



## BRIEFING PAPER

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# Civilian drones

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## Summary

**This paper outlines current regulations for the use of recreational and commercial drones in the UK. It also presents recent policy development in the UK and internationally, as well as emerging technological and regulatory issues related to drone integration into domestic airspace.**

The [Civil Aviation Authority](#) (CAA) is the independent statutory authority responsible for regulating civil aircraft, including drones. Relevant legislation is contained chiefly in the [Civil Aviation Act 1982](#) and the [Air Navigation Order 2016](#), as amended, with detailed guidance set out in the CAA's [Unmanned Aircraft System Operations in UK Airspace – Guidance](#).

Aviation is a reserved matter, meaning that drone policy and legislation are primarily the responsibility of the UK Government through the Department for Transport (DfT). The DfT have conducted two consultations since 2016 covering various aspects of drone policy. Several proposals, including new operating restrictions and a registration scheme, have subsequently been introduced.

Some of the enforcement issues surrounding drones are not aviation-related and, therefore, do not fall within the CAA and DfT's remit. The police, for example, hold responsibility for the enforcement of drone activities for criminal and terrorist purposes.

Drones have been in the headlines following the disruption caused in December 2018 when Gatwick Airport closed after several reports of drone sightings. This disrupted several thousands of passengers whose flights were either cancelled or significantly delayed during the nearly 36 hours in which the airport was closed.

There does not appear to be a ready-made solution available to airports to effectively monitor and prohibit drones from entering the airspace around an airport. The Secretary of State, in the immediate period following the Gatwick incident, announced that new police powers would be introduced allowing the police to: request evidence from drone users where there is reasonable suspicion of an offence being committed; and issue fixed penalty notices for minor drone offences. The Government is also planning on extending the 1km restrictions on drone use around airports.

The European Union has voted to harmonise drone regulation and to assume competence currently held by Member States. The European Commission, with the help of the European Aviation Safety Agency, is working on more detailed rules, including implementing and delegated regulations. The Regulation states that implementing rules shall be adapted to the new Regulation (EU) 2018/1139 no later than 12 September 2023. The UK's existing regulations generally align with those being introduced as part of the new EU regulations, so the practical impact of these reforms is not likely to be significant. Whether EU regulations continue to apply post-Brexit remain to be seen and depend on the outcomes of Brexit.

Information on other aviation-related matters can be found on the [Aviation Topical Page](#) of the Parliament website.

# 1. Introduction

What are popularly known as drones<sup>1</sup> – but also referred to as remotely piloted aircraft systems (RPAS), Small Unmanned Aircraft (SUA), or unmanned aerial vehicles (UAVs) – come in a variety of shapes and sizes,<sup>2</sup> ranging from small hand-held types up to large aircraft.<sup>3</sup> Drones can either be piloted or autonomous, though the latter are at an early stage of development and the drones referenced in this paper are the former.

Drones have been emerging beyond the confines of the military and are now used in a wide range of industries, such as:

- precision agriculture;
- inspection of public facilities;
- safety (including inspecting high, dangerous structures such as oil rigs);
- mapping;
- aerial photography (including by the news media); and
- filming and by police and security forces for, among other things, search and rescue operations, border patrols and general surveillance.<sup>4</sup>

There is potential for this technology to have a considerable and positive economic impact and for it to disrupt several industries. In many cases, the technology has not evolved enough for the full economic and disruptive impact to be felt, with the technological maturity of these operations in different sectors shown in the table below.<sup>5</sup>

The Air Accident Investigation Branch (AAIB), are an example, of a UK organisation that have fully incorporated drones into their operations. Drones provide an “efficient alternative” for the AAIB to police or search-and-rescue helicopters. The AAIB:

...first used a drone at an accident site in 2014 and the technology has improved markedly in just a few years. Our latest drone is capable of taking high quality stills and video in winds up to 20 kt, with the ability to take overlapping images to map the whole of an accident site.<sup>6</sup>

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<sup>1</sup> Many view the use of the term ‘drone’ as inaccurate and misleading, as it fails to capture either their purpose or degree of technological sophistication. However, for the purposes of this paper, the term drone will be used as a well-known shorthand throughout.

<sup>2</sup> For more information, see: House of Lords European Union Committee, [Civilian Use of Drones in the EU](#) (Seventh Report of Session 2014-15), HL Paper 122, 5 March 2015, Table 1, p.12

<sup>3</sup> CAA, [Flying Drones - Guidance on the safety rules](#) [accessed 21 February 2017]

<sup>4</sup> Statewatch, [Back from the Battlefield – Domestic Drones in the UK](#), May 2014; also in April 2015 UPS announced its participation in a study for the use of UAVs for humanitarian disaster relief operations, see: UPS press notice, “[UPS Brings Technology and Logistics Expertise to Study of Drone Use in Humanitarian Response](#)”, 21 April 2015

<sup>5</sup> Adapted from: Oliver Wyman, [In Commercial Drones, The Race is on](#), 2015, Table 2

<sup>6</sup> AAIB, [How we use drones at air accident sites](#), 7 June 2018

	Early Stage	Middle Stage	Late Stage
Aerial Photography			✓
Border Control			✓
Construction/infrastructure monitoring		✓	
Emergency management		✓	
Mail and package delivery	✓		
Filmmaking		✓	
Oil and gas exploration		✓	
Precision agriculture			✓
Public safety			✓
Weather forecasting		✓	
Wildlife monitoring		✓	

There are now almost 5,000 permissions for commercial drone operations in the UK, having doubled since February 2017 and increased from just five in 2010.<sup>7</sup> Recreational use of drones has also been growing, as consumer-grade devices become increasingly sophisticated and cheaper. It was estimated that British consumers purchased 530,000 drones in 2014,<sup>8</sup> and according to the CAA, 1.5 million were anticipated to be sold during the Christmas period of 2017.<sup>9</sup>

Drones have been in the headlines over the past few years in the UK. There was a police investigation into a suspected drone incident in April 2016 involving a British Airways flight on approach to Heathrow.<sup>10</sup> There was also a major incident at Gatwick Airport in December 2018, with reported drone sightings grounding flights for almost 36 hours.<sup>11</sup> Additionally, it has emerged that the number of 'near misses' involving drones and other airspace users has risen significantly in the past year.<sup>12</sup>

These incidents have reinforced public concerns about safety, privacy and security. The Department for Transport's (DfT) October 2018 public attitudes tracker revealed that 79% of respondents had at least one concern regarding the use of drones, with privacy issues standing out as the biggest concern. 28% also mentioned the potential misuse of drones for criminal activity and 25% mentioned airspace or aircraft collisions as perceived threats from drones.<sup>13</sup>

<sup>7</sup> CAA, [Approved SUA operators](#), as at 19 January 2019

<sup>8</sup> NATS, [Know your drone](#) [accessed 21 February 2017]

<sup>9</sup> CAA press notice, [Drones flying high with 1.5 million to be sold this Christmas: CAA reminds users of the need to follow safety rules](#), 2 December 2017

<sup>10</sup> Though the subsequent investigation found that a drone was probably not involved, see: CAA, [Annual Reports & Accounts 2015/16](#), CAP 1421, 21 July 2016, p24

<sup>11</sup> [Two arrested as Gatwick reopens following latest drone sighting](#), *The Guardian*, 22 December 2018

<sup>12</sup> UK Airprox Board, [Monthly reports](#), December 2018

<sup>13</sup> DfT, [Transport and Technology: Public Attitudes Tracker](#), October 2018, p10

## 2. Basic safety rules

The [Civil Aviation Authority](#) (CAA) is the independent statutory authority responsible for regulating civil aircraft, including drones. Relevant legislation is contained chiefly in the [Civil Aviation Act 1982](#) and the [Air Navigation Order 2016 \(SI 2016/765\)](#), with detailed guidance set out in the CAA's [Unmanned Aircraft System Operations in UK Airspace – Guidance](#) (CAP 722). Amendments were made in July 2018 to the law surrounding drone registration and usage via the [Air Navigation \(Amendment\) Order 2018 \(SI 2018/623\)](#).<sup>14</sup>

### 2.1 Recreational use

A small drone (or 'recreational drone') is defined in Schedule 1 of the ANO as "any unmanned aircraft, other than a balloon or a kite, having a mass of not more than 20kg without its fuel but including any articles or equipment installed in or attached to the aircraft at the commencement of its flight". Articles 94 and 241 of the ANO stipulate the general conditions of all drone usage, including that it must not "endanger any person or property" and that the person in control must "maintain direct, unaided visual contact" at all times. All "small unmanned aircraft" must not be flown at a height of more than 400 feet or within 1km of an airport or airfield boundary. Additional conditions apply to the use of drones which weigh more than 7kg, including that it must not be flown:

- in Class A, C, D or E airspace<sup>15</sup>; or
- within an aerodrome traffic zone during the notified hours of watch of the air traffic control unit.<sup>16</sup>

Additional regulations apply if the drone is equipped to undertake any form of surveillance, Article 95 of the ANO states in this case it may not be flown:

- over or within 150 metres of any congested area;<sup>17</sup>
- over or within 150 metres of an organised open-air assembly of more than 1,000 persons; or
- within 50 metres of any person.

There are severe penalties in place for misuse of drones, such as up to five years imprisonment for endangering an aircraft.<sup>18</sup> The Crown

<sup>14</sup> For detailed guidance of the amendments, see: [CAP1687: Air Navigation \(Amendment\) Order 2018 - Guidance for small unmanned aircraft users](#)

<sup>15</sup> The first key principle of aviation regulation is the categorisation of the airspace which determines where different types of aircraft can fly. By international agreement, airspace is designated into classes A-G according to different types of aircraft operations, for more information see: CAA, [The Application of ICAO Airspace Classifications in UK Flight Information Regions](#), 13 November 2014

<sup>16</sup> [HC WPO 36085](#), 9 May 2016

<sup>17</sup> The ANO defines a congested area as being 'any area of a city, town or settlement which is substantially used for residential, industrial, commercial or recreational purposes'

<sup>18</sup> [HC WPO 38744](#), 9 June 2016

Prosecution Service has successfully prosecuted where there has been reckless drone usage.<sup>19</sup>

### The Drone code and Drone Assist

To explain the risks of drones and users' safety obligations, the CAA introduced [The Dronecode](#) – a 'common sense' interpretation of the regulations. This was supplemented by NATS in December 2016 by the launch of an app – [Drone Assist](#) – to help drone pilots comply with UK rules on safety and airspace. The app:

...presents users with an interactive map of airspace used by commercial air traffic so that you can see areas to avoid or in which extreme caution should be exercised, as well as ground hazards that may pose safety, security or privacy risks when you're out flying your drone.

It also contains a 'Fly Now' feature that enables you to share your drone flight location with other app users and the wider drone community, helping to reduce the risk of a drone related incident in the UK's airspace.

It should be noted that the conditions of recreational drone usage have changed slightly because of the amendments in the *Air Navigation (Amendment) Order 2018*. The main change is that it is now against the law to fly above 400ft (120m) and to fly a drone within 1km of an airport or airfield boundary, although the Government has plans to introduce additional 5km long by 1km width exclusion zones from runway ends.<sup>20</sup> From 30 November 2019, there will also be requirements for the registration of small unmanned aircraft **operators** (of drones with a mass of 250 grams or more) and for the competency of **remote pilots** to be tested.<sup>21</sup>

### What is the difference between a drone operator and a remote pilot?

Role definitions of the operator and remote pilot, as found in the [ANO 2016](#), are currently as follows:

**Operator:** person or organisation who has management of the small drone but may not be directly controlling the flight. There is no requirement for the operator to be present during the small drone flight but their responsibilities are listed here:

**Remote pilot:** person who operates the flight of the small drone by manual use of the controls, or when the small drone is flying automatically, monitors its course and is able to intervene and change its course by adjusting its flight controls.

