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UK Commercial Drone Industry

Professional, responsible and
considerate drone use

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Executive summary

Drawing on research with members of the UK drone industry, this report shares **industry voices and perspectives on professional, responsible and considerate commercial drone use**, and the **challenges and barriers presently facing the UK commercial drone sector**. This report is accompanied by an **industry toolkit**, sharing best practice for members of the commercial drone industry.¹ This report is designed for members of the commercial drone industry, and is also relevant for wider decision-makers and stakeholders, including regulators, policy-makers, special interest groups, and local authorities. Key findings include:

Current use cases and benefits: Commercial drone use spans a growing range of sectors and is primarily associated with two core applications: Aerial imagery, video and sensor data capture, and the transport and carriage of goods. Drones are associated with a range of benefits, including: the capture of data enabling information provision and informing decision making; increasing the speed of data capture; enabling repeat data collection; increasing operational safety; improving access, connection and/or convenience; offering environmental benefits; and potential cost-savings.

Impacts of drones on communities and environments: Drones variously impact communities and environments. While drones offer a range of benefits, they can also prompt concerns from members of the public around privacy, safety, and noise disruption. Participant members of the drone industry encouraged consideration of these concerns, as well as engagement with local communities in areas of drone flight. Drones can also impact wildlife in a range of ways. Participants suggested that considering the choice and size of drone and flight pattern can reduce potential impacts. While highlighting that drones can reduce carbon emissions, participants urged further consideration of their wider environmental impacts. Participants highlighted that commercial drone use both impacts and is impacted by other airspace users, including manned aviation.

Professional, responsible and considerate commercial drone best practice: Participant members of the drone industry stressed the importance of awareness and adherence to applicable regulation, as well as proactive flight planning and risk assessment. They urged considering and engaging with local communities and stakeholders in the area of flight, detailing a range of potential approaches. Participants advised additional measures where subcontracted pilots are used, as well as the careful maintenance of equipment. Participants stressed the importance of being visible, both digitally (e.g. flight planning apps) and physically (e.g. high vis). They also encouraged thinking like an aviator and the value of lessons learned from manned aviation.

Challenges and barriers facing the UK drone industry: A range of challenges and barriers were identified. During flight planning these included: landowner identification, navigating blanket bans and local byelaws, processes for notifying local police about drone flights, and navigating the roll out of geofencing. Participants also raised issues around UK drone regulation, including: difficulties and (cost incurring) delays associated with regulatory approvals to fly, lengthy response times, changes to assessors, frustrations around changes to and the scope of qualification requirements, and Beyond Visual Line of Sight (BVLOS) regulations remaining in their infancy (impacting scalability). Concerns were expressed that innovation was potentially being stifled and talent lost to other countries. Participants also raised concerns about other airspace users, both with regard to ongoing barriers around electronic conspicuity and in relation to tensions with the General Aviation community. Participants encouraged further dialogue between different airspace users.

Ambitions and desires for commercial drones in the future: Participant ambitions and desires included: visibility of all aircraft and adopting electronic conspicuity to enable scaling, and the development and normalisation of business as usual drone operations and routine BVLOS flight. They described the need for more opportunities to test and validate operations, as well as desires for more R&D resourcing, the automation of aspects of air traffic control, seeing more women in the sector, and greater engagement with local communities and stakeholders as drone innovation progresses. While recognising legal and social challenges, participants expressed desires for a shift from one-person-to-one-drone to one-person-to-multiple-aircraft in the future.

UK Commercial Drone Industry: Professional, responsible and considerate drone use

