THE COMMERCIALISATION

OF THE UK CIVIL AIR DRONE INDUSTRY

An Industry White Paper Presented to UK Government

By

The Drone Delivery Group

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Introduction

On 22 November 2018, London's City Hall played host to a meeting of leading drone or air drone industry stakeholders who gathered to discuss how best to harness UK expertise to enable the delivery of BVLOS, UAM flights and UTM systems. The meeting signified the UK drone industry's commitment to providing a solution to the sector's biggest challenge of making routine commercial drone flights a reality in UK skies.

The outputs of the meeting represented an important industry contribution to government thinking on the long-awaited 'Drone Bill', the Air Traffic Management and Unmanned Aircraft Bill, which is now before Parliament. Previous discussions between Drone Major Group Ltd, which convened the meeting and representatives of the Department for Transport (DfT), the Greater London Authority (GLA), British Standards Institution (BSI) and others, highlighted the need for the industry to come together to agree the best approaches to ensure that the UK maintains its leading role in the drone industry's continued development as one of the world's most economically significant disruptive technologies[1].

The immediate objective of the City Hall meeting was to formally establish a Working Group tasked with producing a White Paper for presentation to the DfT and CAA, designed to assist in the adoption of future guidelines, operational protocols and standards for BVLOS and UTM.

This White Paper represents the culmination of 12 months of intensive research into the current working projects being undertaken or planned by the Government and extensive collaboration by industry.

Robert Garbett

Chief Executive

Drone Major Group

[1] Disruptive technology is an innovation that significantly alters the way that consumers, industries, or businesses operate. A disruptive technology sweeps away the systems or habits it replaces because it has attributes that are recognisably superior.

1 Executive Summary

The purpose of this Paper is to provide the UK Drone Industry's coordinated guidance (represented by the 300+ strong Drone Delivery Group[2]) to the Government's Air Traffic Management and Unmanned Aircraft Bill. Despite the very best-intentioned efforts, the overall Government landscape is fractured with different departments sponsoring, or as a minimum working with, different groups and approaches with no clear national strategy to understand and ultimately develop and standardise an evidence-based UK UTM landscape.

The commercial drone market is growing rapidly, analysts at Barclays estimate that the global commercial drone market will grow tenfold from £3bn last year to £30bn in five years. They believe the use of drones will result in cost savings of some £77bn[3].

The UK industry is unable to progress as quickly as in other countries such as Japan, the US and China, which have all embraced testing infrastructures for the industry and provided access to intelligence obtained from testing activity for regulators and standards makers.

It is vital that the UK maintains a safe infrastructure capable of managing airspace which can also accommodate drone operations. In order to realise the commercial value of this industry that has unquestionable potential to benefit the UK economy, a national approach is urgently needed.

Physical testing sites (Sandboxes[4]) will be required for a variety of different operational environments and conditions such as meteorological and oceanographic, high interference, metropolitan, mixed metro, maritime, and rural. Sandboxes should be tailored to investigate a variety of use cases, such as parcel delivery, ground or infrastructure surveying, indoor operations, or freight carrying drones.

The use of sandboxes will enable the industry to test and evaluate technologies and concepts from platforms, through UTM to communications infrastructure, in the sandbox managed airspace, without burdening the already overstretched CAA.

The CAA must be adequately resourced to support this activity. Government must now realise that this is a vital foundation for the drone industry. This will give the UK a significant advantage in solving the drone challenges that face the industry now and into the future. Not to do so will leave the UK lagging the rest of the world in this critical new domain.

It is hoped that the guidance contained herein is used to inform Government plans for the implementation of the physical and virtual sandbox areas which are essential to ensure that the drone industry is able to evolve to full commercialisation.

[2] The Drone Delivery Group represents an industry-backed initiative to bridge the gap between Government and industry. The Group was founded with the goal of establishing an open channel of communication between key stakeholders within the drone delivery industry (manufacturers, operators, and investors) and Government, standards bodies and regulatory organisations.

[3] Source FT https://www.ft.com/content/cbd0d81a-0d40-11ea-bb52-34c8d9dc6d84 accessed 24th Feb 2020 (Currencies have been converted and rounded to £)

[4] A sandbox is a testing environment that enables users to run and learn from experiments in a safe and secure environment without affecting the wider system or environment in which they operate.