## 2.2 Commercial use

To operate a drone outside the limits above or to carry out aerial work, requires [operating permission](#) from the CAA, even if the activity is non-commercial. Permission is considered on a case-by-case basis by the

<sup>19</sup> [HC WPO 29436](#), 10 March 2016

<sup>20</sup> DfT, [Taking Flight: The Future of Drones in the UK - Government Response](#), 7 January 2019, p5

<sup>21</sup> CAA, [CAP1687: Air Navigation \(Amendment\) Order 2018 - Guidance for small unmanned aircraft users](#), July 2018

CAA to “ensure that sufficient safety measures have been put in place”.<sup>22</sup>

Additionally, an individual or organisation that wishes to conduct regular flights with their drone needs to submit an Operations Manual to the CAA for a permanent approval. As with a permission to carry out aerial work, the CAA needs to be assured of the competence of the person who will be flying the device. The ‘pilot’ therefore will likely need to undergo an assessment process with one of the National Qualified Entities.<sup>23</sup> Detailed guidance on using small drones for commercial work is available on the [CAA website](#) and in the guidance document [Unmanned Aircraft System Operations in UK Airspace](#).

Drones that weigh between 20 kg and 150 kg (i.e. ‘large drones’) are subject to all articles of the ANO as though they were manned aircraft and are not permitted to fly in any non-segregated airspace<sup>24</sup> in the UK, without specific permission from the CAA.<sup>25</sup>

Unmanned aircraft with a mass of more than 150 kg are subject to additional certification requirements as determined by the [European Aviation Safety Agency \(EASA\)](#). Further information about European regulation and recent reform is available in section 5.

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<sup>22</sup> CAA, [Guidance on operating permission for drones](#) [accessed 21 February 2017]

<sup>23</sup> CAA, [Apply for a permission to fly drones for commercial work](#) [accessed 21 February 2017]

<sup>24</sup> Non-segregated airspace is airspace open to all civil air transport.

<sup>25</sup> For details regarding permissions for large unmanned aircraft see: CAA, [Unmanned Aircraft System Operations in UK Airspace – Guidance](#), CAP 722, March 2015

## 3. Drones policy and regulation in the UK

Before the roles of the various UK government Departments and agencies are outlined, it is important to note that the European Union has been and, until the UK official leaves the EU, will continue to be responsible for certain regulation applying to drone usage in the UK. The EU have been responsible for regulating drones with a mass of more than 150 kg, with technical and regulatory oversight provided by the European Aviation Safety Agency (EASA). Recent reforms have been introduced to harmonise drone rules across the EU and to extend the regulatory authority for all drone types to the EU. The new EU regulation entered into force in September 2018, although it is not clear how it may apply to the UK given the uncertainties of Brexit (see Section 5.1 for further detail).

### 3.1 Roles of UK departments and agencies

Aviation is a reserved matter (i.e. the subject matter has not been devolved to the devolved parliaments in Scotland, Wales and Northern Ireland). As such, **drone policy and its legislation are primarily the responsibility of the UK Government through the Department for Transport (DfT)**. The DfT have conducted two consultations since 2016 covering various aspects of drones policy (see Section 3.2).

**Civilian drone operations are regulated and enforced by the CAA**, with its primary aim “to enable the full and safe integration of all UAS operations into the UK’s total aviation system.”<sup>26</sup> The CAA also advises the Government on regulation and produces guidance related to the ANO. The primary guidance produced by the CAA, with respect to drones, is the [guidance on unmanned aircraft system \(UAS\) operations in UK airspace](#), which is:

...intended to assist those who are involved in the development of UAS to identify the route to certification, outline the methods by which permission for aerial work may be obtained and ensure that the required standards and practices are met by all UAS operators.<sup>27</sup>

The CAA states that it is not its role to carry out research and development activities, which it says should be undertaken by the drone industry.<sup>28</sup>

Some of the enforcement issues surrounding drones are not aviation-related and, therefore, do not fall within the CAA and DfT’s purview. To bring clarity in this area the DfT and CAA signed a [memorandum of understanding \(MOU\)](#) with the police and the Home Office to ensure that the areas of responsibility are defined.<sup>29</sup> The Home Office, under

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<sup>26</sup> CAA, [An introduction to unmanned aircraft systems](#), [accessed 21 January 2019]

<sup>27</sup> CAA, [Unmanned Aircraft System Operations in UK Airspace – Guidance](#), CAP 722, March 2015, p12

<sup>28</sup> Op cit., [Unmanned Aircraft System Operations in UK Airspace – Guidance](#), p51

<sup>29</sup> Op cit., [Annual Reports & Accounts 2015/16](#), p11

the MOU, “will work together towards drafting and implementing effective legislation in respect of drones to mitigate misuse and the threat posed”, while the police will “assess reports of drone misuse...with resources to be concentrated on investigation the most serious misuse.” Guidance has also been produced by the National Police Chiefs’ Council to officers around the legislation and dealing with the misuse of drones.<sup>30</sup> A Cross-Government Working Group has also been established, which meets quarterly, chaired jointly by the DfT and MoD. The Working Group has commissioned work to analyse the potential use of drones for criminal and terrorist purposes. This is ongoing and is being kept under review.<sup>31</sup>

**Responsibility for public investment and research** into civilian drones is the responsibility of the DfT and the Department for Business, Energy and Industry Strategy (BEIS). Early public support for the development of drones technologies came following the publication of 2004 Aerospace Technology Strategy, in which the then Department for Business Innovation and Skills supported the research and demonstration of civil drone technologies through the UK’s flagship research programme [ASTRAEA](#) – a programme to address the regulatory and technological requirements to enable the routine operation of drones in non-segregated airspace. The Government has also recently published Sector Deal with the aerospace industry, which will “provide up to £125 million to aerospace and other manufactures to research and engineer new technologies and infrastructure, which industry will match.”<sup>32</sup>

**The approach of local authorities towards the use of drones varies.** As the DfT describe in their 2016 consultation document:

At a local level, local authorities often have the power to set bylaws which can be adapted to regulate the use of drones in a park or other areas within the authority’s jurisdiction. Private landowners, such as the National Trust, may also set their own rules for drone use on their land.<sup>33</sup>

Leicester City Council, for example, prohibits the use of drones, both for recreational and commercial purposes, on council lands. The reason behind this policy is concern over the authority’s liability for any legal action as a result of the activities of a drone and its operator, including accident or injury, and the close proximity of the land to private properties.<sup>34</sup>

### 3.2 Recent policy developments

In the 2016 Queen’s Speech the Government announced a *Modern Transport Bill*, which was expected to include “legislation that will put the UK at the forefront of safe technology in the autonomous vehicles industry, such as drones ... paving the way for commercial drone

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<sup>30</sup> NPCC, [Guidance to Officers on Drones – Legislation and dealing with misuse](#), 2015

<sup>31</sup> [HC WPO 40015](#), 15 June 2016

<sup>32</sup> HM Government, [Industrial Strategy – Aerospace Sector Deal](#), December 2018

<sup>33</sup> DfT, [Unlocking the UK’s high tech economy: consultation on the safe use of drones in the UK](#), 21 December 2016, p37

<sup>34</sup> Law Library of Congress, [Regulation of Drones](#), April 2016, p119

operations".<sup>35</sup> The *Modern Transport Bill* eventually became the [Vehicle Technology and Aviation Bill](#), but this had nothing in it on drone regulation and eventually fell before the 2017 General Election.

The Government has since held two consultations covering various aspects of drones policy, including safety, privacy, security insurance and technological development. Details of the consultations, including policy and legislative outcomes, as well as plans for a Drones Bill are provided below.

## Consultation and outcome, 2016-17

In December 2016 the DfT published its consultation '*Unlocking the UK's High Tech Economy: Consultation on the Safe Use of drones in the UK*' and sought views on the following issues and proposals:

- A call for evidence to establish if the current **drone testing sites** in the UK meet the needs of the start-up and small-medium enterprise drone services industry, to include series of options for improving the UK's testing site provisions, including the implementation of 'Drone Innovation Zones';
- Establishment of a 'clear and sophisticated' framework of **standards of pilot competency and qualifications** for all operations (mostly commercial), taking a risk-based approach and potentially in future to enable repeat commercial operations if carried out by suitable qualified pilots;
- Ensure appropriate **insurance** cover for any incidents that may occur;
- Mandate that drone manufacturers and/or vendors issue official **guidance** on safety and legal flying requirements at point of sale and/or drone activation;
- Reduce the **complexity of rules** for drones by amending the flying rules for small drones to simplify them and ensure consistency;
- A call for evidence as to whether the **current penalties** for breaking laws relating to drones should be increased, and whether a new offence for the misuse of drones is required;
- A call for evidence as to how drone flight restrictions could be better enforced so as to improve the restriction of drones flying in **sensitive or dangerous areas**;
- Introduce a **registration scheme** for all owners and their drones weighing 250g and above, whether bought new or second-hand or home-built;
- Make drones **electronically identifiable**, in order that they can be identified in flight; this capability could be extended to include identification of the aircraft by persons on the ground, allowing the reporting of drones being misused to the Police; and

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<sup>35</sup> HMG, [Queen's Speech 2016: background briefing notes](#), 18 May 2016, p17

## 12 Civilian drones

- The principles for designing and operating a drone **traffic management system** in the future, to ensure safety and enable complex drone operations.<sup>36</sup>

The consultation closed in March 2017. In its response to the consultation, the Government announced two new measures it planned on introducing to improve safety aspects of drone usage in the UK:

- 1 a requirement for all drone users of drones of 250g and above to register themselves, and their drone(s) too. This was with a view to considering how best to embed electronic identification and tracking capability so that enforcement action against irresponsible drone use can be improved; and
- 2 the introduction of mandatory competency testing, such as online tests, for all leisure users (commercial users already have required standards to meet).<sup>37</sup>

These were the only formal proposals the Government advanced following the consultation, although it stated that it was exploring:

- Whether to tighten rules around where users can fly certain classes of drones;
- Options to increase penalties when the law is broken;
- The possible banning of the use of drones within the proximity of airports; and
- Reviewing the powers law enforcement agencies have to enforce relevant law.<sup>38</sup>

The Government also said that it would:

- Continue to explore the development of an unmanned traffic management system (UTM); and as a key first step,
- Bring forward work to create an authoritative source of UK airspace data, which will facilitate the implementation of geo-fencing and build greater awareness of airspace restrictions amongst drone users.

On 30th May 2018 the Government laid new legislation in the Houses of Parliament, [Air Navigation \(Amendment\) Order 2018](#), amending the Air Navigation Order 2016, to introduce:

- A height restriction of 400ft for all small drones;
- A 1km restriction on all small drone flights around protected aerodromes;
- A registration scheme for operators of small drones of a mass between 250g and 20kg inclusive; and
- Competence requirements for remote pilots of small drones of a mass between 250g and 20kg inclusive.<sup>39</sup>

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<sup>36</sup> DfT, [Unlocking the UK's high tech economy: consultation on the safe use of drones in the UK](#), 21 December 2016, pp23-25

<sup>37</sup> DfT, [Unlocking the UK's High Tech Economy: Consultation on the Safe Use of Drones in the – UK Government Response](#), July 2017, p8-9

<sup>38</sup> Ibid, p9

<sup>39</sup> DfT press notice, [New drone laws bring added protection for passengers](#), 30 May 2018

## Consultation and outcome, 2018-19

In July 2018 the DfT published its consultation '*Taking Flight: The Future of Drones in the UK*'. Following the amendments made to the Air Navigation Order 2016, the consultation sought additional views on: "the proposed age limit for small drone operators; and whether the airport restriction coming into force on 30th July 2018 is sufficient, and if not, what kind of further extension should be considered."<sup>40</sup> The consultation also sought views on the possible content of a draft Drones Bill, including:

- The proposed use of a flight information and notification system (FINS) or systems (FINSs) prior to and/or whilst flying certain types of drone or for certain types of users, and how this could or should be regulated; and
- Police powers relating to drones and fixed penalty notices.<sup>41</sup>

The consultation closed in September 2018, with the Government publishing its response on 7 January 2019 in the immediate aftermath of the drone disruption at Gatwick Airport over the 2018 Christmas period. Secretary of State Chris Grayling said that incident was a "stark example of why we must continue to ensure drones are used safely and securely in the UK."<sup>42</sup>

The flagship proposal at the back end of this consultation was that the introduction of new police powers. As the Secretary of State elaborated:

These include allowing the police to request evidence from drone users where there is reasonable suspicion of an offence being committed, as well as enabling the police to issue fixed penalty notices for minor drone offences. Those new powers will help to ensure effective enforcement of the rules. They will provide an immediate deterrent to those who might misuse drones or attempt to break the law.<sup>43</sup>

The Secretary of State also expressed his desire to "ensure that the most up-to-date technology is available to detect, track and potentially disrupt drones that are being used illegally." He added that the consultation responses would be "used by the Home Office to develop an appropriate means of using that technology in the UK."<sup>44</sup> The other main proposal to come from the consultation was the introduction of:

...additional protections around airports, with a particular focus on protected exclusion zones from runway ends, alongside increasing the current aerodrome traffic zone restrictions around airports. Drone pilots wishing to fly within these zones must do so only with permission from the aerodrome air traffic control. [The Government] will amend the Air Navigation Order 2016 to implement these changes.<sup>45</sup>

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<sup>40</sup> DfT, [Taking Flight: The Future of Drones in the UK](#), July 2018, p8

<sup>41</sup> Ibid, p9

<sup>42</sup> DfT, [Oral statement to Parliament - Drones: consultation response](#), 7 January 2019

<sup>43</sup> Ibid.

