small Aircraft' under ANO Art 155 • Minimum operational constraints **(but See Note 1)** • No airworthiness standards
7–20 kg	'Small Aircraft' under ANO Art 155 • Operational constraints required by ANO Art 98(2)(a) – (d) and additional aerial work constraints **(See Note 2)** • CAA Permission required under ANO Art 98(2)(e) which is subject to further constraints as the CAA thinks fit **(See Note 3)** • No airworthiness standards
20–150 kg	• Exemption required including constraints at **Notes 2 and 3** • Impact kinetic energy must be determined to be not more than 95 KJ **(See Note 4**) • Airworthiness recommendation from accredited body **(See note 5)**
>150 kg	• Existing national operating rules • EASA airworthiness standards

NOTE 1: Impending Changes to Regulation

The CAA is in the process of a consultation with industry over a proposal to amend the Air Navigation Order to require the operators of UAS with a UAV component of less than 7 kg mass to obtain a CAA permission, as is currently the case for UAVs with a mass of 7-20 kg. This proposal intends to ensure public safety by applying such operational constraints to flights of a UAV, or UAVs, of less than 7 kg mass as are appropriate to the type of operation envisaged and the potential risk to members of the public.

If the consultation exercise approves the proposal, it is likely that the ANO Amendment will pass into law in December 2008. Potential operators of UAS with a UAV component of less than 7 kg should ascertain, before commencing operations, whether or not they are required to obtain a CAA permission. The point of contact is:

Flight Operations Policy (General Aviation)
Flight Operations Division
Safety Regulation Group
Civil Aviation Authority
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR

01293 573529/573476

e-mail: chris.finnigan@caa.co.uk copy to: ben.watkins@caa.co.uk

NOTE 2: Applicable Operating Constraints (ANO Art 98(2)(a) – (d))

Shall not fly such an aircraft:

a) unless the person in charge of the aircraft has reasonably satisfied himself that the flight can safely be made;

b) in Class A, C, D or E airspace unless the permission of the appropriate air traffic control unit has been obtained;

c) within an aerodrome traffic zone during the notified hours of watch of the air traffic control unit (if any) at that aerodrome unless the permission of any such air traffic control unit has been obtained;

d) at a height exceeding 400 ft above the surface unless it is flying in airspace described in sub-paragraphs b) or c) and in accordance with the requirements thereof.

Additional aerial work constraints:

e) maximum achievable steady speed in level flight must not exceed 70 kt;

f) aerobatics will be prohibited;

g) tasks that involve aerial inspection of, or close to, any object or installation that would present a risk to safety in the event of damage due to any impact by the UAV. (e.g. Chemical/gas storage areas) shall be prohibited;

h) participation in any public flying display is prohibited (except with the written permission of the CAA).

NOTE 3: Further Constraints the CAA May Think Fit to Apply

Further constraints the CAA may think fit will normally include a prohibition on flight:

a) at a distance beyond the visual range of the UAV-pilot/operator of the said aircraft and in any event at a distance exceeding 500 metres from the UAV-p/operator;

b) within a specified distance, normally 150 metres, of any congested area of a city, town or settlement;

c) within a specified distance, normally 50 metres, of any person, vessel, vehicle or structure not under the control of the aircraft operator except that during the takeoff or landing an aircraft to which this subparagraph applies shall not fly within 30 metres of any person other than the person in charge of the said aircraft or a person in charge of any other small aircraft or a person necessarily present in connection with the operation of such an aircraft;

d) unless the aircraft is equipped with a mechanism that will cause the said aircraft to land in the event of a failure of or disruption to any of its control systems, including the radio link, and the person in charge of the said aircraft has satisfied himself that such mechanism is in working order before the aircraft commences its flight.

NOTE 4: Kinetic Energy Limits

Two crash scenarios should be considered in determining the impact kinetic energy of the UAV, as follows:

a) a free-fall from 400 ft for all UAVs; and

b) additionally, for a UAV 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 400 ft will hit the surface at 95 kt and the kinetic energy at impact will be 95 KJ if the mass of the object is 80 kg. Should the object in fact exhibit significant aerodynamic drag (without reliance upon any onboard parachute deployment system), the impact velocity will be less and a higher mass may be permissible without exceeding a calculated 95 KJ.

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

Further detail on the policy can be found in a CAA Paper available on the CAA Website[1].

NOTE 5: Application for Approval to Operate

To expand on the statement regarding Qualified Entities made in Section 3, Chapter 2, paragraph 4.1.1, the CAA would welcome the establishment of Qualified Entities able to provide it with recommendations concerning the design and build standards of UAS and to oversee the test flying of UAVs.

1. www.caa.co.uk/docs/1416/srg_str_00002-01-180604.pdf

In the absence of such Qualified Entities, the CAA may accept representations from other sources on a case-by-case basis where acceptable evidence of their expertise is presented. In all cases the CAA will expect to be presented with evidence that the standards applied are at least as demanding as those applied by the Large Model Association to large recreational model aircraft (20-150 kg).

The inclusion of an operations manual covering the procedures to be followed for all envisaged operations of the UAS is a key requirement to enable the CAA to accurately assess the application and the safety case it makes, before deciding whether to grant an exemption or permission.

3.3 Application for an Exemption or Permission should be made to the CAA Flight Operations Inspectorate (General Aviation), using the contact details below, stating the mass, configuration and performance details of the UAV. It is vital to be clear who is the operator (defined in ANO Article 155(3)). The operator, i.e. the person having management of the aircraft, and not another person who may, for example, have contracted with the operator to have work done, should apply for an Exemption or Permission.

3.4 Security of radio control links and provision for flight termination in the event of a malfunction should be considered from the outset.

3.5 UAVs (other than balloons) intended for operation beyond visual range of the UAV-p will require an approved method of aerial collision avoidance that ensures compliance with Rule 8 of the Rules of the Air Regulations 2007 (Rules for avoiding aerial collisions), or will be restricted to operations within segregated airspace. For practical purposes, it is considered that the maximum range over which effective visual control can be exercised should not normally exceed 500 metres. Note that the collision avoidance rules apply to flights conducted under the instrument flight rules (IFR) and to flights made with an air traffic control clearance, as well as to flights under the visual flight rules (VFR).

4 Source Documents

[1] Air Navigation Order 2005, Rules of the Air Regulations 2007.

[2] CAP 032 UK Aeronautical Information Publication.