2 Scope

This document sets out the UK Civil Air Drone industry's view on the foundations required to ensure the safe and secure commercialisation of the industry and it applies to all types and sizes of civil air drones.

3 Abbreviated Terms

For the purpose of this document, the following abbreviations and their meanings apply.

ASTRAEA	Autonomous Systems Technology Related Airborne Evaluation & Assessment
ASTM	American Society for Testing and Materials
ATM	Air Traffic Management
BSI	British Standardisation Institution
BVLoS	Beyond Visual Line of Site
CAA	Civil Aviation Authority
EASA	European Union Aviation Safety Agency
EUROCAE	European Organisation for Civil Aviation Equipment
FAA	Federal Aviation Authority
ICAO	International Civil Aviation Organization
ISO	International Organisation for Standardization
JAA	Joint Aviation Authorities
JARUS	Joint Authorities for Rulemaking on Unmanned Systems
NAA	National Aviation Authorities
NASA	National Aeronautics and Space Administration
NATs	National Air Traffic Service
SARPS	Standards and Recommended Practices
SME	Small and medium-sized enterprises
SORA	Specific Operations Risk Assessment
UAS	Unmanned Aerial System or Civil Air Drone. For the purposes of this White Paper, the term Drone will be used when referring to UAS.
UTM	UAS Traffic Management
UAM	Urban Air Mobility
VToL	Vertical Take-off and Landing
VLoS	Visual Line of Sight

4 Definitions

For the purpose of this document, the following terms and definitions apply.

4.1
Open Source Information

any data, analytics and findings collected which are shared without limitations to its use, re-use and distribution and are considered public domain

4.2
Detect and Avoid

safety system designed to prevent collision between drones and objects or other aircraft, also known as Sense and Avoid

4.3
Sandbox

testing environment that enables users to run and learn from experiments in a safe and secure environment without affecting the wider system or environment in which they operate

5 Background

5.1 Aim

The aim of this White Paper is to deliver industry backed guidance to the UK Government on the steps required to enable safe and secure rapid commercialisation of the UK drone industry.

5.2 Drone Delivery Group

The Drone Delivery Group, formed in November 2018, is an industry initiative involving over 300 senior UK drone industry members with the aim to develop a White Paper outlining the steps required to commercialise the UK drone industry.

5.3 Deliverable

This White Paper, which will be presented to UK Government departments including DfT, BEIS and the CAA, is the recommended approach to building the necessary framework to enable the development of the UK drone industry and the evolution of UK airspace management to facilitate the inclusion of unmanned systems.

Working with the Group, both industry and Government will be able to confidently support the implementation of the solutions to ensure safe and secure commercial drone flights become a reality in UK skies.

6 The Current State of Drone Delivery Technology

6.1 Background

The UK Government has been at the forefront of drone regulatory development ever since the industry's first tentative steps with the pre-emptive development of CAP722 (Unmanned Aircraft System Operations in UK Airspace – Guidance) published by the CAA in 2001. CAP722 has been used by other NAAs as a guiding template for their own drone regulations and was adopted by JAA / EuroControl UAV Task Force as a key source of information to understand the issues associated with the integration of UAS in European airspace.

In the last few years, the UK Government has worked tirelessly to understand and develop strategies to enable what is widely understood as one of the most exciting emerging industries in modern history. The drone industry encompasses many elements which, when fully commercialised, will create significant benefits to UK Plc. While the drone industry spans all environments (surface, underwater, air & space), for the purpose of this White Paper, the term drone is used purely to represent air drones (UAS).

More recently EASA, instigated at the Riga Conference in March 2015, laid out 3 main categories (Open (low risk), Specific (medium risk) and Certified (high risk)) based on their perceived risk profile. This approach has become commonplace across the EU and is now also reflected in the latest editions of CAP722.

All this prior work by NAAs and governments has been focused on the regulations affecting the air system and they fall into several organisational areas:

- The aerospace governing agencies and regulators are concentrating on regulation concerning drones.