<sup>44</sup> Ibid.

<sup>45</sup> DfT, [Oral statement to Parliament - Drones: consultation response](#), 7 January 2019

## Drones Bill

The Government is intending to bring forward a Drones Bill in 2019 which will provide police with additional powers for enforcement.<sup>46</sup> The new police powers Government is taking forward as part of the Drones Bill are outlined below and include allowing the police to request evidence from drone users where there is reasonable suspicion of an offence being committed:

- Require the production of evidence in specific circumstances for:
  - drone operator registration,
  - remote pilot acknowledgement of competency, and
  - other requirements for specific flights, such as permission for commercial drone use or exemptions from the CAA from any ANO 2016 articles;
- Obtain information such as the names and addresses of the registered drone operator and/or remote pilot believed to be in charge of the drone in specific circumstances (such as where there is a reasonable suspicion of the commission of an offence).
- If the identity of the drone operator is not provided, the power to obtain the name and address of the person who made the drone available for use by the remote pilot should be given to the police;
- Require a remote pilot to land a drone in specific established offence circumstances;
- Enter and/or search premises, with a warrant, where there is reasonable suspicion that there is a drone and/or its associated components which the police reasonably suspects of having been involved in the commission of an offence;
- Seize and retain a drone and/or its associated components which the police reasonably believe has been involved in the commission of an offence on entering and/or searching premises;
- Access information stored electronically on a seized drone and/or its associated components which a constable reasonably suspects:
  - is evidence in relation to an offence, or
  - has been obtained as a result of the commission of an offence, and
  - it is necessary to do so in order to prevent it being concealed, lost, tampered with or destroyed.
- Require any information stored in electronic form on a drone to be produced in a visible and legible form. The power can only be exercised if the police has reasonable grounds for believing that:
  - it is evidence in relation to an offence, or

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<sup>46</sup> DfT, [Taking Flight: The Future of Drones in the UK - Government Response](#), 7 January 2019, p5

- it has been obtained as a result of the commission of an offence, and
- it is necessary to do so in order to prevent it being concealed, lost, tampered with or destroyed.<sup>47</sup>

The fixed penalty notice (FPN) offences being taken forward are outlined below:

- Not producing registration documentation, and/or proof of registration for drones between 250g and up to and including 20kg in mass, at the request of a police constable;
- Not producing evidence of any other relevant permissions required by legislation, for example if you are a commercial drone operator or have an exemption from the CAA from an ANO 2016 article;
- Not complying with a police officer when instructed to land a drone; and
- Flying a drone without a valid acknowledgement of competency, or failure to provide evidence of meeting this competency requirement when requested.

Other offences under the ANO, such as flying a small drone (SUA) with a camera or other data collection device within 50m of people, vehicles or buildings may also be subject to a FPN but only under certain conditions. An FPN may be issued where a constable believes that the offender did not, and did not intend to:

- endanger any other aircraft (whether or not an unmanned aircraft);
- cause any persons harm, harassment, alarm or distress;
- cause any persons occupying any premises nuisance or annoyance relating to their occupation of the premises;
- undermine security or good order in prisons or in other institutions where persons are lawfully detained;
- disturb public order; or
- damage property (including land or buildings).<sup>48</sup>

The specific timetable for the introduction of the Drones Bill is unclear but as part of his 7 January 2019 oral statement to the House, the Secretary of State for Transport said that his "department has been working closely with the Home Office on the legislative clauses that will deliver these changes."<sup>49</sup>

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<sup>47</sup> DfT, [Taking Flight: The Future of Drones in the UK - Government Response](#), 7 January 2019, p19-20

<sup>48</sup> *Ibid.*, p22

<sup>49</sup> DfT, [Oral statement to Parliament - Drones: consultation response](#), 7 January 2019

## 4. Safety and regulatory issues

Achieving the full and safe integration of drones into non-segregated airspace will require technology that automatically senses and avoids other air traffic under all possible scenarios. This technology is only in the early stages of development and drones are still manpower-intensive and impose considerable workload on the operators.<sup>50</sup>

Before autonomous technologies are fully developed, several safety issues need consideration particularly around the system reliability of drones, as well as training and qualification standards for drone pilots and operators.<sup>51</sup> Other issues need to be considered regarding privacy and liability, to improve integration and perhaps as importantly, public perceptions about the wider use of drones in society.

It is beyond the scope of this paper to identify, in detail, the technical aspects of these problems and the viability of possible solutions. The sections below outlines, in general terms, the nature of the problems and solutions that have been identified, either by government or industry, to date.

It should also be noted that these issues are being dealt with through a combination of industry, central government and EU regulatory measures. The discussion below relates primarily to the actions taken by the UK government, but in several instances, the EU has been working on finding regulatory or technical solutions to these problems. Reference has been made to relevant EU proposals, with more detail on the process of reform in section 5.

### 4.1 Safety

#### Airworthiness and product standards

The airworthiness of a drone relates to both the standard of the product when manufactured and the assessment and maintenance of a drone once in operation.

**Product standards of drones** are dealt with at the European and international level. Drones with an operating mass of more than 150kg are subject to *European Regulation (EC) No. 216/2008*, which enforces airworthiness standards. But those below 20kg, the sector where most commercial operations are currently taking place, are subject to few existing standards or assessments. The House of Lords European Union Committee concluded, as part of its 2014-15 inquiry into 'Civilian Use of Drones in the EU', that product standards should be developed for small drones:

We support the ongoing development of EU airworthiness standards for small RPAS. These standards should be, as far as possible, consistent with emerging international approaches,

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<sup>50</sup> ASTRAEA, [Opening the airspace for UAS](#), 2012

<sup>51</sup> Congressional Research Service, [Pilotless Drones: Background and Considerations for Congress Regarding Unmanned Aircraft Operations in the National Airspace System](#), September 2012

particularly that of the USA. The requirement for airworthiness standards should depend on the type of RPAS operation.

We recommend that the Commission quickly considers requiring CE marking for small toy-like RPAS (below 2kg). While this is not an airworthiness standard, and would not compensate for pilot error, it would introduce basic quality standards for these products.<sup>52</sup>

In response to the 2016/17 consultation, the Government said that it would continue “the work of the Government and CAA at European and international level to agree and implement product standards, and possibly standards for ‘age labelling’ on packages, for all drones sold in the UK and EU.”<sup>53</sup> In response to its 2018 consultation, the Government said that “the Department for Transport is committed to working with the Home Office and the Department for Business, Energy & Industrial Strategy to consider product standards for drones.”<sup>54</sup>

### New EU product standards

Recently adopted European regulations have proposed new product requirements. Specifically, all drones available on the market will now require a CE marking (“Conformité Européenne”) and a number between 0 and 4 that will specify the class of the drone (C0, C1, C2, C3 and C4). The operator will also find in each drone package a digital consumer information with the “do’s and don’ts” related to each class on how to fly a drone safely.

In terms of the **ongoing assessment and maintenance obligations for drone users**, again, those with an operating mass of more than 150kg are subject to [European Regulation \(EC\) No. 216/2008](#), but drones below 20kg, are not. In certain circumstances the CAA might require additional airworthiness assessments for drones, for example for flights over people, or flights beyond the visual line of sight of the pilot.<sup>55</sup> However, it is not a routine requirement for recreational drones. The Government did not offer any specific proposals in its 2018 consultation around future assessment and maintenance obligations.

## Training

Negligent or reckless drone pilots present a safety risk, particularly **recreational operators** such as hobbyists, for whom there has previously been no regulatory requirement to be licenced or to receive training.

Before the CAA issues any operating permission, a potential **commercial operator** must demonstrate that the drone pilot or operator has at least a basic understanding of the applicable regulations to ensure that the drone does not constitute a greater risk than a comparable commercial manned operation. [Training and certification schemes](#) such as the ‘Basic National Unmanned Aircraft Systems Certificate – Small’ and the ‘Remote Pilot Qualification – Small’ are

<sup>52</sup> Op cit., [Civilian Use of Drones in the EU](#), p34

<sup>53</sup> Op cit., [Unlocking the UK’s High Tech Economy: Consultation on the Safe Use of Drones in the – UK Government Response](#), p14

<sup>54</sup> Op cit., [Taking Flight: The Future of Drones in the UK - Government Response](#), p10

<sup>55</sup> Op cit., [Unmanned Aircraft System Operations in UK Airspace – Guidance](#), Chapter 3

initiatives which allow operators to formally demonstrate their competence.<sup>56</sup>

The issue of whether training and licencing for drone pilots is sufficient in the UK was scrutinised as part of the House of Lords inquiry and it recommended that “commercial RPAS pilots operating...should be assessed for their competence to fly safely to a level which reflects the risk of the operation to be undertaken.”<sup>57</sup> It was also addressed by Government in response to their first consultation. The main proposal from this consultation was the introduction of a registration scheme from November 2019 requiring all drone users of drones of 250g and above to register themselves, and their drone(s) too. In addition to this, the Government will introduce mandatory competency testing, such as online tests, for all leisure users (commercial users already have required standards to meet).<sup>58</sup>

There are currently no age restrictions in UK legislation with regards to the use of small drones for leisure purposes. The CAA has a minimum age requirement of 18 to have a permission issued allowing operators to conduct any commercial operations with their drone. A permission is valid for up to 12 months, and subject to annual renewal.<sup>59</sup> In its 2018 consultation, the Government put forth the proposal to raise the minimum age of a drone operator, as opposed to a remote pilot, to 18 for drones weighing more than 250g.<sup>60</sup> The response to the consultation is summarised below:

This position was largely supported in the responses to the consultation. Regardless of the widespread definition misinterpretation, many respondents echoed the Government’s view that early learning and skill transfer are very important and thus people of all ages should have access to leisure drone flying. Many also recognised that by implementing a minimum age for an SUA operator, regulations are more likely to be understood and adhered to. Respondents felt this would lead to a culture of responsibility and increased trust associated with drone operations.<sup>61</sup>

The Government said that it “still supports a minimum operator age, but will defer a decision until there is clarification and confirmation from EASA regarding future legislation at the European level with regards minimum ages for drone operators and remote pilots.”<sup>62</sup>

### Geo-fencing and counter-drone systems at airports

**Geo-fencing** is a technique whereby all major airports and other security sensitive locations are stored in the database of the navigation system of the drone. It provides a radius around a location (e.g. 5 miles

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<sup>56</sup> Full details of the pilot competence requirements can be found in the [CAA guidance document CAP 722](#).