5 Point of Contact for Applications for Exemptions or Permissions

Mr George Duncan
FOI(GA)
FOD, SRG
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR

Tel: 01293 573526
Fax: 01293 573973

E-mail: george.duncan@caa.co.uk

Alternative contact:

FOI(GA) Admin

Tel: 01293 573525
Fax: 01293 573973

E-mail: ga@caa.co.uk

Chapter 2 Certification

1 Scope

1.1 This Chapter covers design and production standards applicable to the civil certification of the whole UAS, including components of UAS remote from the aircraft that support or can affect the airworthiness of the UAS.

2 Lead Agency

2.1 With the creation of the European Aviation Safety Agency (EASA) (reference paragraph 5 [1]) in September 2003, certification of a UAS with an operating mass of greater than 150 kg is the responsibility of EASA (with some exceptions – see paragraph 2.2). General queries and applications for certification for a UAS regulated by EASA should be addressed directly to EASA.

2.2 UAS not covered within the scope of EASA are excluded by various articles of European Council Regulation 1592/2002, as follows:

2.2.1 Article 1 excludes aeronautical products, parts and appliances, as well as personnel and organisations involved in the design, production or maintenance of such products, part or appliances that are engaged in military, customs, police or similar services. The UK interpretation of military, customs, police or similar services is given by Airworthiness Notice 13 as published in CAP 455, which can be viewed on the CAA website (www.caa.co.uk/AN13).

2.2.2 Article 4(1) and Annex II excludes aircraft specifically designed or modified for research, experimental or scientific purposes, and likely to be produced in very limited numbers. This exclusion does not apply to the testing of designs or modifications that are ultimately to be embodied in a UAS to be used for other than experimental or scientific purposes.

2.2.3 Article 4(1) and Annex II exclude unmanned aircraft with an operating mass of less than 150 kg.

2.3 Responsibility for the airworthiness regulation of civil UAS that are outside the scope of EASA remains with the National Aviation Authorities which, for the UK, is the Airworthiness Division of the Civil Aviation Authority, Safety Regulation Group.

3 Policy

3.1 UAS Subject To EASA Regulation

3.1.1 Applications or enquiries relating to the certification of UAS within the scope of EASA should be addressed directly to EASA.

3.1.2 In November 2005, EASA issued A-NPA 16/2005 – Policy for Unmanned Aerial Vehicle (UAV) Certification (reference paragraph 5 [6]). This A-NPA makes reference to the joint JAA/Eurocontrol Task-Force study to develop a concept of regulation for UAS (reference paragraph 5 [2]). The A-NPA requested comment on different approaches to the certification of a UAS. The concept to be adopted is a decision for EASA, and the references are provided here solely for background information.

3.2 UAS Subject to National Airworthiness Regulations

3.2.1 Paragraph 2.2 identifies the UAS that are not regulated by EASA and will be regulated by the UK authorities - the MoD for those UAS deemed to be military under the definition within the ANO, and the CAA for all other UAS. For UAS with an operating mass (without fuel) in excess of 20 kg the CAA will apply the General UAS Certification Policy as described in Paragraph 3.2.2. A UK civil UAS with an operating mass of less than 150 kg may be eligible to fly in accordance with the Light UAV Systems Policy as described in Paragraph 3.3.

3.2.2 For a civil UAS with an operating mass not exceeding 20 kg (without fuel), no airworthiness certification is required. However, an operational permission may be required for such aircraft – see Section 3, Chapter 1.

3.2.3 The airworthiness approval for any UAS between 20kg and 150kg should be a Certificate of Airworthiness (or a permit to fly). However, to facilitate the development of UAS of under 150 kg, the CAA has produced the Light UAV Policy as described in Paragraph 3.3.

3.2.4 Above 150 kg MTOM the airworthiness approval should be a Certificate of Airworthiness or a permit to fly ("B" Conditions[1] may be applied to facilitate test flying). Organisations undertaking design and/or manufacture of civil UAS above 150 kg will be required to hold Organisation approvals conforming to Chapter A8-21 of BCAR Section A[2] – Airworthiness Procedures where the CAA has Primary Responsibility for Type.

3.2.5 The Light UAS policy is an interim alternative to the general certification procedures and standards provided the UAS meets the defined applicability criteria and operates within the constraints stipulated by the CAA. If a light UAS is to be operated outside of these constraints, the applicant should discuss these issues directly with the CAA at the earliest opportunity to determine whether mitigating measures can be applied that would allow an exemption to be issued. Failing this, insistence upon compliance with the general UAS certification policy would be expected.

3.3 The 'Light UAV Systems' Policy

3.3.1 UAS with a UAV component operating mass of less than 150 kg may be eligible for operation in accordance with this policy.

3.3.2 Light UAVs have mass and speed characteristics similar to those of model aircraft used for recreational purposes. The CAA has reviewed the safety record of model aircraft and concluded that UAS can be operated safely under a similar level of regulation, provided that the UAS in question has no greater capability than the majority of the existing model aircraft fleet and is subject to procedures and limitations that are at least as demanding as those applied to model aircraft.

3.3.3 UAS that do not exceed the defined maximum speed and kinetic energy levels representative of the existing model aircraft fleet may be exempted from compliance with certain requirements provided that operational restrictions at least as demanding as those applied to model aircraft are complied with. The applicable operational limitations include: operating within visual line-of-sight (not more than 500 metres from the UAV-pilot); not operating at a height exceeding 400 ft above the surface, and not over or within a defined distance of any person, vehicle or structure not directly involved in the operation of the UAS. (Further details of the Light UAS policy can be obtained from reference paragraph 5 [4], which is summarised in Section 3, Chapter 1 of this document).

1. 'B Conditions' means the conditions so entitled set out in ANO paragraph 2 of Part A of Schedule 3.
2. See CAP 553 - www.caa.co.uk/CAP553

3.3.4 The granting of the exemptions and permissions needed to allow the operation of a UAS within these constraints will be subject to receipt by the CAA of a positive recommendation from an organisation approved for that purpose. Such recommendations will be made following appropriate examination of design and manufacture and witnessing of a successful programme of function and reliability flight-testing. Series examples of a light UAS will not automatically qualify for an exemption but will be subject to individual approvals to ensure consistency in build standards and flight characteristics. Modification to a light UAS is prohibited for the same reason, unless the UAS is subject to re-examination/re-assessment and a further recommendation from an approved organisation is submitted to the CAA for issue of a new exemption.

3.4 General UAS Certification Policy

3.4.1 Any UAS with an operating mass of greater than 20 kg (without fuel) will be regulated under this policy, unless the CAA has granted an exemption under the light UAS policy.