- Standards bodies in many individual countries, such as BSI in the UK, ASTM in the US and ISO operating on a global basis are developing standards for the industry.

- The UK Government has instigated a number of initiatives such as the BEIS Industry Action Group (IAG) and the DfT Pathfinder programmes, and also a number of research programmes such as the Innovation Hub, ASTRAEA and AirStart. Some of these initiatives are still active and there is work available that could still be exploited in future initiatives such as the work done on sense and avoid if it were released to the wider industry.

- EUROCAE is an aviation industry wide organisation that develops standards for aviation across all sectors including unmanned aircraft through a series of working groups. The working groups of particular interest are WG72 (Aeronautical System Security) and WG105 (Unmanned Aircraft Systems).

- JARUS is a group of experts from the NAAs and regional aviation safety organisations. Its purpose is to recommend a single set of technical, safety and operational requirements for the certification and safe integration of drones into airspace and at aerodromes. JARUS provides guidance material aiming to assist each authority to write their own requirements and to avoid duplicated efforts.

Despite the very best-intentioned efforts, the overall Government landscape is fractured with different departments sponsoring, or as a minimum working with, different groups and approaches with no clear national strategy to understand and ultimately develop and standardise an evidence-based UK UTM landscape.

Recently, the UK Government launched the Industrial Strategy Challenge Fund (ISCF) Future Flight programme which has requested projects to investigate and develop technology, processes and approaches to open up UK airspace to new and novel platform types, including drones, UAM and hybrid / electric sub-regional aircraft. However, this initiative seems slow, biased towards larger companies and could generate more 'one off' projects which would add little to the acceleration of the industry's commercialisation. It would be hugely beneficial if this initiative was used to support the development of interconnected, commercially funded, sandbox testing areas. [5]

6.2 Leaders in the Industry

EuroControl, NATS and other national airspace operators realise the need to develop a systems approach to integrating drones into national airspace through UTM systems in a controlled manner. However, in general, different approaches are being employed with no plan to establish a system of shared research or test data to underpin any future approach.

The industry continues to invent new and innovative ways of using drones in more and more disruptive and useful applications and across an ever-increasing range of airspace sectors. The need for national air traffic systems to enable safe commercial drone flights to evolve alongside manned aviation has therefore become pressing.

While traditional ATM and UTM companies (with academic and services industries as partners) are developing competing solutions, this seems to be happening in closed, isolated silos with each acknowledging that there could be more than one UTM service intercommunicating as part of a federated solution. However, the drive to dominate the market as either the single hub, largest or first system to be employed, is stifling cooperation and slowing progress.

6.3 Ongoing Concerns

Regulators and standards makers need to understand the minimum requirements necessary to ensure that the drone industry can evolve safely. However, despite a number of initiatives to ascertain what is possible, no single project has been created to develop the safety foundations on which the wider industry can evolve to a commercially viable state.

UK Regulators have done their best to engage with industry but a lack of resource, available open source 'lessons identified' data and opportunities for collaborative working with an agreed set of objectives, has resulted in a deficiency of concrete progress and significant frustration from industry.

Industry has established practices for suitable risk-based safety management systems that support compliance with EASA & CAA Regulations; however, better sharing of detailed information would improve and support the management of risk between entities. There is a clear need to establish the key set of safety bodies that can share airworthiness and regulatory information across the community in an open, proactive push format.

Companies developing UTM solutions currently retain test data under the premise of confidentiality, which makes it very difficult to extrapolate trends and issues and for decision makers to understand how to proceed with drone regulations and standards development and how best to employ UTM technology in the UK. Some initial work by a UK SME as part of the H2020 Horizon RAWFIE UTMEXP[6] programme has been conducted, but this was high level and is still in its early stages.

The evolution of the drone industry relies heavily on the ability for manufacturers, operators and UTM providers to test and develop their technologies and concepts without large costs and significant delays. So far, the UK has failed to achieve this.

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[5] See recommendations in Section 11.

[6] Road. Air & Water-based Future Internet Experimentation funded by the EU Horizon 2020 Programme.