<sup>57</sup> Op cit., [Civilian Use of Drones in the EU](#), p30

<sup>58</sup> Op cit., [Unlocking the UK's High Tech Economy: Consultation on the Safe Use of Drones in the – UK Government Response](#), p9

<sup>59</sup> Op cit., [Taking Flight: The Future of Drones in the UK](#), p20

<sup>60</sup> Op cit., [Taking Flight: The Future of Drones in the UK](#), p24

<sup>61</sup> Op cit., [Taking Flight: The Future of Drones in the UK - Government Response](#), p14

<sup>62</sup> Ibid, p14-15

of an airport) whereby the drone either cannot start its motors within the prohibited area or will simply not enter the area if already airborne.

Use of compulsory geo-fencing could address many of the security and safety concerns around drone use, particularly with respect to disruption at major airports in the UK (see box below). Although it should be noted that geo-fencing does not protect light aircraft or helicopters operating away from major airports, such as Air Ambulances. These situations can attract hobbyists and others wishing to photograph incidents such as road traffic accidents.<sup>63</sup> It is also recognised that geo-fencing could not prevent deliberate incursions, as users can hack the drones and remove any installed geofencing capability.<sup>64</sup>

Presently there is no legal requirement for a drone to adopt geo-fencing. The British Airline Pilots' Association, the professional association and registered trade union for UK pilots, have previously said that consideration should be given to making it "mandatory on all but the very lightest of small drones".<sup>65</sup> While a large proportion of commercially available drones already include geo-fencing capabilities, the technology is, however, not widely available across all drone types.<sup>66</sup> The then Transport Minister, Robert Goodwill, told the House in April 2016 that the Government was:

... talking to both the Civil Aviation Authority and airports to develop potential technical solutions to the problems around airports, these include mandated geo-fencing and frequency jammers.<sup>67</sup>

### Disruption at London Airports – 2018, 2019

There had been several reports of drone sightings in recent years, but none were threatening enough to cause extended disruption or cancellations at any of the UK's major airports. This changed in December 2018 when Gatwick airport closed in response to several reports of drone sightings. This disrupted several thousands of passengers whose flights were either cancelled or significantly delayed during the nearly 36 hours in which the airport was closed.

The drone disruption was eventually resolved by, what the Secretary of State described as, "...the smart and innovative use of new technology", although for "security reasons" he did not provide details to the House as to how this was actually achieved.<sup>68</sup>

The cost of the disruption became clearer in the aftermath of the incident. EasyJet, for example, said the drones cost it £15m in passenger compensation and lost revenues, and hit 82,000 customers.<sup>69</sup>

The House debated the issue of drone disruption at airports in response to the Secretary of State's statement on 7 January 2019. In that debate, Andy McDonald, Shadow Secretary of State for Transport, called the

<sup>63</sup> Chartered Insurance Institute, [One 'near miss' too many? Drone safety issues and possible solutions: an airspace user view](#), Think piece No. 119, October 2015

<sup>64</sup> Op cit., [Unlocking the UK's high tech economy: consultation on the safe use of drones in the UK](#), p20

<sup>65</sup> BALPA, [Supplementary written submission to the House of Lords inquiry Civilian Use of Drones in the EU](#), 9 December 2014

<sup>66</sup> Op cit., [Taking Flight: The Future of Drones in the UK - Government Response](#), p10

<sup>67</sup> [HC WPO 34296](#), 21 April 2016

<sup>68</sup> DfT, [Oral statement to Parliament - Drones: consultation response](#), 7 January 2019

<sup>69</sup> ['EasyJet says drone chaos was 'wake-up call' for airports'](#), BBC News, 22 January 2019

government's approach "chaotic" and said Mr Grayling had been "totally negligent in failing to bring forward measures to better protect national infrastructure" after a 2017 drone incident at Gatwick.<sup>70</sup>

Other commentators were also less than complimentary about the incidents and how they were managed by the airport and the police,<sup>71</sup> particularly after a Crawley couple were arrested and questioned by police for 36 hours but were then released without charge.<sup>72</sup> Reports emerged in the aftermath of the incident that there were no actual drones in the area.<sup>73</sup> Gatwick strongly refuted that there were drone sightings and that it took "the necessary actions to ensure the safety of passengers."<sup>74</sup> The Police also said that "we can unequivocally state that there have been numerous illegal drone sightings at the airport over three days from December 19 to 21."<sup>75</sup>

As at 7 February 2019, the police had yet to make an arrest and "there is still a dedicated senior investigating officer committed to this enquiry with a full team working to explore all avenues."<sup>76</sup>

In response to its 2018 consultation, the Government said that it was "engaging directly with drone manufacturers and industry on how [geo-fencing] capabilities may be improved." It added:

We are working with NATS and the CAA to ensure that robust data on airspace restrictions, such as those around airports and other critical national sites, will be available in a format that manufacturers and technology developers can easily use, in order to improve safety and help drone users fly in accordance with the rules.<sup>77</sup>

However, there does not appear to be a ready-made solution available to airports to effectively monitor and prohibit drones from entering the airspace around an airport.<sup>78</sup> Gatwick Airport said, in response to the incident at its airport, said that "there is no single proven commercial solution to what we were faced with."<sup>79</sup>

Other options are therefore needed in the interim to combat the intrusion of drones into security sensitive locations, particularly airports. Police have warned against shooting the Gatwick drones out of the sky "because of what may happen to stray bullets". Shooting down a UAV also risks it crash landing on an individual or property.<sup>80</sup>

Several other proposals have been put forth, either in the media or elsewhere, around ways to protect airports from drone deliberate and

<sup>70</sup> [HC Deb 07 January 2019 vol 652 c104](#)

<sup>71</sup> ['Drone wolf': what the papers say about the Gatwick airport chaos', \*The Guardian\*, 21 December 2018](#)

<sup>72</sup> ['Gatwick airport drone chaos: Man, 47, and woman, 54, arrested in Crawley', \*The Telegraph\*, 22 December 2018](#)

<sup>73</sup> ['Gatwick airport drones disruption wasn't all for nothing, UK police insist', \*CNN\*, 24 December 2018](#)

<sup>74</sup> Gatwick Airport press notice, [Illegal drone activity](#), 24 December 2019

<sup>75</sup> ['Gatwick airport drones disruption wasn't all for nothing, UK police insist', \*CNN\*, 24 December 2018](#)

<sup>76</sup> ['Gatwick drone disruption: Review of police response expected this month', \*Crawley Observer\*, 5 February 2019](#)

<sup>77</sup> Op cit., [Taking Flight: The Future of Drones in the UK - Government Response](#), p10

<sup>78</sup> ['Does the UK have adequate laws and technology on drones?', \*Financial Times\*, 21 December 2018](#)

<sup>79</sup> ['Can airports ever make themselves safe from drones?', \*Financial Times\*, 10 January 2019](#)

<sup>80</sup> ['Does the UK have adequate laws and technology on drones?', \*Financial Times\*, 21 December 2018](#)

unintended drone incursions. A 10 January 2019 [Financial Times article](#) provides a useful discussion around the role technology can play in dealing with drone intrusion around airspace. Possible options explored in this article include:

- a Royal Air Force anti-drone system to detect and destroy drone; shoulder-mounted cannons to launch small nets to capture drones;
- an “octocopter”, a drone armed with a net to take down drones; and
- radar systems that can detect, identify and track small drones.

NATS, the primary air-traffic controller in the UK, have also unveiled a partnership with an avionics company called Altitude Angel to create technology that would broadcast the position and flight data of drones.<sup>81</sup> A range of equipment to detect, track and ground drones has been reportedly installed on the roof of Gatwick’s south terminal.<sup>82</sup>

The matter of counter-drone systems at airports was raised as part of the Government’s 2018 consultation ([Section 7 of the document](#)). The document said that the Home Office and Ministry of Defence chair a cross-government counter-drones working group, leading the Government’s work on countering drones. The document also said that:

The Government is also engaging directly with drone manufacturers and industry on technical solutions, for example geo-fencing (software and data contained in the drone that can restrict it from flying in certain areas, such as airports).

In addition, there are multiple programmes of work underway focusing on testing and evaluating technology to detect and counter drones, supporting the development of new technology, and understanding how these systems should be practically used. Trials and demonstrations have taken place to examine the applicability of different technological options.

Chair of the Defence Committee Dr Julian Lewis [wrote to the Secretary of State for Defence Gavin Williamson on 9<sup>th</sup> January](#) 2019 expressing concern at the official response to the incident at Gatwick and sought clarification on whether the Ministry of Defence had an adequate contingency plan for unauthorised drone activity at airports. In [response on 14 January 2019](#), Mr Williamson said that:

...the responsibility for drone activity at civilian airports lies with airport operators. As such, Defence does not have a contingency plan to respond to such an incident. Despite this, Defence was able to deploy capability within 6 hours at the request of the Police...This support allowed airport operators the time and space to make some rapid improvements to their standing counter-drone infrastructure...

He said that the Home Office was taking forward a plan to develop a national counter-drone response capability, although he said:

...there were no simple answers here. Defence official have been involved in counter-drone work for a number of years and will

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<sup>81</sup> Altitude Angel press notice, [Air traffic controller partner with Altitude Angel to integrate drones safely in UK skies](#), 5 March 2018

<sup>82</sup> [‘Gatwick and Heathrow buying anti-drone equipment’](#), BBC News, 4 January 2019

work closely with the Home Office as work on the national capability progresses.

In further correspondence with the Dr Lewis on 25<sup>th</sup> January, Mr Williamson elaborated on the work the Government was doing on developing national counter-drone capabilities:

The Home Office, as a matter of priority, are driving forward a cross-Government work programme on Counter Unmanned Aerial Vehicles (C-UAV). This work programme will consider inter alia the national requirement for C-UAV and how this capability can be most effectively maintained and employed within the UK. It will also consider how to most effectively provide adequate UAV protection to fixed sites of Critical National Infrastructure, as well as requirement for deployable platforms to provide protection to large gatherings.

### What would happen if a drone hit an aircraft?

There is no absolute certainty as to what would happen if a drone hit an aircraft, including the risk to flight-critical elements such as its engines, control surfaces, windscreen, and vital flight sensors; not to mention the danger to smaller aircraft or helicopters.<sup>83</sup> However, a number of UK and EU safety organisations have investigated what risk a drone might present to an aircraft in the event of a collision.

EASA's 'Drone Collision' Task Force [published a report in October 2016](#). It found that:

- large aeroplanes and large rotorcraft are by the nature of their scale and design requirements generally more resilient to collisions with drones and the severity level is limited for the smallest drone categories; and
- for smaller aeroplanes and light rotorcraft, more components are vulnerable and the severity level is higher.

The Department for Transport, the Military Aviation Authority and the British Airline Pilots' Association commissioned a study into the effects of a mid-air collision between small drones and manned aircraft. Specifically, the study sought to find the lowest speed at collision where critical damage could occur to aircraft components. Critical damage was defined "to mean major structural damage of the aircraft component or penetration of drone through the windscreen into the cockpit." The [results of this study were published in July 2017](#), with the key findings below:

- Non-birdstrike certified helicopter windscreens have very limited resilience to the impact of a drone, well below normal cruise speeds.
- The non-birdstrike certified helicopter windscreen results can also be applied to general aviation aeroplanes which also do not have a birdstrike certification requirement.
- Although the birdstrike certified windscreens tested had greater resistance than non-birdstrike certified, they could still be critically damaged at normal cruise speeds.
- Helicopter tail rotors are also very vulnerable to the impact of a drone, with modelling showing blade failures from impacts with the smaller drone components tested.