Overview

- Drone use continues to grow across UK skies.
- Drones enable the capture of aerial imagery and data, and the carrying and transport of items and goods, and are used across diverse use cases, applications and sectors.
- Drones can enable and afford various data gathering, safety, access, connection, environmental, economic and cost-saving benefits.
- From privacy and safety concerns, to noise, visual and wildlife disruption, drones can also negatively impact local communities and environments.
- Members of the UK drone industry highlight professional, responsible and considerate commercial best practice, including understanding regulation, thorough risk assessment and flight planning, engaging local communities, and thinking like an aviator.
- While a 2022 Government ambition statement outlines a vision that by 2030 commercial drones will be commonplace, a range of challenges and barriers continue to impact the industry. These include flight preparation (e.g. landowner identification, byelaws), regulatory challenges (e.g. approvals to fly, limitations to Beyond Visual Line of Sight flight), and other airspace users (e.g. regarding electronic conspicuity).
- **Members of the UK drone industry** expressed ambitions and desires for commercial drone use in the future, including business as usual drone applications and routine Beyond Visual Line of Sight (BVLOS), greater resourcing (e.g. R&D and testing), and increasing automation (e.g. 'one-person-to-multiple-aircraft').

1. Introduction

Drone use continues to grow across UK skies. In January 2023 the UK's aviation regulator, the Civil Aviation Authority, stated that it has 500,000 drone 'operators and flyers' registered under its Drone and Model Aircraft scheme, processes 7,000 operational authorisation applications per year, and that the total number of drone pilots and aircraft are already '80% larger than the General Aviation and commercial air sector added up'.² Drones enable the capture of aerial imagery and data, as well as the carrying and transport of items or goods.

The UK's drone sector is growing, with drones used for inspection, monitoring, surveillance, and carrying and transport roles across diverse sectors, from agriculture to oil and gas, construction to local administration and emergency service.³ Commercial drones are praised as enabling the carrying out of 'tasks faster, safer, cheaper and with less impact on the environment than traditional methods'.⁴ To this end, a 2022 report by the Department for Business, Energy & Industrial Strategy and the Department for Transport outlines a vision 'that by 2030 commercial drones will be commonplace in the UK in a way that safely benefits the economy and wider society'.⁵ This echoes wider forecasting around the 'potential for drones to positively impact the UK economy', with a 2022 report by PricewaterhouseCoopers (PwC) estimating that by 2030, 'drones could contribute up to £45bn to the UK economy; more than 900,000 drones could operate in UK skies; £22bn in net cost savings may be realised; carbon emissions could be reduced by 2.4M tons; and 650,000 jobs may be associated with an economy that fully adopts drones'.⁶ However, the report continues that while commercial drones can be associated with a range of benefits and opportunities, so too do there remain a range of 'challenges' to be addressed – from public perception and regulation, to technology and implementation – in order to 'realise' these benefits.⁷

2. Methodology

This report draws on engagement with members of the UK drone industry to explore professional, responsible and considerate drone use, and the challenges and barriers presently facing the UK commercial drone sector. This report was produced by Dr Anna Jackman as part of the Economic and Social Research Council funded 'Diversifying Drone Stories' research project (ES/W001977/1), and was developed in partnership with The Association of Remotely Piloted Aircraft Systems UK (ARPAS-UK), the not-for-profit trade association for the UK drone industry. Exploring the use, perception, and impact of drones in changing UK airspace, the 'Diversifying Drone Stories' project more widely engaged with diverse stakeholders (including industry, emergency services, lawyers, pilots, air traffic controllers, local authorities, and members of the public) to examine and understand different uses, experiences and perspectives on drones in UK skies. Further information about the project can be found on the Drone Stories webpage.⁸

This report recognises the value of sharing industry experiences, expertise and best practice. It draws on engagement with members of the UK drone industry, including three online focus groups, each 2 hours in duration, and involving a total of 21 participants. The focus groups explored current use cases and benefits of commercial drones, the impacts of commercial drones on communities and environments; professional, responsible and considerate commercial drone best practice; challenges and barriers facing the UK commercial drone industry, and ambitions and desires for commercial drones in the future. This report is accompanied by an industry toolkit, designed to share best practice with and for members of the commercial drone industry.⁹

3. Current uses and benefits

Commercial drone use spans a growing range of sectors, from construction to agriculture and logistics to utilities, and is primarily associated with two core applications:

Aerial imagery, video and sensor data capture

- Drones collect aerial image and video data, can be equipped with sensors (e.g. thermal, multispectral, hyperspectral, lidar) to collect sensor data, and can be paired with software to enable different forms of mapping and survey (e.g. photogrammetry)
- Drones undertake inspection and survey (e.g. of assets and stock, sites and facilities)
- Drones undertake surveillance (e.g. critical infrastructure, security)
- Drones undertake monitoring (e.g. environmental – including emissions).