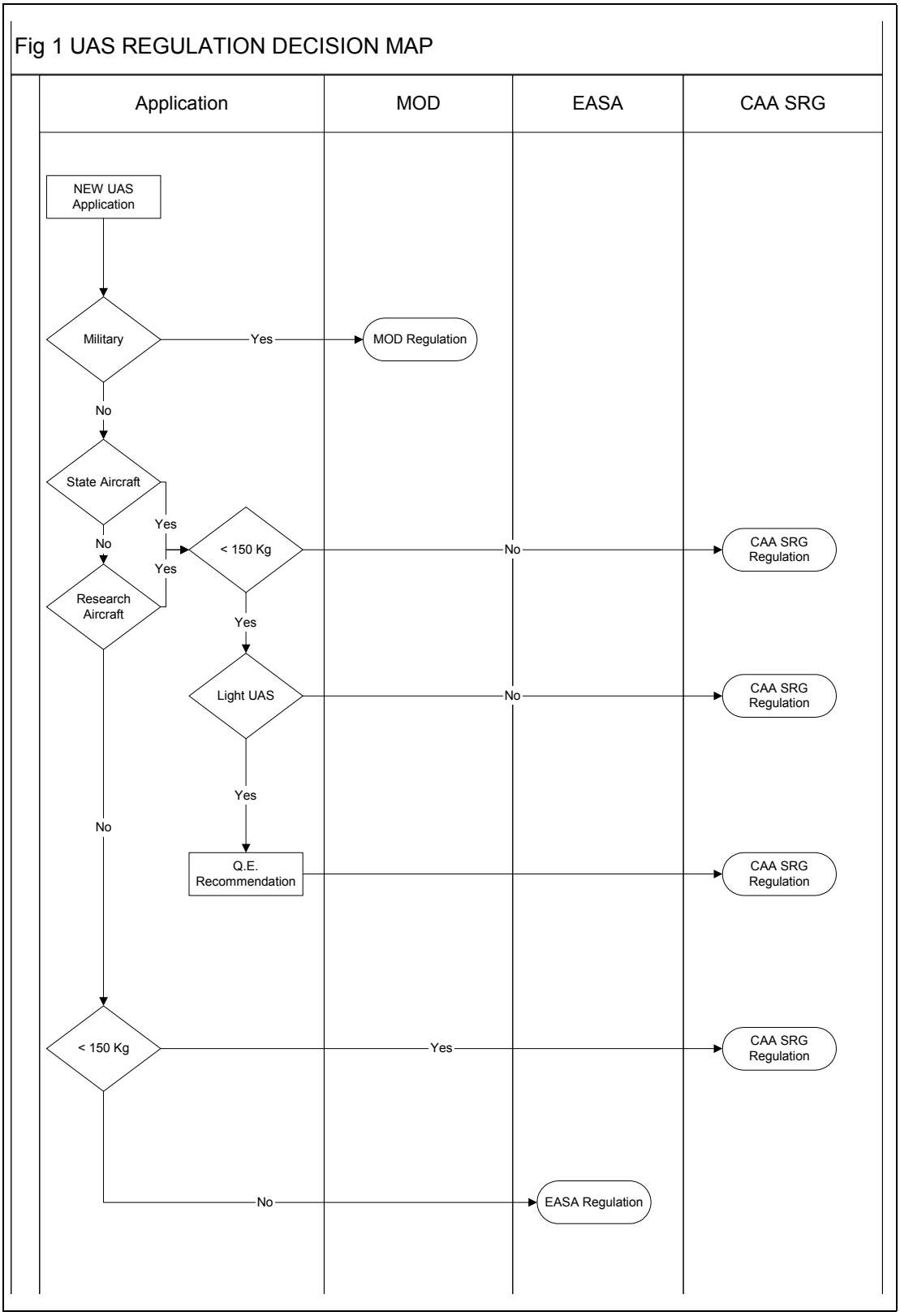
3.4.2 Under the General UAS Certification Policy – CAA Paper "*Aircraft Airworthiness Certification Standards for Civil UAVs* (reference paragraph 5 [3]), organisations undertaking design and/or manufacture of civil UAS (that is to fly other than in accordance with the light UAS policy) will be required to hold Organisation approvals that conform to EASA Part 21 requirements or similar requirements acceptable to the CAA. Initial application for design or production activity should be made to the Applications and Approvals Department as detailed in Paragraph 6.2.

3.4.3 As detailed in the General Policy, airworthiness design requirements appropriate to each type of UAS seeking certification will be derived from the existing codes of requirements as currently applied to manned aircraft. Demonstration of compliance with the applicable requirements will allow the issue of a Type Certificate. Certificates of airworthiness will be issued to individual UAS following acceptable demonstration of compliance to the Type Certificate standard and when the CAA is satisfied that the UAS is fit to fly.

3.4.4 Where any function of a UAS is essential to, or can prejudice, continued safe flight and landing of the UAS, that function, and the equipment performing that function (including equipment remote from the UAS), shall be considered as part of the aircraft for the purposes of the validity of the certificate of airworthiness. As such, that function will have to comply with the applicable airworthiness requirements.

3.4.5 The UAS, including the Ground Control Station, should be designed taking into account Human Factors issues. CAP 719 Fundamental Human Factors Concepts gives guidance in this area (reference paragraph 5 [7]).

Fig 1 UAS REGULATION DECISION MAP



4 Qualified Entities

4.1 Light UAV Between 20 kg and 150 kg

4.1.1 Contained within the Light UAV Policy is the concept of recommendations from suitable accredited bodies, which will be known as Qualified Entities. The standards to be met by UK Qualified Entities are currently being developed and will be published as Chapter A8-22 of BCAR Section A – Airworthiness Procedures where the CAA has Primary Responsibility for Type.

5 Source Documents

[1] Regulation (EC) No.1592/2002 of the European Parliament and of the Council of the 15 July 2002 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency.

(Available to download from the EASA website: www.easa.europa.eu)

[2] The Joint JAA/Eurocontrol initiative on UASs. UAV Task-Force Final Report.

(Available to download from the JAA website: www.jaa.nl)

[3] CAA Paper "*Aircraft Airworthiness Certification Standards for Civil UAVs*" D.R. Haddon/C.J. Whittaker; August 2002.

(Available to download from the CAA website www.caa.co.uk/docs/393/srg_acp_00016-01-120203.pdf)

[4] CAA Paper "*UK-CAA Policy For Light UAV Systems*" D.R. Haddon/C.J. Whittaker; June 2004.

