

UNMANNED AIRCRAFT SYSTEMS – NATIONAL CHALLENGES

**UAS/RPAS Legal Workshop
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Scope

- UK policy towards UAS operations**
- Current activities/where we currently are**
- Future requirements/steps**

The Current Situation



The scale/range of the subject



Fundamental Principles

- **They are Aircraft** – not ‘drones’ ‘toys’ ‘UAVs’ etc
- **They are Piloted** – albeit remotely
- **equivalence** – to manned aviation (level of capability)
- **No ‘automatic rights’** - to airspace or special privileges
- **Transparency** – to ATC
- **Operate within the bounds of existing legislation**
- **Internationally Shared View**
(UK, EASA, FAA, ICAO, other NAAs)

The existing aviation legislation is designed to enable the safe and efficient operation of manned aircraft in all classes of airspace.

General Considerations

- **‘Pilot in Command’ Responsibilities**
 - Piloting ‘function’ same for manned and unmanned – both ‘move’ aircraft through the air
 - Same Airspace, Same Weather, Same Rules
- **Pilot ‘separated’ from aircraft**
 - Avoidance of collisions/Lookout principles
 - Airworthiness
 - Integrity of ‘link’ to aircraft
 - Complex Flight Control Systems

UAS Ops Within UK Airspace

▪ Visual Line of Sight (VLOS)

- 'See and Avoid' responsibilities through direct visual observation (visually managed)
- Limited range- Size/Colour, weather conditions
- 400ft vertical, 500m horizontal – basic limits
- Extended VLOS -ops within/beyond 400ft/500m, RP's 'direct visual contact' requirement addressed differently – collision avoidance still achieved through 'visual observation'

▪ Beyond Visual Line of Sight (BVLOS)

- Detect and Avoid System
- Segregated Airspace (if no D&A system fitted)

Small Unmanned Aircraft (SUA)

- “Any unmanned aircraft, other than a balloon or a kite, having a mass of not more than 20kg without its fuel but including any articles or equipment installed or attached at the commencement of its flight”
- Note - this does not differentiate between model/recreational or other uses
- SUA are exempted from the majority of the UK Air Navigation Order (UK Air Law), but 3 specific articles apply: Arts 138, 166 & 167



Mystery as £20k 'spy' helicopter goes under cover in city

“DESPERATE: (*name removed*) searches the skies for his missing Draganflyer X6 helicopter”



Regulation/Operation of Small UAS (Urban environments etc)



Balance of Risk
Judgement



Risk of injury to
members of the
public



Risk of consequences
to victims of
emergency or crime

ANO 2009 - Key Articles



■ 138 – Endangerment

- 'A person shall not recklessly or negligently permit an aircraft to endanger persons or property'

■ 166 – Small Unmanned Aircraft (20kg or less)

- Articles or animals must not be dropped so as to endanger persons or property
- The 'person in charge' may only fly the aircraft if reasonably satisfied that the flight can safely be made
- Person in charge must maintain 'Direct Unaided visual contact' – for the purpose of avoiding collisions (ie. VLOS flights only)
- >7kg ATC permission for A,C,D,E airspace, ATZ's, >400ft.
- Flights for the purpose of aerial work require specific permission to be granted by the CAA.

ANO 2009 - Key Articles

- 167 – Small Unmanned Surveillance Aircraft
 - ‘SUSA’ is a small unmanned aircraft equipped to undertake any form of surveillance or data acquisition.
 - Unless in accordance with a permission from the CAA, a SUSA must not be flown:
 - Over or within 150m of congested area or assembly of >1000 people
 - Within 50m of vessels, vehicles or structures (not under the control of the person in charge of the aircraft)
 - Within 50m of any person (exceptions exist for take-off/landing (30m) and persons under the control of the person in charge of the aircraft)
 - Art 167 ‘covers off’ flights which are not aerial work