Transport and carriage of goods

- Drones are not solely data capturing devices and are also deployed to move, carry, drop and disperse items or goods.
- Drones undertake delivery (e.g. middle mile and last mile logistics, medical goods/matter)
- Drones conduct dispersal applications (e.g. aerial spraying).

While understanding the drone as one 'tool for a job' and emphasising the need to consider its suitability for a given operation,¹⁰ participants highlighted the following **benefits of drone use**:

- Drone data capture and processing affords situational awareness and **enables information provision** (e.g. image, video, sensor data) to inform decision making (e.g. resource or asset management) and/or the creation of digital assets (e.g. 3D twin)
- Drones can increase the **speed of data capture** when compared to other modes of remote sensing, and enable repeat data collection (e.g. monitoring progress or change over time)
- Drones can **increase operational safety** (e.g. reducing workers at height, reducing entry to dangerous sites or increasing understanding of site before entry), support lifesaving (e.g. emergency service response), and contribute to the safe running of the UK's 'ageing infrastructure' via monitoring

- Drones can increase and/or **improve access, connection** and/or **convenience** in remote or congested areas (e.g. delivery) and can ‘reduce health inequalities’ through improving health connectivity and ‘medical response and delivery times’¹¹
- Drones can offer **environmental benefits** (e.g. reduction of carbon emissions, reduction of scaffolding, potential reduction of traditional vehicles and emissions)
- Drones can be associated with **cost-saving**, through enabling pre-emptive surveys (e.g. of buildings, structures, assets) and when compared with other methods of aerial imaging or remote sensing.

Current rules

The UK’s aviation regulator, the Civil Aviation Authority, details relevant regulation applying to drone flight in the UK. Rules around drone flight are ‘based on the risk of the flight – where you fly, the proximity to other people, and the size and weight of your drone’.¹² UK drone rules are based around three categories (the open category, specific category, and certified category). The Open category is ‘intended for low-risk drone flights’, the Specific Category is for ‘higher risk flights’ and requires ‘an operating approval’, and the Certified Category ‘is for large drones which have to meet specific safety certifications along the lines of aircraft’.¹³ There is ‘no distinction between flying commercially and flying for pleasure or recreation’, i.e. this means that an ‘approval just to operate commercially is not required’, though ‘all commercial drone flights require valid insurance cover’.¹⁴ It should be noted that in August 2023 the Civil Aviation Authority launched a call for input into its review of UK drone regulations.¹⁵ The review sought feedback on wide-ranging issues, including ‘operational categories’ (e.g. current ‘exclusions for users of UAS [drones] weighing below 250g’), and ‘standards adoption’.

Useful resources

- Civil Aviation Authority: Drones [\[link\]](#)
- The Drone and Model Aircraft Code [\[link\]](#)
- CAP722 Unmanned Aircraft System Operation in UK Airspace – Guidance [\[link\]](#)
- CAP2569 Call for input: Review of UK UAS Regulations [\[link\]](#)

4. Impacts of drones on communities and environments

Drones can both positively and negatively impact local communities and environments. In discussion of the impacts of drones on communities and wildlife, participating members of the UK drone industry highlighted the following: public perception (including reactions from members of the public, and concerns about privacy, safety and noise), potential disruptions to wildlife, environmental impacts, and the experiences of other airspace users.

Public perception and engagement

Privacy and safety: Participants highlighted ‘privacy’ and ‘safety’ as dominant concerns expressed by members of the public. In discussion of perceptions of ‘drones violating privacy’, participants described several encounters where they were ‘challenged’ by members of the public who were concerned about ‘what’ they were ‘taking a picture of’ or whether they could see inside homes or bathrooms, while underscoring the importance of clear communication (see Professional, responsible and considerate drone use). Research into the UK general public’s perception of drones echoes this, with surveys highlighting concerns around the ‘privacy implications’ and potential ‘intrusion’ of drones in relation to accessing ‘and potentially recording’ both personal data and data in ‘personal spaces’ such as ‘private property’.¹⁶