(Available to download from the CAA website www.caa.co.uk/docs/393/srg_str_00002-01-180604.pdf)

[6] EASA A-NPA 16/2005 – *Policy for Unmanned Aerial Vehicle (UAV) Certification*

(Available to download from the EASA website: www.easa.europa.eu)

[7] CAP 719 *Fundamental Human Factors Concepts*

(Available to download from the CAA website www.caa.co.uk/CAP719)

6 Points of Contact

6.1 For enquiries relating to CAA UAS design standards:

Head of Aircraft Certification Department
Airworthiness Division
Safety Regulation Group
Civil Aviation Authority
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR
UK

Tel: 01293 573293
Fax: 01293 573975

E-mail: department.certification@caa.co.uk

6.2 For enquiries relating to CAA approval of design and production organisations:

Applications and Approval Department
Airworthiness Division
Safety Regulation Group
Civil Aviation Authority
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR
UK

Tel: 01293 768374
Fax: 01293 573860

E-mail: a&a@caa.co.uk

6.3 For EASA contact details, see the EASA web site www.easa.europa.eu.

Chapter 3 Registration

1 Scope

1.1 The registration requirements for civil UAS are contained in the ANO and are in line with the requirements of ICAO Annex 7.

2 Lead Agency

2.1 CAA – Aircraft Registration Section.

3 Policy

3.1 The registration requirements for UAVs are the same as for any other aircraft. The legislative requirements are contained in the ANO, Articles 3, 4 and 5.

3.2 As mentioned earlier in the document, exceptions are made for small aircraft. A small aircraft is defined in the Order as any unmanned aircraft weighing not more than 20 kg without fuel. None of the registration requirements apply to small aircraft.

3.3 EC Regulation 785/2004 came into force on 30th April 2005 requiring most operators of aircraft, irrespective of the purposes for which they fly, to hold adequate levels of insurance in order to meet their liabilities in the event of an accident. This EC Regulation specifies amongst other things the minimum levels of third party accident and war risk insurance for aircraft operating into, over or within the EU (including UAVs) depending on their MTOM.

3.4 Compliance monitoring of the Insurance regulation is carried out by the CAA Aircraft Registration Section. Details of the insurance requirements can be found on the CAA website[1] under "Mandatory Insurance Requirements".

4 Source Documents

[1] Air Navigation Order 2005, Articles 3, 4 and 5. Other guidance material is available at www.caa.co.uk/aircraftregister.

5 Point of Contact

5.1 Guidance on the Registration of civil UAVs in the UK should be sought from:

CAA, Aircraft Registration Section
Head of Aircraft Registration
CAA House
45-59 Kingsway
London
WC2B 6TE

Tel: 020 7453 6660
Fax 020 7453 6670

E-mail: aircraft.reg@caa.co.uk

Web: www.caa.co.uk/aircraftregister

1. www.caa.co.uk/default.aspx?catid=122&pagetype=90&pageid=4510.

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Chapter 4 Maintenance and Inspection

1 Scope

1.1 This Chapter addresses continuing airworthiness requirements including maintenance applicable to civil UAS and components of a UAS that can affect the airworthiness of the UAV.

2 Lead Agency

2.1 CAA – Safety Regulation Group (SRG), Survey Department, Airworthiness Division.

3 Policy

3.1 UAS on the UK Civil Register will be required to hold valid certificates of airworthiness. For civil UAS subject to EC regulations the CAA as the UK competent authority will issue the airworthiness certificate. For civil UAS not subject to EC Regulations certificates of airworthiness will be subject to the provisions of the ANO.

3.2 Continuing airworthiness requirements, including maintenance, appropriate to each type of UAS issued with an airworthiness certificate will be in accordance with the requirements that currently apply to manned aircraft.

3.3 Organisations undertaking continuing airworthiness and maintenance tasks on civil UAS will be required to hold appropriate approvals and licences under EC Regulations or the ANO as applicable.

4 Source Documents

[1] Regulation (EC) No.1592/2002 of the European Parliament and of the Council of the 15 July 2002 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency.

[2] Commission Regulation (EC) No. 2042/2003 on the continuing airworthiness of aircraft and aeronautical products, parts and appliances, and on the approval of organisations and personnel involved in these tasks.

- Annex I – Part M Continuing airworthiness requirements.
- Annex II – Part 145 Approval of maintenance organisations.
- Annex III – Part 66 Certifying Staff, aircraft maintenance licence.
- Annex IV – Part 147 Training organisation requirements.

[3] The ANO.

5 Point of Contact

5.1 For enquiries relating to the continuing airworthiness and maintenance requirements for UAS:

Chief Surveyor
Survey Department
Airworthiness Division
Civil Aviation Authority
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR

Tel: 01293 573362
Fax: 01293 573984

E-mail: ray.nimmo@caa.co.uk

Chapter 5 Security Issues

1 Scope

1.1 This Chapter offers guidance to industry on how to implement and satisfy the requirements for security through all the UAS lifecycle activities (i.e. initial concept, development, operation and maintenance and decommissioning).

2 Lead Agency

2.1 In the UK the government has responsibility for aviation security. The CAA provides advice to the government and industry on these issues.

3 Current Policy

3.1 It is CAA Policy that "any UAS outside a UK Danger Area will not increase the risk to existing users and will not deny airspace to them". This policy requires a level of safety and security equivalent to that of manned aviation.

3.2 Current policy also states that a UAS must have adequate security to protect the system from unauthorised modification, interference, corruption or control/command action.

4 Factors for consideration when developing security for UAS

4.1 Holistic approach

4.1.1 When considering security for the UAS it is important to approach it from a holistic viewpoint, paying equal cognisance to technical, policy and physical security for the UAS as a whole. Utilising this approach will help ensure that issues are not overlooked that may affect security which could ultimately affect safety.

4.1.2 By utilising proven industry approaches to the protection of Confidentiality, Integrity and Availability (CIA), security measures applied can benefit the UAS operator by assuring availability of service and the integrity and confidentiality of both data and operations.

5 Security aspects to be addressed

5.1 The security aspects are required to address particular possible weaknesses of a UAS such as employees, location, accessibility, technology, management structure and governance.

5.2 Such security aspects include but are not limited to:

- The availability of system assets e.g. ensuring that system assets and information are accessible to authorised personnel or processes without undue delay.
- Physical security of system elements and assets e.g. ensuring adequate physical protection is afforded to system assets.