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<sup>83</sup> Chartered Insurance Institute, [A "near miss" or too close to the mark? Balancing drone risk and regulation](#), Think piece, No. 125, May 2016; and "[What Really Happens When a Drone Strikes an Airplane](#)", *Popular Mechanics*, 22 December 2016

- Airliner windscreens are much more resistant, however, the study showed that there is a risk of critical windscreen damage under certain impact conditions:
  - It was found that critical damage did not occur at high, but realistic impact speeds, with the 1.2 kg class drone components.
  - However, critical damage did occur to the airliner windscreens at high, but realistic, impact speeds, with the 4 kg class drone components used in this study.
- The construction of the drone plays a significant role in the impact of a collision. Notably, the 400 g class drone components, which included exposed metal motors, caused critical failure of the helicopter windscreens at lower speeds than the 1.2 kg class drone components, which had plastic covering over their motors. This is believed to have absorbed some of the shock of the collision, reducing the impact.
- The testing and modelling showed that the drone components used can cause significantly more damage than birds of equivalent masses at speeds lower than required to meet birdstrike certification standards.<sup>84</sup>

The CAA also [published an assessment in January 2018](#) about the likelihood of an unintentional drone collision and the severity of any possible impact between an aircraft and a smaller unmanned vehicle (defined as under 2kg). The CAA found that it was “unlikely that a small drone would cause significant damage to a modern turbo-fan jet engine; even if it did, a multi-engine aircraft would still be likely to be able to land safely.”

## Navigation

The ability of drones to automatically ‘detect and avoid’ obstacles<sup>85</sup> on the ground and in the air has been described by Government as the “key to the safe integration of [drones] into the airspace”.<sup>86</sup> Although a number of UK aerospace companies are collaborating with Government to develop autonomous **detect and avoid technology**,<sup>87</sup> it is not yet available and will not be for some years to come.<sup>88</sup> As such, interim technical solutions are required to enable enhanced navigational capabilities and improved integration of drones into airspace.

At present, transponders, as part of the Traffic Collision Avoidance System,<sup>89</sup> are the way in which manned aircraft ‘see and avoid’ each other. All drones operating in non-segregated airspace must be equipped with, and be able to operate, a Secondary Surveillance Radar transponder.<sup>90</sup> Currently, small drones cannot be seen by NATS<sup>91</sup> radars so if the drone itself was able to transmit its own location it would

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<sup>84</sup> MAA, DfT, BALPA, Small Remotely Piloted Aircraft Systems (drones) Mid-Air Collision Study, 2016, p4-5

<sup>85</sup> That is, the capability of the drone to remain at safe distance from, and to avoid collisions with other aircraft.

<sup>86</sup> Op cit., [Submission to the House of Lords inquiry Civilian Use of Drones in the EU](#)

<sup>87</sup> Drone Wars UK, [Off The Leash – The development of autonomous military drones in the UK](#), November 2018

<sup>88</sup> Op cit., [Taking Flight: The Future of Drones in the UK](#), p33

<sup>89</sup> For more info, see: Eurocontrol, [History and future of airborne collision avoidance](#) [accessed 7 February 2019]

<sup>90</sup> Op cit., [Unmanned Aircraft System Operations in UK Airspace – Guidance](#), p77

<sup>91</sup> NATS is the UK’s leading provider of air traffic management services.

possibly be an advantage.<sup>92</sup> However, within the framework of the conventional air traffic management systems the use of transponders is not feasible given the small size of most drones and the potential quantity of drones in the airspace network.<sup>93</sup> A more refined system to manage and coordinate the traffic of low-level flights would therefore be needed in order to ensure the safety of increased small drone operations.<sup>94</sup>

A traffic management system for drones, akin to that used to safely manage airspace in the UK, has been proposed as a way of managing the additional drone airspace traffic. The Government said in its 2016 consultation that it “would be a system of both software and hardware, which ensures drone operations meet existing and future aviation safety standards, taking account of each other and within the existing physical environment.”<sup>95</sup> The Government said it was working with industry and regulatory partners to explore developing an overall national architecture for an unmanned traffic management system (UTM). It added:

The overall national architecture for UTM would ultimately set out how the system will operate, be funded and regulated. This development is currently at a very early stage, so the consultation set out an overview and underlying principles of the UK UTM solution. The financial and organisational aspects of UTM have not yet been considered in detail.<sup>96</sup>

In response to the consultation, the Government said that it “remains convinced that a drone traffic management system will be the best way of replicating and ensuring the high safety standards currently applied to manned aviation. The Government will therefore continue pursuing the development of a drone traffic management system.”<sup>97</sup>

In the 2018 consultation, the Government said that a UTM forms “part of the DfT’s longer term objective to facilitate the management of unmanned aircraft in airspace.”<sup>98</sup>

### European Commission U-space concept

The U-Space notion was introduced by the European Commission in its blueprint for fostering a market for safe, secure and efficient drone operations in Europe.<sup>99</sup> U-Space is specifically:

...a set of new services relying on a high level of digitalisation and automation of functions and specific procedures designed to support safe, efficient and secure access to airspace for large numbers of drones. U-space is an enabling framework

<sup>92</sup> “[How to solve the drone dilemma](#)”, *NATS blog*, 14 July 2016

<sup>93</sup> Op cit., [Civilian Use of Drones in the EU](#), p39

<sup>94</sup> *Ibid.*, p40

<sup>95</sup> For more general information about a possible traffic management system, see: Op cit., [Unlocking the UK’s high tech economy: consultation on the safe use of drones in the UK](#), p46-49

<sup>96</sup> Op cit., [Unlocking the UK’s High Tech Economy: Consultation on the Safe Use of Drones in the – UK Government Response](#), p52

<sup>97</sup> *Ibid.*, p20

<sup>98</sup> Op cit., [Taking Flight: The Future of Drones in the UK](#), p33

<sup>99</sup> Eurocontrol, [Implementation of U-Space Services in the European Union](#), 27 November 2018

designed to facilitate any kind of routine mission, in all classes of airspace and all types of environment - even the most congested - while addressing an appropriate interface with manned aviation and air traffic control.

In support of this initiative, in 2017 the SESAR Joint Undertaking drafted the [U-space blueprint](#), a vision of how to make U-space operationally possible. The blueprint proposes the implementation of four sets of services to support the EU aviation strategy and regulatory framework on drones:

- U1: U-space foundation services covering e-registration, e-identification and geofencing.
- U2: U-space initial services for drone operations management, including flight planning, flight approval, tracking, and interfacing with conventional air traffic control.
- U3: U-space advanced services supporting more complex operations in dense areas such as assistance for conflict detection and automated detect and avoid functionalities.
- U4: U-space full services, offering very high levels of automation, connectivity and digitalisation for both the drone and the U-space system.

EUROCONTROL has since [published a report](#) in November 2018 on the implementation of services for Very Low Level drone operations in the European Union.

For more information about the U-space programme see the [SESAR Joint Undertaking website](#).

## 4.2 Enforcement

The CAA is responsible for ensuring compliance with the ANO, which is primarily concerned with safety and does not include concerns over privacy or broadcast rights.<sup>100</sup>

The enforcement actions of the CAA had in the past been aimed primarily at commercial users of drones. A number of those who gave evidence to the House of Lords 2014 inquiry questioned whether the CAA was the appropriate body in the UK to carry out enforcement of existing legislation against leisure users. Indeed, it was recognised that the CAA had very little statutory authority over the leisure use of drones unless that use breached the ANO. Consequently, the Committee recommended that the police should have a greater role in enforcing existing legislation.<sup>101</sup>

The CAA, the police, DfT and the Home Office have since signed a [memorandum of understanding](#) to ensure that the areas of responsibility for drones are properly defined and understood.<sup>102</sup> The CAA has agreed with the Police that the latter will take the lead in dealing with drone misuse incidents, particularly at public events, that may contravene aviation safety legislation or other relevant criminal legislation.<sup>103</sup> A police working group was also set up to consider how existing legislation for public order or harassment offences could be applied when the offence had been committed using a drone. The

<sup>100</sup> CAA, [Reporting misuse of a drone](#) [accessed 7 February 2019]

<sup>101</sup> Op cit., [Civilian Use of Drones in the EU](#), p48

<sup>102</sup> [HL WPO 7729](#), 27 April 2016

<sup>103</sup> CAA, [Reporting misuse of a drone](#) [accessed 7 February 2019]

result of this was the development of national guidance for enforcement.<sup>104</sup>

As discussed in Section 3.1, the Government have decided to grant additional powers to the police to more effectively enforce the law around drone usage. The powers include allowing the police to request evidence from drone users where there is reasonable suspicion of an offence being committed, as well as enabling the police to issue fixed penalty notices for minor drone offences. The Secretary of State believes that these “new powers will help to ensure effective enforcement of the rules. They will provide an immediate deterrent to those who might misuse drones or attempt to break the law.”<sup>105</sup>

### How many people have been convicted of drone offences?

In the first conviction in the UK for a violation of aviation laws by a drone operator came in 2014 when the CAA prosecuted an individual who lost control of his drone near a nuclear submarine facility.<sup>106</sup>

In response to a [written question in November 2017](#), the then Justice Minister Dominic Raab said that “there were 3 convictions for the illegal usage of drones in England and Wales in 2016.” While the Government’s 2018 consultation noted that “prosecutions have increased”,<sup>107</sup> there has not been an update of this figure for more recent years.

Many of the drone convictions appear to be connected to their use around prison. In response to a [written question in November 2018](#), Justice Minister Rory Stewart said that:

...at least 45 people have been convicted of illicit drone activity, with those sentenced serving a total of more than 140 years in prison. On 26 October, following the largest investigation of its kind, an organised criminal gang of 15 were collectively sentenced to nearly 40 years in prison for using drones to drop drugs into a number of prisons. The ringleader, Lee Anslow, received a sentence of 10 years, the highest single sentence for drone-related activity to date.

A man was recently found guilty on two charges after flying close to a Police helicopter. [In response to this](#), the CAA said that “the case sends a clear message to drone users that unsafe flying is totally unacceptable and that if you break the laws covering drone flying you could go to prison for up to five years.”

Despite these efforts, enforcement is made difficult by the fact that it is not always possible to identify the owner of a drone. The Government have proposed the introduction of a registration scheme from November 2019 requiring all drone users of drones of 250g and above to register themselves, and their drone(s) too.<sup>108</sup> However, it should be noted that licensing might not provide a complete solution to the problem: even if ownership of a drone could be confirmed, the owner might not be the same person as the pilot at the time the offence was committed. To some extent this mirrors the issue with driving offences

<sup>104</sup> NPCC, [Guidance to officers on drones: legislation and dealing with misuse](#), 2015

<sup>105</sup> DfT, [Oral statement to Parliament - Drones: consultation response](#), 7 January 2019

<sup>106</sup> Ibid.

<sup>107</sup> Op cit., [Taking Flight: The Future of Drones in the UK](#), p15

<sup>108</sup> Op cit., [Unlocking the UK's High Tech Economy: Consultation on the Safe Use of Drones in the – UK Government Response](#), p9

such as speeding, where vehicle owners are required by law to give details to the police of the driver of a vehicle at the time an offence is committed.

### 4.3 Privacy

Drones usually carry video cameras to allow the remote pilot to fly them. These may record images and include technologies such as high-power zoom, microphones and a multitude of sensors as well as GPS systems recording the location of persons filmed.<sup>109</sup> A major concern regarding drones is that they could be used to record images of other people without their consent.

The [Data Protection Act 1998](#) (DPA) is the predominant legislation covering personal data protection. It is promoted and enforced by the Information Commissioner's Office (ICO), which can:

...take enforcement action against a person who breaches the DPA by requiring them to change their practice, by imposing fines for unlawfully obtaining or accessing personal data which is a criminal offence under the DPA.<sup>110</sup>

The ICO has [produced guidance](#) for drone users which makes it clear that drones with cameras could pose a privacy risk. In 2015, the ICO updated its [code of practice on surveillance cameras](#) and personal information to include the use of drones on the grounds that they have the potential for 'collateral intrusion' by recording images of individuals unnecessarily.<sup>111</sup>

#### EU data protection legislation

The EU has a framework of privacy and data protection legislation. [The Charter for Fundamental Rights of the EU](#) establishes, in particular, the rights to respect private and family life, home and communications (Article 7) and addresses the protection of personal data (Article 8).<sup>112</sup> These rights are implemented through the [EU Data Protection Directive 95/46/EC](#). The UK [Human Rights Act 1998](#) and the [European Convention on Human Rights](#) also currently apply to the operation of surveillance drones.

The European Commission [published an extensive report](#) in November 2014 looking at the privacy, data protection and ethical risks in civilian drone operations. The European Parliament's Citizens' Rights and Constitutional Affairs Department also [published research](#) in June 2015 looking into EU policy on drones and the potential impacts on citizens' right to privacy and data protection, as well as on security and safety.