Drone noise: Participants highlighted noise and the ‘amount of sound’ that drones can generate as an impact requiring further attention as drone use grows and ‘the UK market’ is ‘opened’ and scaled. Participants shared different views on the potential significance of drone noise. Some participants viewed drone noise as a ‘problem that won’t go away’ but that can be ‘mitigated as much as possible’ (e.g. through the choice of drone flown, through route and altitude), some understood drone noise as a ‘challenge’ for ‘engineers’ who have demonstrated the ability to ‘make

aircraft much quieter', while others cautioned that to a certain extent 'we're guessing what the public will think because' drones have not been flown 'in volume' with enough frequency to determine their effects. While noting the 'range of opinion among stakeholders with respect to the degree of nuisance that drone noise represents now and in the future', in its 2021 report on the regulation of drones in the UK, the Regulatory Horizons Council noted that 'the noise problem has not yet loomed large, noise is universally disliked, and it cannot be assumed that this will not be an issue in public acceptance'.¹⁷

Participants also highlighted that the geographical context of the flight, i.e. whether in urban or rural environments was likely to be important. One participant suggested that drone flights in urban areas may 'become part of the background noise' and may be 'more acceptable'. One participant described 'sending a drone up' on a London street and surprising an onlooker who had expressed a concern that 'drones can be noisy' and who quickly could not hear the drone. In contrast, in discussion of drone operations in rural environments, participants expressed that given the comparatively quieter background levels of noise, they felt as if 'everybody knows about' drone flights in such areas. Here, a participant described working with 'private land owners' who expressed concerns that paying members of the public wouldn't 'want drones flying over the site because they disturb people' and disrupt the site's 'tranquillity'. Research into the public perception of future flight technologies including drones has found that participants 'living near a busy road' were concerned 'that the visual and aural disruption' that they experience 'at ground level would be duplicated in the air above their homes', while those living 'in less built-up areas' were concerned that 'the peacefulness of green spaces' may 'be spoilt by the sights and sounds' of such technology.¹⁸

Public priorities

Participants were also eager to highlight both the wide-ranging reactions and responses their drone operations received from members of the public (including 'curiosity', 'interest and fascination'), as well as the 'beneficial impacts' of drones, from 'bringing new jobs' to enabling new forms of 'connection' and 'access' (see Current uses and benefits). Participants again raised geographical context, highlighting that while the potential impacts of drone noise may be more acute in rural locations, so too may the benefits be more 'obvious', from 'medical delivery to postal delivery and search and rescue'.

Participants also repeatedly expressed the need to share and 'sell' the benefits of drones with members of the public, underscoring the importance of 'proving our benefit'. Some participants suggested prioritising and promoting use cases with 'obvious societal benefits', such as medical applications (e.g. 'health service trials') and emergency services. They continued that this would assist in forging a 'societal vision of benefit' as a 'first step piece' in a wider debate around drone use. Another participant added that applications for 'social good' are the use cases 'that people are more comfortable with' at present. This is echoed in wider research on the public perception of drones in the UK, with a 2021 survey led by BT finding that 'the public is most positive about the impact drones can have on society for the greater good' and that the 'public are generally accepting of drone usage for wider societal benefit, but are more wary of usage for purely commercial purposes'.¹⁹ A 2022 Future Flight Challenge mini public dialogue exploring 'future flight technologies' including drones found that 'justifiable applications' included 'those that are seen to bring about significant public good', such as emergency service response, while also identifying a 'distinct difference between marginal improvements to convenience' and 'significant improvements that improve quality of life for members of the public'.²⁰ To this end, the public dialogue identified 'key benefits that were seen as justifiable significant improvements' as inclusive of 'surveying and maintaining infrastructure in risky or remote environments, and connecting island or remote communities', while identifying 'individual drone delivery services' as the 'most likely' to 'lead to busy skies' and cause 'logistical and regulatory issues'.²¹

Several participants also stressed the importance of further engagement with the public moving forward. In discussion of Beyond Visual Line of Sight (BVLOS) flight, one participant gave the example of 'needing' engagement with both 'land owners' and members of 'the public', who may be 'customers' and/or 'stakeholders' in the 'section of airspace we're trying to cover'. They described wanting to 'bring people along with us', while also stressing the importance of 'public engagement to bring that positive spin' both practically (because drones 'are going to need to fly from somewhere, land somewhere' and all this 'needs somebody to sign off') and commercially (as 'if they turn negative to it' it may 'kill' a 'fledging industry'). Collectively, participants felt that public perception, engagement and acceptance were 'massive drivers in the commercial piece'.