- Procedural security for the secure and safe operation of the system e.g. ensuring adequate policies such as Security Operating Procedures are drafted, reviewed and maintained.
- Data exchange between system elements e.g. ensuring the confidentiality and integrity of critical assets is maintained during exchanges within the system, over communication channels and by other means such as physical media.
- Accuracy and integrity of system assets e.g. ensuring threats to system assets caused by inaccuracies in data, misrouting of messages and software/hardware corruption are minimised and actual errors are detected.
- Access control to system elements e.g. ensuring access to system assets is restricted to persons or processes with the appropriate authority and 'need-to-know'.
- Authentication and identification to system assets e.g. ensuring all individuals and processes requiring access to system assets can be reliably identified and their authorization established.
- Accounting of system assets e.g. ensuring that individual accountability for system assets are enforced so as to impede and deter any person or process, having gained access to system assets, from adversely affecting the system availability, integrity and confidentiality.
- Auditing and Accountability of system assets e.g. ensure that attempted breaches of security are impeded, and that actual breaches of security are revealed. All such attempted and actual security incidents shall be investigated by dedicated investigation staff and reports produced.
- Object Reuse of system assets e.g. ensure that any system resources re-usage, such as processes, transitory storage areas and areas of disk archive storage, maintains availability, integrity and confidentiality of assets.
- Asset Retention e.g. ensuring that system assets are securely retained and stored whilst maintaining availability, integrity and confidentiality.

5.3 Identified and derived requirements would then sit within each identified security aspect and be applied (where necessary) to parts of the UAS e.g. ground system (including the communications link) and the UAV itself. The requirements should be ultimately traced to the overall policy requirements given in 3.2 above.

6 Security Process

6.1 The security of the UAS is in support of overall UAS safety and with this in mind any agreed security design, evaluation and accreditation process should be integrated (where necessary) with the existing certification, approval and licensing processes utilised for manned vehicles.

6.2 The security design, evaluation and accreditation process should consider as a factor the operational scenario, including but not limited to:

- Applicable flight rules;
- Air vehicle capabilities and performance including kinetic energy and lethal area;
- Operating environment (type of airspace, over flown population density);
- Opportunities for attack and desirability.

6.3 The operational scenarios, along with other applicable factors, should be combined with possible weaknesses to the system to determine a measure of perceived risk. A possible security lifecycle for the UAS is shown in Figure 1 and this particular phase is referred to as the risk assessment phase of the process.

6.4 Risk management techniques should then be utilised to reduce the perceived risk to an acceptable level of residual risk. As shown in Figure 1 this phase is referred to as the risk mitigation phase of the process.

6.5 The risk management techniques implemented are verified and evaluated for effectiveness in a regular cycle of 'action and review' ensuring optimum effectiveness is maintained throughout the lifecycle. As shown in Figure 1 this phase is referred to as the validation and verification phase of the process.

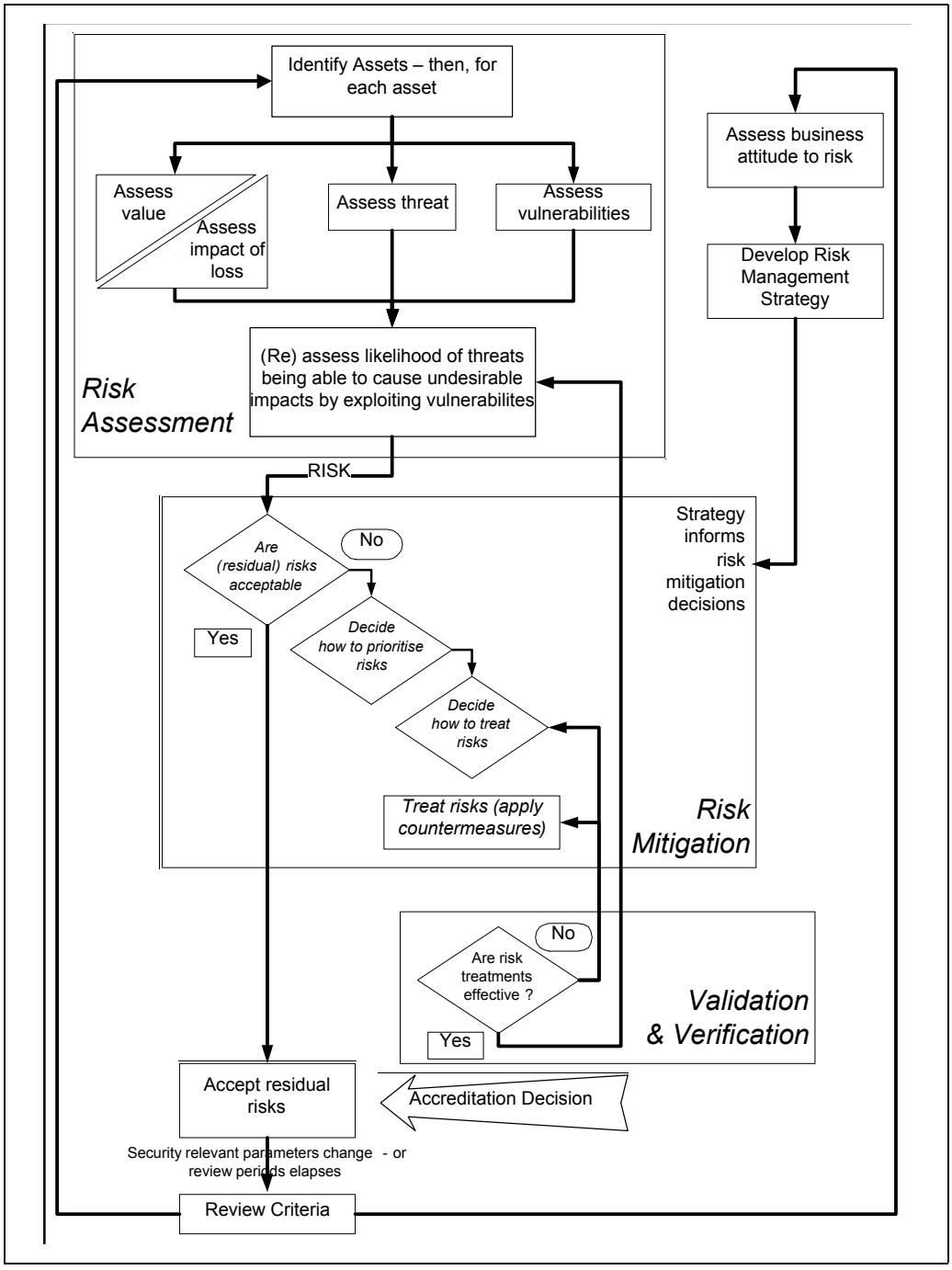

Figure 1 Possible Security Approach

6.6 Although the approach above is directly applicable to technical security it must be borne in mind that this process must be supported by the application of both good physical security and procedural security and these could be drawn up by interactions between industry, the CAA and Government agencies.

7 Current UAS security work

7.1 The current security research work draws on sector experience and recognised security standards. Through liaison with government agencies system security policies are formed that are not only thorough due to their holistic approach but also achievable due to the recognition that systems will have varying operational roles.