In an environment where it is important to ensure that operational constraints/rules are in place, it is crucial that the application of such rules does not stifle commercialisation. With this in mind, the CAA will need improved processes and resources to cope with the demand required to take the industry to full commercialisation.

7 Regulations and Standards

7.1 Active Regulations and Standards

In the UK, CAP722 will continue to be maintained by the CAA and it is considered highly unlikely that it will deviate from the developing EASA model irrespective of the UK leaving the EU.

In general, regulators are working to create rules and approaches in isolation through JARUS which, despite its formidable membership, has no power to regulate. However, JARUS has contributed to the development of the industry by producing useful data and systems, such as SORA for early safety case assessments.

As the UK's national standards body, BSI is responsible for the development of the national standards for drones and, working as the UK member of ISO, has a global influence. The BSI Drone Standards Committee ACE20 is working to develop the safety and quality standards required to underpin the drone industry and support regulators. However, the industry has largely failed to engage with this critical activity which is also not openly supported by the Government. This vitally important opportunity for international standardisation is therefore being created in a theoretical vacuum with other countries having a greater influence on the outcome of international standards.

7.2 Government Departments & Public Bodies

There are a significant number of UK Government departments and other public bodies involved in various aspects of work aimed at developing the drone industry.

The DfT is responsible for the architecture of the flying environment in the UK. The Department also sets the policies for this aviation infrastructure and these may be defined in law. Accordingly, DfT has a very important role to play in implementing current EASA Regulations into UK Law such as EASA 945 & 947.

The CAA has a dedicated drone structure, addressing an area of policy that will eventually fall upon it to regulate. Unfortunately, the significant draw on the CAA's resources from a rapidly growing industry has meant that it has had to concentrate on regulation and licensing. However, the CAA has recently implemented a new structure and objectives, as part of the Airspace Modernisation Strategy, which are complementary to this proposal in many ways.

BEIS is active in the provision of support to the industry through the creation of the Industry Action Group (IAG) which has members from both industry and Government. Unfortunately, the IAG is a closed group with very limited industry participation.

It is the opinion of the Drone Delivery Group that an open, collaborative industry group should be formed to deliver the recommendations of this White Paper to drive the evolution of the drone industry in the UK forward successfully[7].

[7] See recommendations in Section 11.

7.3 What is the challenge?

For the UK to maintain its reputation for being at the forefront of this dynamic emerging industry, industry and Government must collaborate in establishing a new approach. Presently, UTM development efforts are fractured, regulatory barriers make testing and evolving technology and concepts expensive and very slow, and standards are being prepared in isolation from a large proportion of the current industry knowledge base.

Progress being made is hindered as individual lessons learned are retained by consortiums with little or no effort being made concerning the cooperative intercommunications of UTM Systems from different vendors. National regulators have no way to determine minimum operating requirements upon which to regulate and, while BSI and ISO are forging ahead in the development of internationally recognized standards for UTM safety and quality, progress will be extremely difficult and slow without a mechanism for gathering, comparing and testing intelligence which generally comes from experimentation.

To create a safe infrastructure capable of managing drone operations in UK airspace, and to realise the commercialisation of an industry that has unquestionable potential to benefit UK Plc, a coordinated, national approach with wider industry and Government in partnership is needed to develop the most effective UTM ecosystem.

There is a legal challenge to urgently confront: the UK needs to create a National Scheme in accordance with EASA 2019/945 which includes the requirements of the regulation, but which also reflects the needs of UK industry. Failure to address these requirements in a timely manner could see the UK UAS landscape restricted by the need to obtain legal approval via other European nations' scheme owners.

8 The Way Forward

8.1 Introduction

The following section of this White Paper will now propose a way forward to overcome the issues and information difficulties that have been described thus far. It will explore the development of dedicated testing areas or 'Sandboxes' as a means to create a safe environment where open experiments can be run efficiently, commercial operations can evolve, and lessons learned can be shared in a collaborative way.

8.2 Sandboxes

In an unmanned aviation context a sandbox can be a temporary (virtual) or permanent (designed to transition to commercial operations) area in which drone manufacturers, operators, UTM and Command and Control Communication Service Providers (C2 CSP) can test and evolve their technology and concepts in an environment which does not require lengthy regulatory clearance and allows for lessons identified and intelligence data to be shared and used to inform regulators and standards makers.