Small UAS Operations

- Regs proportionate to the potential risk, ‘light touch’ where suitable
- Specific aim “to protect those not involved in the activity”
 - Permissions – required where greater level of detail is required
 - Aerial work, flight close to people/property
- For safety purposes only, not ‘privacy’ (Privacy aspects are covered by the data protection regulations)
- Small UAS Currently the biggest/most notable development area (Police, Fire, ‘security’, Aerial Phot Surveys)
 - Over 180 Small UAS operators currently flying in UK

ANO 2009 – Legal Aspects

- A **congested area** in relation to a city, town or settlement, means any area which is substantially used for residential, industrial, commercial or recreational purposes
- Offences under Arts 166 and 167 are both Summary Only Offences and, therefore, have 6 months statutory time limit.
- Art 138 (Endangerment) Difficult to prove but carries maximum of 5 years

SUAS Legal Challenges

- **Procedures and Powers**

- There is no Power of Arrest under the Air Navigation Order
- Consider other offences that may have been committed (i.e. Public Order, Harassment, Offences Against the Person, Offences against Property etc..)
- Seizure of equipment an advantage, if arrested. Photograph of equipment if no arrest
- Arrest under s.24 PACE if appropriate

Biggest problem is getting EVIDENCE – A particular problem with Small UAS

- **Essential evidence**

- Who controller / pilot was
- Details of the equipment used (seized or photograph). In SUSA cases there will be images / video footage of the flight
- Distances from vessels, vehicles, structures or persons (as above) or numbers at an assembly
- Witnesses



Larger UAS Operations



Airspace Challenges

- **Airspace types/classifications**
 - Different Access permissions
 - Flight Rules – VFR/IFR
 - Conspicuity
- **ATC Cannot monitor all UA**
 - radar coverage
 - workload
 - uncontrolled airspace aspects
 - cannot track ‘small’ a/c
- **Link Loss and Emergencies**

UK AIRSPACE – A Busy Environment



Visual Lookout..... or lack of it !



Detect and Avoid

- **Generic expression used to reflect a technical capability commensurate with a pilot's ability to 'see and avoid' other air traffic and hazards**
 - **Not 'just' Collision Avoidance**
 - **Needs to work in 'Real Time'**
- **The 'key' to full integration**

‘Detect and Avoid’ must enable the pilot of an Unmanned Aircraft to:

- **Separation/Traffic avoidance**
 - Perform the same ‘give way’/‘maintain sufficient distance so as not to cause a hazard’ roles undertaken by the pilot of a manned a/c iaw the Rules of the Air
- **Collision Avoidance**
 - Undertake collision avoidance manoeuvres (ie. ‘last ditch’ avoidance) if the normal separation provision fails
 - ‘Automatic’ system also required (Eg. If control link is lost)

Detect What?



Detect what?

Rules Of The Air

Converging flight paths



Giving way

(implies recognition of aircraft category)

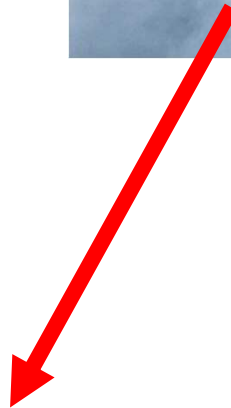
Sense what?

In Flight Conditions – VMC/IMC?

Visibility?



Distance From Cloud



Integration with the Aerodrome Environment

How will a UA/RPA interact with these?





Segregation ?



Segregation ?



UAS Segregation

- **UK uses Danger Areas as prime tool for UA segregation purposes**
 - UA flight not considered inherently dangerous
 - Activity demands an enhanced level of protection both to, and from, other airspace users
 - Danger Area does not 'prohibit' flight however (but suitable out to FIR boundary – 'P' and 'R' only enforceable to 12nm limit)
- **Short term needs may be catered for through temporary airspace restrictions - TDA**
- **But....Segregation denies airspace to other users**

The challenges of UAS certification

- **Certification will be new & novel - system elements?**
- **UA must be safe to fly over the UK landmass**
- **UAS specific Certification Specifications still being developed - to some extent, we are going into the unknown**
- **Certification also includes ops, airspace and other 'traditional' pilot actions which are not normally considered for manned aviation – wider and more involved process**