8 Point of Contact

8.1 For enquiries relating to UAV security:

Aircraft Certification Department
Airworthiness Division
Safety Regulation Group
Civil Aviation Authority
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR
UK

Tel: 01293 573293
Fax: 01293 573975

E-mail: department.certification@caa.co.uk

Chapter 6 ATM Procedures

1 Introduction

1.1 Air Traffic Services (ATS) in the UK are provided by personnel who are suitably trained and qualified to provide services at one or more of the three levels of provision: Air Traffic Control, Flight Information Service and Air/Ground Communication Service.

1.2 It is not possible to anticipate all of the issues and queries relating to ATS integration that will inevitably arise during the future development of UAS and their operational procedures. Any enquiries for further guidance or to establish the UK policy on a particular issue should be made to the address below.

2 Scope

2.1 This Chapter provides guidance on the policy associated with the provision of Air Traffic Services within UK airspace.

3 Lead Agency

3.1 CAA – Safety Regulation Group (SRG), Air Traffic Standards Division (ATSD).

4 Policy

4.1 Individual ATS units may provide services within clearly defined geographic boundaries (such as a specific portion of airspace) or may provide services within a general area (for example, in the vicinity of an aerodrome).

4.2 The rules pertaining to aircraft flight and to the air traffic service provided will be determined by a number of factors (including airspace categorisation, weather conditions, aircraft flight rules and type of air traffic service unit).

4.3 Not all aircraft within the same geographic area will necessarily be in communication with the same ATS unit or operating under the same rules.

4.4 It is important that those managing UAS operations are familiar with the relevant rules and procedures applicable within any airspace through which the aircraft will be flown.

4.5 UAS operation is expected to be transparent to ATS providers. The UAS-p will be required to comply with any air traffic control instruction or a request for information made by an ATS unit in the same way and within the same timeframe that the pilot of a manned aircraft would. These instructions may take a variety of forms, for example, to follow another aircraft or to confirm that another aircraft is in sight.

4.6 International regulations and standards require that any new system, procedure or operation that has an impact on the safety of aerodrome operations or Air Traffic Services (ATS) shall be subject to a risk assessment and mitigation process to support its safe introduction and operation. Where an agency intends to operate a UAS in UK airspace it will be required to provide CAA SRG (ATSD) with a safety assessment demonstrating that associated hazards to other airspace users have been identified, that the risks have been assessed and either eliminated or reduced to a level which is tolerable and is as low as reasonable practicable through ATS and/or other measures.

4.7 Where it is intended to operate a UAS in segregated airspace such a safety assessment should reflect measures intended to reduce the risk of mid-air collision between UAS and between UAS and manned aircraft. The safety assessment (which may also be presented in the form of a safety case or ATS sub-section of a broader UAS safety case) would be expected to include safety arguments concerning ATS and/or other measures to reduce the risk of accidents resulting from unplanned incursions into the segregated airspace by manned aircraft and unplanned excursions from the segregated airspace by the UAS.

5 Source Documents

5.1 Further information about the various levels of ATS and the services available from ATS units can be found in the following documents:

[1] Air Traffic Control - CAP 493 Manual of Air Traffic Services Part 1.

[2] Flight Information Service - CAP 410 Manual of Flight Information Services.

[3] Air/Ground Communication Service – CAP 452 Aeronautical Radio Station Operator's Guide.

5.2 Further information about the classification of airspace and flight rules can be found in CAP 32 UK Aeronautical Information Publication.

5.3 Further information about radiotelephony procedures can be found in CAP 413 Radiotelephony Manual.

5.4 Further guidance on the conduct of Safety assessments relating to ATS aspects of UAS operations can be found in CAP 760 Guidance on the Conduct of Hazard Identification, Risk Assessment and the Production of Safety Cases For Aerodrome Operators and Air Traffic Service Providers

6 Point of Contact

6.1 Guidance on civil ATM procedures for UAS should be sought from CAA – Safety Regulation Group (SRG), Air Traffic Standards Division (ATSD).

Head of Air Traffic Standards Division
Safety Regulation Group
Civil Aviation Authority
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR

Tel: 01293 573423
Fax: 01293 573974

E-mail: ats.enquiries@caa.co.uk

Chapter 7 Emergency ATM Procedures

1 Scope

1.1 The guidance below outlines the requirements for an operator of a UAS in UK airspace to include robust provision for ATM aspects of the efficient handling of relevant UAS emergencies.

2 Lead Agency

2.1 Preplanned arrangements for emergency manoeuvring of UAS, including manoeuvre into emergency orbit areas, emergency landing areas, 'cut-down' points and ditching areas should be developed in consultation with CAA Directorate of Airspace policy (DAP), who will coordinate with CAA Safety Regulation Group (SRG) and associated Air Navigation Service Providers (ANSP).

3 Policy

3.1 In accordance with the overarching principle that UAS operation is expected to be transparent to ATS providers, the ATM handling of emergencies involving UAS should be expected to follow the same process as that for manned aircraft with the controller/FISO/Air-Ground radio operator providing assistance to the UAS-p in order to recover and /or land the UAS without injury to life and, where possible, without damage to property. However, the absolutely overriding objective in any emergency situation is the safety of human life. ATM procedures for dealing with UAS emergencies should, therefore, focus on assisting the UAS-p to resolve the situation without endangering other airspace users or people on the ground. Although the ATS provider can offer assistance, ultimate responsibility for concluding a UAS emergency safely must rest with the UAS-p.

3.2 UAS operators should, as a minimum, develop procedures which provide for the emergency notification of the relevant ATM agencies in the event that guidance of a UAS is lost or significantly restricted. Such notification should include the last known position, altitude and speed of the UAS and sufficient additional information, such as endurance, which would enable other airspace users and aerodrome operators to be alerted to the hazard. Such notification arrangements should be reflected in the UAS operator's safety assessment.

4 Source Documents

4.1 Further information about ATS arrangements for dealing with aircraft emergencies can be found in the following documents:

[1] Air Traffic Control – CAP 493 Manual of Air Traffic Services Part 1.

[2] Flight Information Service – CAP 410 Manual of Flight Information Services.

[3] Air/Ground Communication Service – CAP 452 Aeronautical Radio Station Operator's Guide.

4.2 Further guidance on the conduct of Safety assessments relating to ATS aspects of UAS operations can be found in CAP 760 Guidance on the Conduct of Hazard Identification, Risk Assessment and the Production of Safety Cases For Aerodrome Operators and Air Traffic Service Providers.