For the drone industry, the set-up and use of a number of sandboxes representing different operational environments with an open data and lessons learned philosophy, will bring real advantages to the development of standards and regulations at a pace not previously possible. Such standards and regulations will also be demonstrably based on real-world data and testing of new technology and regulatory environment integration, bestowing the necessary credibility on the process.

Interconnecting sandbox environments will not only provide for system testing and regulation but will also create opportunities for industry stakeholders.

The proposed network of sandboxes will provide the most effective solution to the current lack of collaboration within the UK industry. Projects undertaken within the sandbox environment will have multiple outcomes: manufacturers and operators can test new technologies and concepts, UTM systems can evolve alongside new system testing, the Government can glean intelligence from testing to understand issues and develop regulations, and standards bodies can assess what is required to underpin the continued safe advancement of technologies, all within controlled pre-defined and pre-authorised areas.

The funding of sandbox projects must now be a priority for initiatives such as Future Flight which should be organised by a wider industry and Government partnership.

8.3 Sandbox Use Cases

8.3.1 UTM Development

The deployment of sandboxes will provide UTM developers with the opportunity to test new services and to manage the airspace within the test area.

The roll-out of multiple, interconnected sandboxes will inevitably lead to faster and safer UTM technology and service development, the acceleration of standards development and the provision of quantifiable data to underpin the evolution of regulations in this area. Indeed, the CAA's 'Innovation Sandbox', a virtual space where new technology can be safely tested, offers innovative companies the chance to discuss, explore, trial and test emerging concepts.

8.3.2 Communications with National Infrastructure

Good communication between UTM providers and national infrastructure and regulatory agencies is essential to ensure the success of a widespread programme of sandboxes throughout the UK. All stakeholders that are part of these multiple sandboxes must be encouraged to share the initiatives, updates and results being continuously delivered across all platforms and between different locations. Additionally, the direct collaboration between all involved will ensure awareness of the changing regulatory space, in turn providing regulatory agencies with the data required to regulate the UTM space more effectively and accurately.

There have been several examples of sandbox initiatives around the world which have been created to achieve a similar goal such as:

- the US Federal Aviation Administration Integration Pilot Program which launched multiple drone sandboxes partnering with various organisations under the FAA's oversight; and
- the Financial Conduct Authority initiative which found that communication with participants led to an increase in investor funding, product and market testing, testing validity, better consumer safeguards, reduced time to market, and reduced challenges in data sharing.

By following similar communication procedures between stakeholders, UTM sandboxes deployed throughout the UK will be able to achieve similar results.

8.3.3 Autonomous Flight

Sandbox environments will enable the development of critically important, robust detect and avoid, autonomous route and hazard management systems. Such systems are immature at present but are critical to the commercialisation of the industry through their ability to ensure that risk is minimised in the UTM environment.

NASA has determined through its Unmanned Aircraft System Traffic Management Project, that UTMs have the ability to reduce risk by introducing collision and obstacle avoidance, airborne radar, ground radar, vehicle-to-vehicle communication, direct flight plans, and aircraft recognition. With similar risk mitigating practices, like autonomous routes and hazard management implemented in the sandbox UTMs deployed in the UK, UTMs can present minimum risk to aircraft and personnel both within and outside the UTM.

8.3.4 Commercial Development

The development of industry funded, Government supported, commercial sandboxes will be essential to accelerate the development of industry sectors valuable to the UK economy. While commercial in nature, such projects would adhere to the principles of open lessons learned data sharing with regulators, standards makers and wider industry to ensure cross fertilisation of best practice.

An initial example of a commercial sandbox would be that of 'mid-mile' delivery systems which would establish the ability for logistics companies to move cargo by UAS systems from depot to sub-depot thus significantly reducing road traffic, overcoming pinch-points, reducing the need for additional infrastructure spending, improving the efficiency and environmental footprint of the logistics chain and enhancing the safety of delivery personnel. Further examples could include, air mobility, last mile delivery, medical distribution, support to blue light services and many more where commercial interest is significant.