Any covert use of a drone by a public authority likely to obtain private information, including by any law enforcement agency, requires authorisation under the [Regulation of Investigatory Powers Act 2000](#) (RIPA). That Act permits covert investigatory techniques to be used only

<sup>109</sup> European Parliamentary Research Service, [Civil drones in the European Union](#), October 2015

<sup>110</sup> Op cit., [Unlocking the UK's high tech economy: consultation on the safe use of drones in the UK](#), p57

<sup>111</sup> ICO, [In the picture: A data protection code of practice for surveillance cameras and personal information](#), 21 March 2015, p27

<sup>112</sup> European RPAS Steering Group, [Roadmap for the integration of civil Remotely-Piloted Aircraft Systems into the European Aviation System](#), June 2013

if they are necessary and proportionate for purposes such as preventing or detecting crime or in the interests of national security.<sup>113</sup> RIPA makes any covert deployment subject to independent oversight, inspection and right to redress in case of individual complaint.

There is not a substantive evidence base to suggest that large numbers of drone users are inadvertently or purposefully breaking privacy and data protection laws, although the “Police do receive reports of drones allegedly being used to breach data protection laws and the privacy of individuals”.<sup>114</sup> The Government’s assumption is that “the large majority of breaches of safety, privacy and data protection laws would happen because some leisure drone users are unaware of the laws that apply.”<sup>115</sup>

There were no major proposals in either of the Government’s recent consultations to deal with privacy concerns. There are laws in place to protect people in these situations, and the broad view is that drones can be dealt with under existing legislation.<sup>116</sup> The House of Lords said that it did “not believe that there should be technology-specific data protection legislation for drones”.<sup>117</sup>

## 4.4 Security

There is the potential for drones to be used for criminal purposes. This has been highlighted, for example, by the use of drones on a number of occasions to convey illicit items into prisons. In response to the use of drones to smuggle certain drugs and other objects into prisons, a new offence was created, making it illegal to land a drone in a prison or to use a drone to drop articles into a prison including certain psychoactive substances.<sup>118</sup>

The maximum penalties for conveying items into and out of prisons depends on the classification of the item. For example, a conviction for conveying controlled drugs is punishable by an unlimited fine or a term of imprisonment not exceeding 10 years or both. Unlawfully causing an article to be projected over or through a boundary of a prison is punishable by an unlimited fine or imprisonment for a term not exceeding two years. As mentioned, as at November 2018 at least 45 people have been convicted of illicit drone activity, with those sentenced serving a total of more than 140 years in prison.<sup>119</sup>

In April 2017, the then Prisons Minister Sam Gyimah announced the launch of Operation Trenton, a specialist team of police and Prison

For more information about counter-terrorism legislation in the UK see the House of Commons Library paper [Counter-Terrorism and Border Security Bill 2017-19](#).

<sup>113</sup> Big Brother Watch, [Unmanned Aerial Vehicles and Unmanned Aerial Systems](#), February 2015

<sup>114</sup> Op cit., [Unlocking the UK's high tech economy: consultation on the safe use of drones in the UK](#), p18

<sup>115</sup> Ibid., p20

<sup>116</sup> Op cit., [Submission to the House of Lords inquiry Civilian Use of Drones in the EU](#)

<sup>117</sup> Op cit., [Civilian Use of Drones in the EU](#), p48

<sup>118</sup> [HC WPO 4266, 19 July 2017](#)

<sup>119</sup> [HC WPO 188007, 12 November 2019](#)

Service investigators, “to work together to intercept drones and track down the criminals behind them.”<sup>120</sup>

Drones may be used in other ways to aid and abet or undertake criminal activity, including terrorist activities. General security and terrorism laws also apply to the use of drones.<sup>121</sup> There is a cross Government counter-drones group whose purpose is to review the risk and explore mitigations.<sup>122</sup>

## 4.5 Insurance and third-party liability

There is ongoing discussion as to whether drone owners should take out insurance, not only to protect their device from damage, but also to protect themselves in case they cause injury, their recording infringes on the privacy of an individual, or someone regards their use of that technology as a form of harassment.<sup>123</sup>

The [EU Regulation 785/2004](#) currently sets out the insurance obligations for all aircraft operators. It requires that commercial drone operators purchase third party liability insurance. The Regulation defines limits for the minimum amount of third party liability insurance required based on the mass of the aircraft on take-off:

- For drones weighing less than 500kg the minimum cover required is approximately €660,000.
- Model aircraft, including drones for leisure use, weighing less than 20kg are not required to have third party liability insurance.<sup>124</sup>

As it stands, the Regulation requires the same minimum amount of third party liability cover for commercial drones weighing 500kg or 1kg, thus is based only on the aircraft’s weight and does not distinguish between the risks posed by large and small drones or the type of operations being undertaken. The House of Lords committee concluded that “the minimum amount of insurance required would ... be too low to cover the cost of compensation for a serious accident”.<sup>125</sup>

A number of commercial drone operators and ancillary businesses noted in their submissions to the House of Lords inquiry the high cost and difficulty of purchasing insurance for third party liability.<sup>126</sup> The reason for this is that there are insufficient precedents set in terms of claims and education to enable underwriters to accurately assess the risks involved in drone operations. The DfT also noted in their 2016 consultation document that:

...the insurance industry is proceeding with caution into the drones sector, due to the lack of data on drones and the potential serious risks they could pose. Some insurers have stopped

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<sup>120</sup> Ministry of Justice press notice, [New squad formed to tackle drone threat to prisons](#), 17 April 2017

<sup>121</sup> Op cit., [Unlocking the UK's high tech economy: consultation on the safe use of drones in the UK](#), p58

<sup>122</sup> Ibid.

<sup>123</sup> See, e.g. [Early Day Motion 784 of 2014-15](#), 10 February 2015

<sup>124</sup> Op cit., [Unmanned Aircraft System Operations in UK Airspace – Guidance](#), p26

<sup>125</sup> Op cit., [Civilian Use of Drones in the EU](#), p5

<sup>126</sup> Ibid, p54

including cover for the use of a drone in larger, all-encompassing policies, such as house insurance.<sup>127</sup>

However, with time, this data will eventually be generated.<sup>128</sup> A Steer Davies Gleave report for the European Commission said that national aviation authorities should improve the data collected on drone operations and accidents and share this information with insurers and operators.<sup>129</sup>

The projected expansion of the drone market and the diversity of potential applications means that there is likely to be significant growth in the need for insurance solutions.<sup>130</sup> Third party liability could be especially prominent, as the greater intensity of use and variety of tasks will mean that drone operations interact with a much greater range and value of third party interests. As the European Commission has said, a key objective will be to:

...find a way to promote the development of an efficient insurance market where fees correspond to the real financial risk estimated on the basis of acquired evidence through incidents and accident reporting.<sup>131</sup>

According to Lloyds, a 'robust regulatory framework' is expected to be crucial to the provision of insurance for drone operations.<sup>132</sup> For example, a regulatory system that relied heavily on responsible behaviour and/or the threat of sanctions could generate significant uncertainty for insurers, owing to the difficulty in monitoring compliance. Possible measures that could assist in the effectiveness and enforcement of regulation, as recommended by Lloyds, include:

- the development of central databases of approved operators;
- the use of serial numbers marked on fire-proof plates to assist in identifying operators after an incident;
- tracking and monitoring technology, incorporated as an integral component of platform design, could provide an effective means to gather evidence of transgressions; and
- geo-fencing technology that could reduce the risk of a drone straying outside a defined area, or into controlled airspace.<sup>133</sup>

In its 2016 consultation document, the Government explored two options to help facilitate the expansion of the drones insurance market:

1. Work with Industry to encourage best practice. The Government already has some engagement with the drone insurance industry, and has recently launched a specific Drones Industry Action Group. Following the consultation, the Government could explore with industry options for

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<sup>127</sup> Op cit., [Unlocking the UK's high tech economy: consultation on the safe use of drones in the UK](#), p30

<sup>128</sup> Marsh & McLennan, [Dawning of the Drones: The Evolving Risk of Unmanned Aerial Systems](#), June 2015

<sup>129</sup> Steer Davies Gleave, [A Study on the Third Party Liability and Insurance of Remotely Piloted Aircraft Systems \(RPAS\)](#), November 2014, p4

<sup>130</sup> Op cit., [Drones Take Flight, Emerging Risk Report](#), p5

<sup>131</sup> Op cit., [Opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner](#), p8

<sup>132</sup> Op cit., [Drones Take Flight, Emerging Risk Report](#), p3

<sup>133</sup> Ibid.

addressing the arising issues and potentially develop an industry agreed and improved standard for drone insurance. Drone operators could then protect themselves by only purchasing drone insurance delivering industry-endorsed standards.

2. Create an Enabling Power in Primary Legislation. Creating an enabling power in primary legislation would allow us to put in place improved insurance requirements on top of the EU requirement, but more tailored to the drone market, following consultation with stakeholders and the public. This proposal is now explored in more detail.<sup>134</sup>

However, the Government opted against pursuing the second proposal as it was clear from the responses that:

...this policy area is not yet developed enough to merit a primary legislation proposal, the Government instead intends to launch with the CAA a 'drone insurance project group' to work together to more comprehensively explore the issues, develop solutions and implement best practice.<sup>135</sup>

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<sup>134</sup> Op cit., [Unlocking the UK's high tech economy: consultation on the safe use of drones in the UK](#), p30

<sup>135</sup> Op cit., [Unlocking the UK's High Tech Economy: Consultation on the Safe Use of Drones in the – UK Government Response](#), p12

## 5. International regulatory and research developments

The EU is nearing the end of its process to reform civilian drone regulation. This work is being completed in parallel with the work completed by the UK Government and deals with many of the same issues around safety, enforcement, privacy and market development, which have been covered in Section 4 of this paper. As such, this section will not go into the detail and rationale of all the EU's proposals. It will instead, with reference to key consultation, policy and legislative documents, focus on the overarching principles of the EU reform, the process of reform and recent developments. Regulatory developments in the United States and among other international agencies are briefly presented at the end of this section.

### 5.1 European Union

#### Why do the EU want to regulate the drones market?

Existing EU aviation rules, set out in [Regulation \(EC\) 216/2008](#) (known as EASA's Basic Regulation), were conceived for large manned aviation and were not adapted to the evolving smaller drones market. Specifically, the common European rules only cover those weighing above 150 kilograms. Below this threshold, individual Member States are responsible for regulation. While many Member States have already adopted drone rules for the smaller drone categories, according to the European Commission ("the Commission" hereafter), "these rules are diverging and cause a fragmentation of the EU internal market", adding that:

Such fragmentation hampers the development of new products and the swift introduction of technologies. Companies – especially SMEs – need legal certainty in order to invest and create jobs. Diverging national rules may also create safety hazards.<sup>136</sup>

The Commission proposed to create an EU-wide framework for drones, abolishing the "obsolete" 150 kilograms threshold, so that the EU is given the competence to regulate drones regardless of their weight. The overarching aim of the reform, as described by the European Parliamentary Research Service (EPRS), is to contribute to:

...fostering growth and jobs, developing the internal market, strengthening Europe's role in global aviation, increasing competitiveness of the European aviation industry and aeronautical manufacturing, and creating a regulatory framework for the integration of new business models and safe integration of unmanned aircraft.<sup>137</sup>

The end goal was to deliver a fully functional drone service market in 2019.<sup>138</sup>

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<sup>136</sup> EC, [The EU Drone Policy – Fact Sheet](#), 29 November 2016

<sup>137</sup> EPRS, [Aviation strategy – Remotely Piloted Aircraft Systems](#), April 2016

<sup>138</sup> EC, [The EU Drone Policy – Fact Sheet](#), 29 November 2016

## Reform process

In 2012, the **Commission** published a staff working document on the civil use of drones and established a steering group to plan and coordinate EU work on civil drones.<sup>139</sup> In 2013, the steering group presented its recommendations in a roadmap that covered all type of drones, except model aircraft and toys.<sup>140</sup> A subsequent Commission Communication, adopted in April 2014, set out plans to create a single market for drones by harmonising airworthiness and operations regulations.<sup>141</sup>

The Transport, Telecommunications and Energy Council, of the **Council of the European Union**, held a policy debate in October 2014 on the future use of civil RPAS in the European aviation market<sup>142</sup> and according to the EPRS:

...most ministers were in favour of a harmonised European approach to civil RPAS while taking into account national experiences. Many of them thought that EASA was best placed to develop technical and safety standards, licences and certificates.<sup>143</sup>

### Riga Declaration

The European aviation community agreed at a conference in Riga on 5-6 March 2015 on the [following principles](#) to guide the drone regulatory framework in Europe:

1. Drones should be treated as new types of aircraft and regulated proportionally to the risk of each operation.
2. Safety rules for drones should be developed urgently at the EU level.
3. Public authorities and the industry should invest in the technologies and standards that are needed to integrate drones into the EU aviation system.
4. Public acceptance of drone services is of key importance. Privacy and the protection of personal data should be guaranteed.
5. The drone operator is responsible for its use. It should be possible to identify him or her (e.g. via ID chip).