5 Point Of Contact

5.1 Guidance on other Emergency ATM procedures for civil UAS should be sought from:

CAA – Directorate of Airspace Policy (DAP)
ORA 4
K6 G3
CAA House
45-59 Kingsway
London
WC2B 6TE

Tel: 020 7453 6544
Fax: 020 7453 6565

E-mail: doug.robertson@caa.co.uk

Chapter 8 Breaches of ATC Regulations

1 Scope

1.1 Guidance relating to breaches of civil ATC regulations should be sought from CAA – Safety Regulation Group (SRG), Air Taffic Standards Division (ATSD).

1.2 Breaches of Aviation Regulation legislation should be reported directly to:

Aviation Regulation Enforcement (ARE)
Civil Aviation Authority
Room 505
CAA House
45-59 Kingsway
London
WC2B 6TE

Tel: 020 7453 6193
Fax: 020 7453 6175

E-mail: AREMailbox@caa.co.uk

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Chapter 9 Incident/Accident Procedures

1 Scope

1.1 Any Accident / Serious Incident / Incident involving UK aviation facilities, including aircraft operators, ATC providers, aerodrome operators. Also includes third parties within the UK.

2 Lead Agency

2.1 Accident / Serious Incident: Air Accident Investigation Branch (AAIB).

Incident: CAA – Safety Regulation Group (SRG), Safety Investigation and Data Department (SIDD).

3 Policy

3.1 Accident / Serious Incident – to be reported to the AAIB. Incident – to be reported to the CAA.

4 Source Documents

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

[2] Air Navigation Order 2005 – Article 142.

[3] CAP 382 (The Mandatory Occurrence Reporting Scheme).

5 Point of Contact

5.1 Accident / Serious Incident:

AAIB
DfT
Farnborough House
Berkshire Copse Road
Aldershot
HANTS
GU11 2HH

Tel: 01252 510300
Fax: 01252 376999

E-mail: enquires@aaib.gov.uk

24 hour Accident/Incident reporting line: 01252 512299

5.2 Incident:

SRG SIDD
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR

Tel: 01293 573220
Fax: 01293 573972

E-mail: SDD@caa.co.uk

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Chapter 10 Aerodrome Operating Procedures

1 Scope

1.1 The ANO does not require UAS operations to take place from aerodromes licensed by the CAA. This Chapter applies to those UAS operations that do take place at licensed aerodromes.

1.2 It is not possible to anticipate all of the issues and queries relating to aerodrome operations that will inevitably arise during the future development and operation of UAS. Any enquiries for further guidance or to establish the UK policy on a particular issue should be made to the address below.

2 Lead Agency

2.1 CAA – Safety Regulation Group (SRG), Aerodrome Standards Department (ASD).

3 Policy

3.1 The aerodrome licence holder is required to demonstrate how the safety of those aircraft requiring the use of a licensed aerodrome will be assured when UAS operations are permitted at the aerodrome.

3.2 The operation of UAS at a licensed aerodrome shall be conducted in accordance with safety management requirements set out in the Aerodrome Manual of the aerodrome. This Manual, which forms a core element of the aerodrome's Safety Management System (SMS), contains the safety policies, accountabilities, responsibilities and procedures to facilitate the safe operation of the aerodrome.

3.3 It is essential that those managing UAS operations are familiar with the relevant rules and procedures applicable at the aerodrome from which they operate. The aerodrome licence holder should provide an operating manual or other documents pertaining to the operation of UAS at that aerodrome, to ensure that risks from all aspects of the intended UAS operation are assessed and mitigated.

3.4 Aerodrome and UAS operating procedures may be subject to audit by the CAA.

4 Source Documents

4.1 Information about the licensing and operation of aerodromes can be found in the following documents:

[1] CAP 168 Licensing of Aerodromes.

[2] CAP 738 Visual Aids Handbook.

5 Point of Contact

Guidance on aerodrome procedures for UAS should be sought from CAA – Safety Regulation Group (SRG), Aerodrome Standards Department (ASD).

Head of Aerodrome Standards Department
Safety Regulation Group
Civil Aviation Authority
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR

Tel: 01293 573250
Fax: 01293 573971

E-mail: aerodromes@caa.co.uk

Section 4 Military Operations

Chapter 1 Certification, Registration and Maintenance

1 Scope

1.1 This guidance provides an overview of the requirements involved in certification, registration and maintenance of UK military UAVS.

2 Lead Agency

2.1 Defence Equipment & Support, Director General Safety and Engineering – Design Modification and Support Division (DMSD).

3 Policy

3.1 UK military in-service UAV Systems[1] (includes the control station telemetry equipment) are to be treated as UK military aircraft and are subject to the regulations contained in the JSP550 suite – Military Aviation Policy, Regulations and Directives that covers all aspects of Military Aviation. JSP 553 describes the Safety Management System adopted by the Ministry of Defence (MoD) for the management and regulation of military aircraft airworthiness. It sets out the policy and associated arrangements agreed by the MoD Aviation Regulation & Safety Board (MARSB), and applies to all UK Military aircraft, including UAVs.

3.2 All military UAVs are to be registered as UK Military Aircraft, either generically by type or by individual airframe, depending on their physical characteristics. The MoD Release to Service (RTS) is the release document that authorises service flying on behalf of the Service Chief of Staff. UK Military Registered UAVs are to be operated within the limitations contained within its specific RTS or Certificate for Flight Trials (CFT) and supported by a Safety Case. When military registration is deemed necessary to a civil owned UAV the military status of the UAV is recognised by the issue of a Certificate of Usage (CoU) by the MoD.

3.3 It is MoD policy that military UAVs are to be maintained in accordance with the same policy and procedures as applicable to manned aircraft. Integrated Project Team Leaders are responsible for the development and publication of specific procedures to support and maintain the airworthiness of their aircraft.