8.4 Sandbox Requirements

Sandboxes will be required for a variety of different operational environments, and conditions such as meteorological and oceanographic, high interference, including metropolitan, mixed metro, maritime and rural. Additionally, sandboxes should be tailored to investigate a variety of use cases, such as but not limited to parcel delivery, medical supply, support to blue-light operations, ground or infrastructure surveying, swarm operations, freight carrying operations and should encompass indoor, VLoS and BVLoS operations. Only by spanning a wide spectrum of operational conditions and applications will the necessary intelligence be available to inform the development of enabling regulations and standards which are vital to rapid commercialisation.

Sandboxes should predominantly be physical in nature to ensure that they have lasting value to the industry and so that intelligence drawn from operations is consistent. However, it should also be possible to establish temporary 'virtual' sandbox areas for operations which do not require extended testing periods.

In addition to existing projects to develop sandboxes in the UK, the Drone Delivery Group has identified a list of organisations which are keen to be considered for inclusion into the development of a UK network of linked sandbox sites.

8.5 Structure and Operation

The structure and operation of sandboxes must be consistent with the open and collaborative intent of the process while still protecting the IP of participating companies. The structure needs to be very carefully studied as will the operation of the individual sandbox. As each sandbox will be tasked with addressing a different aerial and landscape environment, their structures will be different to ensure that their designated aims are met.

There may be a need to develop virtual (temporary) sandboxes in order to address a specific industry need and these will require an equal level of care and attention despite their temporary nature.

The identification of clusters of sandboxes is crucial at this stage and must be formulated and approved by the relevant authorities. By bringing this to the forefront of the CAA Innovation Hub activity, it will be possible to create a foundation that enables the CAA to accept, review and comment on all future applications within a reasonable time period. These clusters should be brought into the UTM strategy and greater airspace design project.

In order to deliver the sandboxes in appropriate locations of the country, involvement of relevant local government organisations such as Local Enterprise Partnerships and local councils will be required.

8.6 Stakeholder Benefits

8.6.1 Manufacturers

Manufacturers benefit from sandboxes as a way to quickly and safely trial and test their technology within a defined environment using required parameters. UK manufacturers currently conduct much of their testing overseas due to the costs and timescales required to obtain clearance to fly in the UK. Controlled testing is proven to accelerate the development of safer technology which, in the absence of easily accessible and affordable sites, can often become a lower priority in an industry where speed to market is critical to success.

8.6.2 Operators

Operators benefit from sandboxes in that they can quickly and safely prove new concepts, practice and make relevant adjustments needed to efficiently and effectively operate the various systems associated with drone delivery (air drones, UTM technologies & autonomous technologies). Controlled areas will not only enable training of operators to expand into more technical areas such as BVLOS, multi modal and specialist environments and applications, but also enable the management and evaluation of business use cases and prepare for upcoming projects in a safe environment.

8.6.3 Government, Standards Bodies & Regulators

Government, standards bodies and regulators benefit from the clusters of sandboxes by being the recipient of the lesson identified intelligence which they will be designed to produce and as a tool to validate regulatory concepts. It is crucial that regulators and standards bodies understand how these systems can operate safely, how to federate them, what issues need to be addressed and how to best develop standards to evolve in line with the needs of the industry.

Additionally, the increased awareness being built through sandboxes will help greatly alleviate technological and general concerns by providing a safe proving ground for explaining newer concepts, showcasing the safety aspects and the “Drones for Good” mentality of the initiatives.

8.6.4 User Community

Major users of drone technology such as the emergency services, infrastructure, construction, logistics and airlines will benefit significantly from the evolution of commercially viable sandbox areas. Quite apart from the obvious advantages to the manufacturers and operators involved in such projects, users would be able to test and evaluate the viability of drone technology while evolving operational safety protocols which could be fed into regulators and standards makers. Industry funding makes it likely that these will be the first areas to be developed.

8.6.5 General Public

The general public benefits from the clusters of sandboxes as the testing and evaluating performed via the sandboxes and the subsequent findings allow for the research and development of the drone delivery systems to operate safely and efficiently – this will lead to safer and more effective systems to benefit the public, without causing harm, irritation, damage or destruction to people and/or property.