The CAA Certification approach

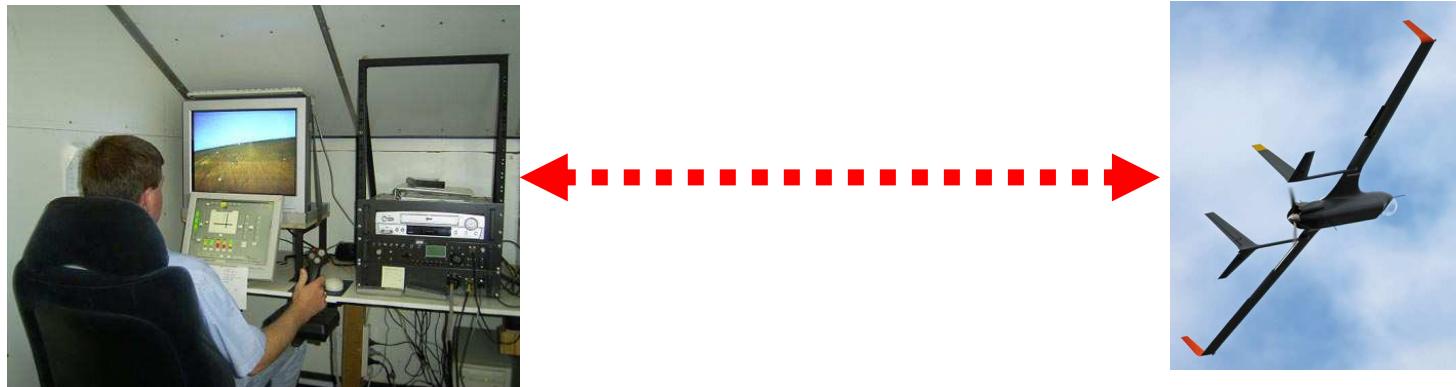
- CAA is taking the 'Synthetic Pilot' approach to UAS certification (ie. the special bit is the bit that 'used to be' just the pilot)
- Airframe systems are considered separately from the Synthetic Pilot, (the Complex Flight Control System)
 - 'known' airframe elements = no change
 - What are the differences/additions that enable it to fly Unmanned/Remotely Piloted ?

Radio Spectrum

To ensure the safety of 'Remote' flight, reliable communications are required for:

- **flight direction commands, response feedback and positional awareness for the Remote Pilot.**
- **communication between the Remote Pilot and ATC for ATM purposes, (where applicable).**

Radio Spectrum



There is only a small amount of protected radio spectrum allocated for civil UAS operations.

UAS 'C3' is potentially 'spectrum hungry'

Frequency spectrum for all applications is allocated by the "World Radio Conference" – Next Conference 2015

- **How much is required for each aircraft?**
- **How do you 'certify' a signal in space?**
- **How do you ensure the signal cannot be interrupted? (Airworthiness and Security aspects)**

Where are we trying to get to?



Next Steps Toward Integration?

- **Step-by-Step expansion of operations:**
 - Visual Line of Sight – below 400 ft / 500m range
 - Extended Visual Line of Sight
 - In segregated airspace over sterile surface
 - In segregated airspace – surface may be populated
 - In segregated - ‘managed’ interaction with manned aircraft
 - In airspace with very low traffic densities/populations (remote, over water)
 - Airspace and overflight as for manned aircraft

To Sum Up

- As for manned aircraft, unmanned aircraft will only be permitted to operate in UK airspace if it is considered that it is safe for them to do so
- In the UK today we have a growing and diverse civil UA industry with many SMEs involved using small rotary and fixed wing aircraft under VLOS. UK's SUA regulations are proportionate, scaleable and have allowed the industry to develop.
- Larger UAS activity shows little development at present (Regulatory or Technical?)
- However – Any regulations must be able to be enforced
- UK airspace is a challenging environment, VLOS below 400ft should not encounter many other aircraft, but D&A a must for full airspace integration, Class G a challenge. Step by step approach to the future
- We are developing appropriate regulation as a part of an international effort.
- **'Safe to be Flown'**- Airworthiness/Cert
- **'Flown Safely'** – Detect and Avoid, Remote Pilot Quals



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