Potential disruptions to wildlife

Drones can disturb wildlife. Research demonstrates that the impacts of drones on animals vary along several lines, from the type of animal (e.g. birds are more likely impacted, as are animals with 'high hearing capabilities') and response type (e.g. from curiosity, vigilance and alert, to alarm, fleeing responses and even aggressive behaviour), to the drone's attributes and flight characteristics (e.g. size, noise, flight pattern).²²

In discussion of wildlife, participants described a range of encounters and mitigations. Noting that seagulls 'do not like drones', one participant described 'planning' around 'seagull activity', for example avoiding flying when 'seagulls are nesting'. They continued that they had learned that seagulls reacted more to 'bigger drones' so flew 'smaller drones for [their] inspections'. They added that they had experimented with an additional drone ('something like a Mavic Enterprise') to try and 'distract' the seagulls, so that they would 'look at that, to distract them from the actual job'. Others added that while 'seagulls show an interest', other birds such as oyster catchers can 'actually swoop' at and/or 'physically try to attack' the drones, while others described having drones 'taken out of the sky' by 'swarms of pigeons'. Several participants advised considering both 'avian activity' (e.g. 'nesting periods') and the platform and flight pattern (e.g. choice of drone, avoiding flying too low) in order to reduce both 'drones disturbing birds' and 'wildlife affecting drone operations'.

One participant also described a confrontation with 'members of the horse riding community' in a rural environment, who were 'concerned over the noise that a drone was making'. Adding context around low flying military aircraft causing injuries (e.g. causing a horse to bolt and the rider to be thrown), the participant suggested that concerns around disruption vary by community and that 'the risk and impact is dependent on point of view'.

Environmental impacts

Participants stated as many drones are 'electric', they are associated with reduced 'carbon emissions' and can be understood as 'better for the environment'. Drone use and a 'shift to the skies' has also been promoted by the UK Government as both 'alleviating pressure on ground level networks, reducing congestion, helping the country towards its net zero targets' and causing 'less impact on the environment than traditional methods'.²³ However, research on delivery drones has also 'cautioned' that while drones 'could reduce' CO₂ emissions and those of 'other air pollutants', there remains a need for further analysis of the 'broader systemic effects along the logistics chain', such as 'emissions relating to extra warehousing', the 'life cycle of batteries' and the 'potential environmental risks' of any 'debris resulting from collisions and dropped cargo'.²⁴ In this vein, one participant urged further consideration of both 'where that electricity is coming from' (though added that this is 'not just a drone related problem', rather impacts the growth of electric vehicles more widely) and of 'the sourcing' and disposal of 'lithium batteries', when considering the 'wider environmental impacts' of drones.

In highlighting the need to consider environmental impact throughout drone operations, one participant provided the example of geospatial surveys. Such surveys require 'ground control points', namely a 'static object' as a marker on the ground, which may be 'board or cloth' or may need to be 'sprayed onto the ground'. While in the latter case a 'temporary spray' would be used, this can still last several months and may be 'visual deterrent for the locals' when sprayed 'across

pavement in front of their house'. They continued that in the case of LiDAR surveys, such paint markers may also be 'padded with other materials like glass beads' to increase 'reflectance'. While this may be considered a 'minor environmental impact', the participant noted that these things 'scale up' in large projects and can 'stay there for a quite a long time', thus requiring consideration. Another participant added that they had undertaken surveys and used 'polyurethane ground control points' which needed to be 'pegged down into the ground in a field'. They noted that 'the cows were eating' the ground control points over night and following the farmer expressing concerns about the cow's 'digestive issues', the team opted to set out the ground control points every day and 're-register' them, which 'became really complex'. The participant noted that this issue highlighted that there are 'specific' environmental 'impacts' and concerns 'for a specific location'.