In September 2015, the **European Parliament's** Transport and Tourism Committee adopted an own-initiative report on safe use of drones. The report highlighted key issues for drone legislation. It suggested distinguishing between regulations for commercial and leisure use and called for a clear, harmonised and proportionate EU and global framework on a risk-assessed basis. Emphasis was placed on safety, privacy, security and data protection.<sup>144</sup>

<sup>139</sup> EC, [Towards a European strategy for the development of civil applications of Remotely Piloted Aircraft Systems \(RPAS\)](#), SWD(2012) 259 final, 4 September 2012

<sup>140</sup> RPAS Steering Group, [Roadmap for the integration of civil Remotely-Piloted Aircraft Systems into the European Aviation System](#), June 2013

<sup>141</sup> Op cit., [Opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner](#)

<sup>142</sup> Council of the EU, [Transport, Telecommunications and Energy Council](#), 8 October 2014

<sup>143</sup> EPRS, [Civil drones in the European Union](#), October 2015

<sup>144</sup> Committee on Transport and Tourism, [Report on safe use of remotely piloted aircraft systems \(RPAS\), commonly known as unmanned aerial vehicles \(UAVs\), in the field of civil aviation](#), (2014/2243(INI)), 25 September 2015

The **European Aviation Safety Agency (EASA)** was tasked by the Commission to develop a set of European rules for drones.<sup>145</sup> Having initially published a [Concept of Operations for Drones](#) in May 2015, EASA published a [consultation document](#) in July 2015 proposing to regulate all drones at the EU level and to adopt different rules based on their operations and risks and defined the following categories of drones for the purposes of the regulatory reform:

- 'Open' category (low risk): minimal rules, defining limits for operations, to be overseen by the police. Authorisation from a National Aviation Authority (NAA) would not be required, even for commercial operations.
- 'Specific operation' category (medium risk): would need authorisation from a NAA. Each risk would be analysed and mitigated via a safety risk assessment.
- 'Certified' category (higher risk): rules similar to manned aircraft (e.g. pilot's licence and certification required).<sup>146</sup>

EASA's [final proposals](#) were presented in September 2015 and the formal regulatory reform process began in December 2015 when the Commission proposed to create an EU-wide framework for drones as part of its Aviation Strategy.<sup>147</sup> The Commission specifically proposed to abolish the obsolete 150 kilograms threshold, so that the European Union is given the competence to regulate drones regardless of their weight. The Commission also proposed that all drones are covered, even smaller ones, but that the rules be proportionate to the risk.<sup>148</sup> The Commission's proposals only contained basic requirements and principles, with technical rules and standards developed by EASA. EASA subsequently published 'prototype' regulation for to the operation of unmanned aircraft in the 'open' and 'specific' categories in August 2016.<sup>149</sup>

The European Parliament's Committee on Transport and Tourism (TRAN) voted on 10 November 2016 on its report on the updated aviation safety rules, which "constituted Parliament's position for negotiations with the Council on the final wording of the regulation." The Committee also approved a mandate to start these negotiations. TRAN Committee members were generally supportive of the Commission proposal.<sup>150</sup>

On 1 December 2016, the Transport, Telecommunications and Energy Council agreed on a general approach on updated aviation safety rules,

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<sup>145</sup> In 2014, the Commission asked EASA to develop a new regulatory framework for RPAS operations and proposals for rules on low-risk RPAS operations by the end of 2015.

<sup>146</sup> EASA, [Introduction of a regulatory framework for the operation of drones](#), Advance Notice of Proposed Amendment 2015-10, 31 July 2015, Section 3, pp12-31

<sup>147</sup> EC, [Aviation Strategy](#), 7 December 2015

<sup>148</sup> EC, [COM\(2015\) 613 final](#), 7 December 2015; For the impact assessment, see: EC, [Impact Assessment](#), SWD(2015) 262 final, 7 December 2015

<sup>149</sup> EASA, ['Prototype' Commission Regulation on Unmanned Aircraft Operations](#), 22 August 2016; For further detail, see the relevant [explanatory note](#)

<sup>150</sup> EPRS, [New civil aviation safety rules](#), EU Legislation in Progress Briefing, March 2018

thus enabling negotiations with the Parliament to start.<sup>151</sup> According to the EPRS:

The Member States broadly supported adopting EU-wide rules on drones, as well as making rules proportionate and dependent on the risk. They also agreed on the need to strengthen cooperation on security matters related to civil aviation, such as cybersecurity and flights over conflict zones.<sup>152</sup>

EASA published its [Notice of Proposed Amendment 2017-05 \(A\) in May 2017](#), setting out its proposed regulations for small drones, covering both the technical and operational requirements to be fulfilled by drone operators and drone manufacturers. The draft regulation included the timelines required for the transition period until the full implementation of the regulation, as well as high-level requirements for operations in the open and specific category (e.g. requirements for registration, geofencing and electronic identification, competent authorities, the concept of UA zones, and model aircraft).<sup>153</sup> EASA issued the [final proposal](#) for the new regulation (*EASA Opinion No 01/2018*) to the European Commission in February 2018.

The European Parliament [voted on 12 June 2018](#) to approve [the new rules](#). The Council adopted the new rules on 26 June 2018, concluding the legislative procedure at first reading.<sup>154</sup> The [new Regulation \(EU\) 2018/1139](#) entered into force on 11 September 2018 and repeals the Regulation (EU) No. 216/2008 and the Regulation (EU) No. 552/2004. The Commission, with the help of EASA, is working on more detailed rules, including implementing and delegated regulations.<sup>155</sup>

### How will the new regulations apply to the UK?

The Commission, with the help of EASA, is working on more detailed rules, including implementing and delegated regulations. The Regulation states that implementing rules shall be adapted to the new Regulation (EU) 2018/1139 no later than 12 September 2023. Until such time, as the implementing regulations are in place, the regulations in place within the UK will continue to apply.

The UK's existing regulations generally align with those being introduced as part of the new EU regulations, so the practical impact of these reforms is not likely to be significant. This is not surprising considering the CAA's policy experts have played a key role in assisting EASA to develop cross-European rules for drone use.

Whether the EU regulations continue to apply post-Brexit remain to be seen and depend on the outcome of Brexit negotiations. It is the [Government's intention](#) to remain part of the EASA system after exit. If this were eventually to be the case, alignment between UK and EU regulations on aviation safety would be a pre-condition on EASA membership.

<sup>151</sup> Council of the European Union, [Outcomes of proceedings - Transport, Telecommunications and Energy](#), 2 December 2016

<sup>152</sup> EPRS, [New civil aviation safety rules](#), EU Legislation in Progress Briefing, March 2018

<sup>153</sup> EASA, [Notice of Proposed Amendment 2017-05 \(A\): Introduction of a regulatory framework for the operation of drones](#), RMT.0230, 5 May 2017, p7

<sup>154</sup> Full information about the EU legislative procedure is available on the [European Parliament website](#).

<sup>155</sup> EU Parliament, [Drones: new rules for safer skies across Europe](#), 7 June 2018

## 5.2 Unites States

Other countries outside the EU are also preparing rules on drones. For example, in February 2015, the US Federal Aviation Administration (FAA) presented draft rules on small drones (under 25 kg) conducting non-leisure and non-governmental operations. These rules would limit flights to daylight and to the operator's visual line of sight, and address height and operational restrictions, operator certification and aircraft registration. Flights over people and in airport flight paths would be forbidden. These new rules came into effect in August 2016.<sup>156</sup>

### NASA

NASA has established a UAS Traffic Management programme, which is researching prototype technologies to help develop airspace integration requirements for enabling safe, efficient, low-altitude operations.<sup>157</sup>

NASA is also working on developing a website which will allow drone pilots to reserve blocks of airspace for flights. This came off the back of its first [work from 2004 to 2006](#) which assessed the capabilities of drones for civil use.

In April 2016, in the first demonstration of its kind, NASA and operators from the FAA flew 22 drones simultaneously to assess rural operations of NASA's UAS traffic management research platform.<sup>158</sup>

In the US, drone operators have to notify air traffic control in advance if they plan to fly their devices within 8km of an airport. All drones, regardless of use, have to be registered. The transportation department has authorised pilot programmes for commercial drone uses in several states including for package deliveries. For more information about drone regulations in the United States, see the [FAA website](#).

## 5.3 Other international developments

Global rules covering unmanned aircraft were established by the 1944 [Convention on International Civil Aviation \(the Chicago Convention\)](#). It set out some basic rules including that all drones regardless of size are prohibited from flying over another state's territory without its permission. The administration and governance of the Chicago Convention is managed by the [International Civil Aviation Organization](#) (ICAO).

International standards to regulate certain aspects of drone operations are currently being considered by ICAO. It set up an Unmanned Aircraft Systems Study Group (UASSG) in 2007, which brought together experts from Member States, stakeholder groups and industry, to discuss the impact of drones on aviation regulation. In 2011 the ICAO issued its circular *Unmanned Aircraft Systems* (CIR328).<sup>159</sup> In November 2014, in

Further information on international regulatory developments can be found in the Law Library of Congress paper [Regulation of Drones](#) and on the [JARUS website](#).

<sup>156</sup> FAA press notice, "[DOT and FAA Propose New Rules for Small Unmanned Aircraft Systems](#)", 15 February 2015 and FAA, [Unmanned Aircraft Systems](#) [accessed 12 October 2016]

<sup>157</sup> "[The robot overhead](#)", *The Economist*, 6 December 2014

<sup>158</sup> NASA press notice, "[NASA Marks Success for Most Complex Drone Traffic Management Test Yet at FAA Test Sites](#)", 21 April 2016

<sup>159</sup> ICAO, [Unmanned Aircraft Systems](#) (CIR328), 2011

response to the rapid developments in drone technology, the UASSG was elevated to the status of a Panel, and it aims to publish Standards and Recommended Practices (SARPs) on unmanned aircraft by 2018.<sup>160</sup>

Besides ICAO, several countries are working together within [JARUS \(Joint Authorities for the Rulemaking of Unmanned Systems\)](#), which is a voluntary membership body comprising national civil aviation authorities from EU and non-EU countries and regional organisations. It has the aim of producing a single set of technical, safety and operational requirements for drones.