4 Source Documents

[1] JSP 550 – Military Aviation Policy Regulations and Directives

[2] JSP 553 – Military Airworthiness Regulations

[3] JAP 100A-01 Military Aviation Engineering Policy and Regulation

[4] Def Stan 00-970 Design and Airworthiness Requirements for Military Aircraft

1. The term UAS has yet to be adopted by the MoD.

[5] Def Stan 05-57 Configuration Management of Defence Materiel

[6] Def Stan 05-122 Procedures for the Military Registration of Civil-Owned Aircraft

[7] Def Stan 05-123 Technical Procedures for the Procurement of Aircraft, Weapons and Electronic System

[8] Def Stan 05-130 Maintenance Approved Organisation Scheme

5 Point of Contact

DES SEAir-DMSD-Pol5
Ash 3b # 3312
MoD Abbey Wood
Bristol
BS34 8JH

Tel: 0117 91 35379

Email: desseair-dmsd-pol5@mod.uk

Chapter 2 Non In-Service UAV Operations

1 Scope

1.1 All non-Release-to-Service (RTS) UAV flying is termed non in-service and must be flown under either a Certificate for Flight Trial (CFT) or a Certificate of Usage (CoU) which are staffed by an appropriate MoD Integrated Project Team (IPT). In both these circumstances the activity is regulated by the Test & Evaluation Support Division (TESD) at MoD Boscombe Down, a division within Defence Equipment & Support (DE&S). This includes all UAVs engaged in Research & Development, Clearance and Production flying, and in-Service Return-to-Works (RTW) activities. TESD regulates Military Registered Civil-Owned Aircraft (MRCOA), which is also applicable to UAVs, when flown in accordance with Def Stan 05-122.

1.2 TESD is also responsible for the regulation and approval of ATC/Range Air Control staff (and associated equipment) providing services within air Danger Areas operated by QinetiQ on behalf of the MoD.

1.3 All MoD IPTs must inform TESD before any contract involving UAV flying is let.

1.4 UAV Systems operated by the MoD are deemed to be in-service when operated by the Army, Royal Navy, Royal Air Force and, under certain circumstances, contractors when they will be flown under a Release to Service (RTS) and regulated by JSP 550 (see Section 4, Chapter 1).

2 Lead Agency

2.1 Defence Equipment & Support (DE&S), Director General Safety and Engineering – Test & Evaluation Support Division (TESD).

3 Policy

3.1 All UAV flying operations will be subject to an appropriate level of approval similar to that applied to manned flying operations.

3.2 This will include approvals for: the company, the designated Head of Flying, all supporting engineering activity, all operating site(s) or airfield(s), the UAV-p, ATC provision and specific approval for all UAV types to be flown.

3.3 Under normal circumstances and until appropriate national airspace procedures have been promulgated, flights will only be permitted within TESD approved Danger Areas or segregated airspace. These Danger Areas and segregated airspace must provide adequate radar services (or such processes that are agreed to be considered equivalent) such that the ANO requirement for the 'Commander' of the aircraft to avoid aerial collisions can be fully acquitted. This will also generally involve the installation of an approved Flight Termination System (FTS) and Identification Friend or Foe (IFF) system.

3.4 All non in-service UAVs are treated as UK military aircraft and placed on the UK military register. They are operated subject to the regulations contained in Aviation Publication 67 (AvP67) – MoD Flying Orders to Contractors. These contractor regulations also require UAV operators to produce flying orders and procedures that mirror the requirements of JSP 550 and that cover, as a minimum, the specifics listed in Section 4, Chapter 3.

3.5 Defence Ordnance Safety Group (DOSG) advice will also be obtained before any UAV is flown under AvP67 regulation.

3.6 Military registered UAVs flown by the Aircraft Test and Evaluation Centre (ATEC) are regulated under JSP 556 – Military Aviation Test Flying Policy.

4 Source Documents

[1] AvP67 – MoD Flying Orders to Contractors.

[2] JSP 550 – Military Aviation Policy Regulations and Directives.

[3] JSP 556 – Military Aviation Test Flying Policy.

[4] Def Stan 05-122 Procedures for the Military Registration of Civil-Owned Aircraft.

5 Point of Contact

Matt Syndercombe
TESD – UAV Operations
MoD Boscombe Down
Salisbury
Wiltshire
SP4 0JE

Tel: 01980 664029

Email: tes-asg-tesd-uav@dpa.mod.uk

Chapter 3 In-Service Operations

1 Scope

1.1 In-Service UAV System operations cover all types of UAV System that have a Release to Service (RTS) and are subject to the control of an Aircraft Operating Authority (AOA).

2 Lead Agency

2.1 MoD Aviation Regulatory Team.

3 Policy

3.1 UK military in-service UAVs are to be treated as UK military aircraft. They are therefore to be subject to the regulations contained in JSP550 - Military Aviation Policy, Regulations and Directives. These regulations require AOAs to produce flying orders that cover, as a minimum:

- Provision of an equivalent level of compliance with the Rules of the Air.
- Permitted areas of operation.
- Provision of the minimum facilities required for safe operation.
- Weather minima.
- Briefing requirements, to include safety of the operating crew and other personnel.
- Flight authorization.
- Pre-flight, in-flight and post-flight checks.
- Operating crew responsibilities.
- Emergency procedures.
- Range Air Controllers duties, if appropriate.
- Flying procedures including take-off and landing procedures.
- Accident and incident reporting and investigation procedures.
- Action to be taken in the event of loss of control data link to UAVS.
- Abort procedures following critical system failure.
- Detailing the training, competency, currency, medical requirements and crew duty considerations for all personnel involved in the operation of UAVs.

4 Point of Contact

Commander Max Snow, Royal Navy
DARS Reg RN SO1
DARS, RAF Northolt
Westland Road
Ruislip
Middlesex, HA4 6NG

Tel: 0208 833 8094

Email: dars-regrnso1@northolt.raf.mod.uk

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Chapter 4 ATM Procedures

1 Scope

1.1 The regulations concerning military air traffic services are contained within JSP 552. These regulations apply to all those concerned with the operation of UK Service aircraft, but they do not absolve any person from using best judgement to ensure the safety of aircraft and personnel.

2 Lead Agency

2.1 MoD Headquarters Air Command (HQ AIR) ATC.

3 Policy

3.1 It is MOD policy that UAVs must show an equivalent level of compliance with regulations for manned aircraft. Routine operations of any UAV outside a UK Danger Area must not increase the risk to other airspace users and should not deny the airspace to them. Any one-off unusual air activity[1], that requires de-confliction with, coordination with and notification to other airspace users should be notified through the DAP Airspace Utilisation Section (AUS) in the same way as for manned aircraft. From the air traffic controller's perspective, the provision of an ATS to a UAV must be transparent. This includes all stages of the flight from pre-notification to landing; there should be no difference in RT, landline communications or transponder data procedures nor should the controller have to apply different rules or different criteria.

4 Point of Contact

4.1 The point of contact for general enquiries regarding ATM procedures is:

Group Captain ATC
Bldg 47
No 1 Site
HQ AIR
RAF High Wycombe
Bucks
HP14 4UE

Tel BT: 01494 494094
RAFTN: 95221 4094
Fax: Ext 01494 492161

E-mail: airbm-atcgpcapt@mod.uk

1. Unusual Air Activity: an event such as an air exercise, trial, display, formation, balloon or kite flight which could adversely affect the operations of other airspace users.

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