8.6.6 3rd Parties

Industries traditionally not directly associated with drones, such as telecoms and utilities companies or other technology sectors, will benefit from clusters of sandboxes by having a cooperation and use case supply platform.

With the increased capabilities of the technology and interconnectivity between all assets it is vital to include a wide range of current and future stakeholders to provide a safe and controlled environment for sector merging innovation.

9 Possible Challenges to Sandbox Development

The development of multiple sandboxes across the UK will face a number of key challenges which must be overcome.

9.1 Independence

For any national array of federated sandboxes to be successful and provide real UK benefits, the wider industry must be seen to adhere to the principles outlined in this paper. To achieve this, it is vital that the Government partner with the industry to develop all sandboxes.

If the cost is covered solely by a commercial organisation, the overall impression of industry will be that there must be a commercial gain irrespective of the philanthropic intentions of the company and the usage levels will therefore become stressed. A scalable approach is to co-fund the development of sandbox testing areas as, regardless of commercial gain, each area will provide benefits to regulators, standards makers and the wider industry.

Co-funded sandbox facilities will enable the industry to accelerate innovation at a lower cost and without the current administrative burdens.

9.2 Confidentiality

Whereas all information and research outcomes need to be in the public domain, in order to help drive innovation and reduce costs for UK industry, it is important that the technology developed to achieve this remains the IP of the operating company. This is an essential distinction. The general architecture and outcomes will need to be made available to others, as will any actual trial data, whilst keeping the core technology private to the company conducting the trial. A collaboration agreement will be necessary, covering these and other commercial sensitivities that will arise during concept development, in order to protect all companies involved.

The development of a national drone and UTM development, trial and test environment with information sharing in the national interest, is a complex issue but all the work by the industry group identified in Appendix A has not yet revealed any logjams that are considered to be insurmountable.

This approach as described will be challenging, but if successful it could give the UK a significant advantage in solving the drone challenges that face the industry now and into the future, and not to do so will leave the UK lagging behind the rest of the world in this critical new domain.

10 Recommendations

10.1 It is recommended that the UK Government supports the creation of a network of sandboxes for UAS testing, facilitating a range of use cases and UTM solutions through the establishment of a wide-reaching open industry and Government partnership.

10.2 It is recommended that the UK CAA be given adequate additional resources to facilitate these vital activities, as the Authority will need bespoke internal processes and resources ahead of the demand that the creation of new sandboxes will naturally generate.

10.3 It is the opinion of the Drone Delivery Group that an open, collaborative industry group should be formed to deliver the recommendations of this White Paper to drive the evolution of the drone industry in the UK forward successfully.

10.4 It is recommended that, in addition to the sandbox environments, the Government funds projects to advance and deploy initial, operational UTM capabilities that build on the lessons learned in sandbox areas in preparation for full deployment.

10.5 It is recommended that existing funding sources such as the 'Future Flight' initiative be used to support the development of interconnected, commercially funded sandbox testing areas.

10.6 It is recommended that a scalable approach to co-fund the development of sandbox testing areas is established imminently as, notwithstanding the commercial gain, each area will also provide benefits to regulators, standards makers and the wider industry.

11 Next Steps

This White Paper will be presented to the UK Government for consideration and possible integration with current plans for the Airspace Modernisation Strategy[8].

The aim of this White Paper is to deliver industry backed guidance to the UK Government on the steps required to enable rapid commercialisation of the UK drone industry so it is hoped that the guidance contained herein is taken forward and plans evolved for the implementation of the physical and virtual sandbox areas which are essential to the success of the drone industry as it evolves to full commercialisation.

The Drone Delivery Group remains available to discuss the planning and implementation of this guidance as required.

[8] The Airspace Modernisation Strategy supersedes the Future Airspace Strategy and sets out the ways, means and ends of modernising airspace through 15 initiatives that will modernise the design, technology and operations of airspace, initially focusing on the period until the end of 2024. Source - https://www.caa.co.uk/News/New-Airspace-Modernisation-Strategy-launched-to-overhaul-UK-airspace/

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