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<sup>160</sup> Op cit., [Civilian Use of Drones in the EU](#), p15

## 6. Drones as a disruptive technology

A PwC report published in May 2016 revealed that the commercialisation of drone usage could lead to disruption in \$127bn worth of traditional industries, while global spending on the production of drones — for both military and commercial use — will reach \$93bn in the next 10 years.<sup>161</sup> The industry with the best prospects for drone applications is infrastructure, with a total addressable value of just over \$45bn:<sup>162</sup>

### Value of drone powered solutions addressable industries (US\$b)

Global view (2015)	
Infrastructure	45.2
Transport and logistics	13.0
Insurance	6.8
Media	8.8
Telecommunication	6.3
Agriculture	32.4
Security	10.5
Mining	4.3
<b>Total</b>	<b>127.3</b>

Adapted from: PWC, [Clarity from above](#), May 2016

In May 2018, PwC published a report that revealed that the social and economic benefits of drones in the UK by 2030 could be as much as £16bn in net cost savings, adding £42bn to GDP, with over 600,000 drone sector jobs. PwC also project that there will be more than 76,000 drones flying over the UK, split across several different industries.<sup>163</sup>

### Estimated number of drones in UK skies in 2030, by sector

Sector	No of jobs
Public and Defence, Health, Education and other services	27,521
Agriculture, Mining, Gas and Electricity	25,732
Transport and Logistics	11,008
Construction and Manufacturing	4,816
Technology, Media and Telecommunications	4,541
Financial, Insurance, Professional and Administrative Services	2,514

<sup>161</sup> PwC, [Clarity from above – PWC global report on the commercial applications of drone technology](#), May 2016; and Teal Group press notice, "[UAV Production Will Total \\$93 Billion](#)", 19 August 2015

<sup>162</sup> Ibid., p4; values presented in this table correspond with the 2015 value of businesses and labour in each industry that may be replaced by drone-powered solutions

<sup>163</sup> PwC, [Skies without limits – Drones taking the UK's economy to new heights](#), May 2018

<b>UK-wide</b>	<b>76,233</b>
<b>Adapted from: PWC, <a href="#">Skies without limits – Drones taking the UK's economy to new heights</a>, May 2018</b>	

The section below provides a brief snapshot into how drones are currently used and how they might be used in the future in a selection of industries. The PwC reports, as well as a [November 2016 report](#) published by the EU's SESAR Joint Undertaking, should be used for more comprehensive discussion of the potential of drones to disrupt existing industries and to stimulate economic growth.

## 6.1 Construction and infrastructure

Drone technology as applied in the infrastructure sector is only in its infancy but, according to PwC, it is 'here to stay', with key applications including investment monitoring, maintenance and asset inventory.<sup>164</sup>

For example, during the pre-construction phase drones may be able to significantly improve the speed and quality of the design process by providing better field data. This is because they are able to capture high-resolution videos and images, enabling 3D modelling and providing data about a site's initial status for investors and property owners before work begins.<sup>165</sup>

Additionally, in the construction phase, drones can be utilised in a number of areas such as:

- Undertaking quick surveys of sites and gathering precise data for progress reports;
- performing precise work such as positioning steel slabs in concrete or measuring the depth of pipelines, preventing costly and dangerous construction errors; and/or
- increasing safety by performing hazardous work, and by monitoring construction areas for possible sources of risk and accidents.<sup>166</sup>

Construction giant Bechtel was one of the first to use drone technology in construction. In 2013 it teamed with Skycatch to prove the technology's viability at one of the largest liquefied natural gas projects in Australia. Bechtel used the technology to do things like collect real-time environmental data (e.g., air quality, temperature, etc.), survey difficult and inaccessible terrain, and track real-time construction progress.<sup>167</sup> According to a July 2016 paper by Colin Snow of Skylogic Research:

<sup>164</sup> Op cit., [Clarity from above – PWC global report on the commercial applications of drone technology](#), p5

<sup>165</sup> "The Construction Industry Is in Love with Drones", *Fortune*, 13 September 2016

<sup>166</sup> Op cit., [Clarity from above – PWC global report on the commercial applications of drone technology](#), p5

<sup>167</sup> Skylogic Research for BZ Media, [The Truth about Drones in Construction and Infrastructure Inspection](#), July 2016, p2

... hundreds of firms across the globe have put in place proof-of-concept projects for drones – not just for construction but also for civil infrastructure and asset management purposes.<sup>168</sup>

Network Rail, in its evidence to the House of Lords committee, noted that it was piloting the use of drones for surveillance of railway infrastructure, because it improved workforce safety “by enabling such surveys to be carried out from a position of safety”.<sup>169</sup>

## 6.2 Logistics

The logistics sector is at the forefront of drone disruption. Unmanned drones have been touted for commercial package delivery. This potentially offers several advantages such as speed (since they are not constrained by road infrastructure and congestion, they can deliver packages faster than a car or truck from a nearby storage location) and relief for inner cities, taking traffic off the roads and reducing congestion.<sup>170</sup>

Various delivery providers are testing drone delivery technologies. Amazon has developed nearly a dozen aircraft as part of its [Prime Air drone project](#) and plans to develop a family of delivery drones to suit different environments. Google is testing drones that could deliver small packages in less than 30 minutes and has announced it will launch its drone delivery service in 2017.<sup>171</sup> DHL recently successfully trialled the integration of its ‘DHL Parcelcopter’ into its delivery chain.<sup>172</sup>

While drones certainly offer several advantages compared with more traditional delivery methods, limitations still lie ahead for the commercial drone delivery market. In particular, drones currently have small shipping capacity and global-positioning system data can be inaccurate, affecting package drop-offs.<sup>173</sup>

While airborne drones are ideal for deliveries in remote areas with poor transport infrastructure, most people live in dense urban areas where safe take-off and landing is likely to be far more difficult.

Additionally, commercial drones currently have to be operated within line of sight of the operator, which obviously limits their operational distance.<sup>174</sup> NATS suggest that remote command and control (including a navigational data link between the ground and the drone) of light

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<sup>168</sup> Ibid., p2

<sup>169</sup> Network Rail, [Submission to the House of Lords inquiry Civilian Use of Drones in the EU](#), 15 October 2014

<sup>170</sup> Stanford Graduate School of Business, [Technological disruption and innovation in last-mile delivery](#), June 2016

<sup>171</sup> [“Google follows Amazon into the sky with drone delivery tests”](#), *Daily Telegraph*, 3 August 2016

<sup>172</sup> DHL press notice, [“Successful Trial Integration of DHL Parcelcopter into Logistics Chain”](#), 5 September 2016

<sup>173</sup> Op cit., [Technological disruption and innovation in last-mile delivery](#)

<sup>174</sup> [“Amazon delivery drones – pie in the sky or a realistic future?”](#), *NATS blog*, 10 December 2013

weight drones is certainly achievable.<sup>175</sup> However, the technology is in development and there is “no operational solution ready for market”.<sup>176</sup>

An eventual operational solution would need to achieve ‘equivalence’ such that a drone is capable of matching the capabilities of a manned operation. An on-board pilot is able to ‘detect and avoid’ any other traffic in the vicinity.<sup>177</sup> Any delivery drone would therefore need to be capable of doing the same. If a number of drone deliveries were scheduled for a similar time in one area, a system to co-ordinate the traffic of small drones in the airspace would be needed.<sup>178</sup>

### 6.3 Civil and freight aviation

Growth in the market for large drones has been slow and is almost entirely the preserve of the military.<sup>179</sup> Drones will certainly have a role to play in the mainstream aviation industry going forward – though the extent of that role is unknown, particularly given that the integration of large drones is very much in the testing phase of development.

There is considerable potential in the cargo sector.<sup>180</sup> Whilst drone testing has so far been limited to relatively small payloads, it seems likely that this will change as UAV technology continues to develop, with constant improvements in flight time, range and payload. Several in-service military drones are already capable of lifting up to one tonne, so larger payloads are sure to be accessible to civilian UAV’s as they are developed with this specifically in mind.<sup>181</sup>

Perhaps more importantly, drones could have the potential to provide access to remote areas where surface and air infrastructure either doesn’t exist, or is unusable due to weather conditions or natural disasters. They could also provide a viable option in dangerous areas, such as conflict zones, where human operators may have traditionally been at risk.<sup>182</sup>

However, with regard to large passenger-carrying drones, there is likely to be “inevitable resistance” from the public to flying on a machine where “the person who holds their life in their hands does not actually sit alongside them”.<sup>183</sup> Additionally, there would also be little financial incentive to produce a remotely piloted passenger-carrying aircraft

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<sup>175</sup> Ibid.

<sup>176</sup> “[Game of drones – what now for drone development in the UK?](#)”, *NATS blog*, 21 October 2015

<sup>177</sup> This is a generic expression used to reflect a technical capability commensurate with a pilot’s ability to ‘see and avoid’ other air traffic and other hazards/objects

<sup>178</sup> Op cit., [Civilian Use of Drones in the EU](#), p36

<sup>179</sup> Op cit., [One ‘near miss’ too many? Drone safety issues and possible solutions: an airspace user view](#); in both the United States Air Force and the Royal Air Force qualified pilots and weapons specialists are further trained to operate RPAS – the work station for the operator is very similar to a flight deck

<sup>180</sup> For more information, see: [The Platform for Unmanned Cargo Aircraft](#) [accessed 13 October 2016]

<sup>181</sup> Chapman Freeborn, [Autonomous freight drones: a revolution in air cargo?](#), 6 June 2014

<sup>182</sup> Op cit., [Clarity from above – PWC global report on the commercial applications of drone technology](#)

<sup>183</sup> BALPA, [Supplementary written submission to the House of Lords inquiry Civilian Use of Drones in the EU](#), 9 December 2014

because it would still require life support infrastructure for passengers and cabin crew, in addition to the extra expense of building a secure ground base station for the pilots.

### Integration of large drones – UK initiatives

Several UK aerospace companies are working with the Government to develop and certify 'detect and avoid' technology for large drones. In April 2013, the £62m Autonomous Systems Technology Related Airborne Evaluation and Assessment ([ASTRAEA](#)) project trialled a system which saw a BAE Systems Jetstream complete a 500-mile trip from Warton, Lancashire to Inverness. This was flown by a ground-based pilot and trialled a cloud-sensing electronic eye, as well as a visual sense and avoid system. It also had two safety pilots on board.

In October 2015, the longer-term integration of larger drones alongside civilian aircraft was successfully tested as part of [SESAR](#)-sponsored Project CLAIRES.<sup>184</sup> This was concerned with identifying the procedures and processes to be applied to enable drone operations in controlled airspace, using the [Thales Watchkeeper](#).

In addition to these larger, publicly-led projects, a number of private companies across the UK are developing their skills in drone development, testing and deployment.<sup>185</sup>

## 6.4 Agriculture

For workers in the agricultural industry, huge amounts of time is spent venturing the land, checking the quality and ripeness of crops, the security of fences and walls, water-levels, and more. According to analysis by *Forbes*, the industry is on the brink of becoming one of the first to embrace drone technology. Agriculture is one of the commercial applications that has the immediate potential to become a multi-billion-dollar drone industry.<sup>186</sup> PWC, in their analysis, identified increasing food demand, underpinned by population growth, as being a driving force behind innovation in the sector, to ensure food production is more sustainable and efficient.<sup>187</sup>

Drone technology potentially offers crop monitoring possibilities at a lower cost. Drones can also be integrated at every stage of the crop lifecycle, from soil analysis and seed planting to choosing the right moment for harvesting. PWC conclude:

Drones will allow farming to become a highly data-driven industry, which eventually will lead to an increase in productivity and yields. Due to their ease of use and low cost, drones can be used for producing time series animations showing the precise development of a crop. Such analysis could reveal production inefficiencies and lead to better crop management. With those possibilities in mind, it can be assumed that this technology will

<sup>184</sup> NATS press notice, "[Unmanned aircraft flies in UK civil airspace](#)", 15 October 2015; and "[Emerging challenges](#)", *NATS blog*, 9 March 2016

<sup>185</sup> e.g. smaller companies like [VTOL](#) and [BlueBear](#); larger companies like [BAE](#) and [Rockwell Collins](#); and universities like [Cranfield](#) and [Southampton](#); see: "[Drones... what could be the future?](#)", *Innovate UK blog*, 7 July 2016

<sup>186</sup> "[Drone Disruption: The Stakes, The Players, And The Opportunities](#)", *Forbes*, 23 March 2016

<sup>187</sup> Op cit., [Clarity from above – PWC global report on the commercial applications of drone technology](#), p16

transform agriculture into a high-tech industry for the first time, with decisions being based on real gathering and processing of data.<sup>188</sup>

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<sup>188</sup> Ibid., p17

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