Other airspace users

Participants stressed the importance of impacting and being impacted by other airspace users, from manned aviation to emergency service air support.

Alongside noting considerations for drone flyers in relation to manned aviation as outlined in Civil Aviation Authority rules,²⁵ participants provided examples that highlighted the importance of considering other airspace users. Here, in discussion of a drone operation 'taking off and landing from an operational airport', a participant noted that while on their initial 'approach to the airport' they were 'kept at arm's length', following good communication they secured 'a temporary operating instruction' from the airport that allowed them 'to do what we needed to do' and to 'integrate' them into the operations. Another participant described the importance of considering military aircraft, noting that while they had 'a temporary danger area confirmed' and 'had NOTAMs raised', they nonetheless 'had multiple air incursions with Chinooks'. While this experience enabled them to practice 'emergency protocols', they argued that it also highlighted the importance of communal 'airmanship'. Lastly, it is also important to remain aware of the presence or onset of emergency service air support, as the presence of external drones can impede and even halt emergency responses.²⁶ Civil Aviation Authority guidance states that 'you must keep out of the way and not fly in any way that could hamper the emergency services when they're responding to an emergency incident' (namely 'any activities by police, fire, ambulance, coastguard or other similar services where action is ongoing in order to preserve life, protect the public or respond to a crime in progress'), and that you must ensure that drones are 'not flown close to or inside any areas where an emergency response effort is ongoing, unless they have permission to do so from the responsible emergency response personnel'.²⁷

Section summary: Impacts of drones on communities and environments

- Drones can impact members of the public in a range of ways. Drones can prompt concerns around privacy, safety, and noise disruption.
- In addition to urging the sharing of potential beneficial impacts, participants recognised that societally beneficial drone use cases were most positively perceived by members of the public.
- Participants stressed the importance of further engagement with the public, particularly in relation to the development of Beyond Visual Line of Sight (BVLOS) applications.
- Drones can impact wildlife in a range of ways. Participants described encounters with wildlife and promoted attention to the choice and size of drone (e.g. fixed wing, multirotor), and the flight pattern, in order to reduce impacts.
- While highlighting that electric drones can be associated with reduced carbon emissions and easing congestion, several participants urged further attention to their 'wider environmental impacts' (e.g. sourcing of electricity, disposal of lithium batteries, and minor impacts such as ground control survey points leaving unsightly marks or being ingested by wildlife).
- Participants recognised that they both impacted and were impacted by other airspace users, from manned aviation (including military flyers), to emergency service air support.

5. Professional, responsible and considerate commercial drone use

A central aim of the focus groups with members of the UK drone industry was to share reflections and best practice for professional, responsible and considerate drone operation and service. Several participants referred to the drone sector as a 'learning industry' and stressed the importance of sharing experience and expertise across the sector, while recognising the 'commercial challenges' that can accompany this. Others also stressed the value that adopting best practice can afford, adding that building a good 'reputation' as a professional operation will enable securing 'more business'. Participants identified the following as key aspects of best practice: understanding regulation, thorough risk assessment and flight planning, engaging with and considering local communities, careful equipment maintenance, tailored and/or ongoing training, visibility and transparency, and thinking like an aviator.

Understanding regulation

Participants stressed the importance of awareness, thorough understanding and 'acting in accordance' with relevant UK airspace regulations (see Current uses and benefits). Here, some participants recalled experiences of witnessing drone flights breaching the regulations and expressed concerns around some drone pilots demonstrating a 'lack' of regulatory awareness and responsibility. One participant added that while aspects of the regulation may be 'complicated' (e.g. the use of 'terms such as CTR (Control Traffic Regions) and ATZ (Aerodrome Traffic Zone), which can be confusing for flyers without a background in aviation), it remained crucially important for drone pilots to fully understand the potential 'dangers they could cause', such as 'collisions with aircraft or infrastructure' (see Thinking like an aviator).

Another participant also suggested that even where relevant rules are adhered to, drone flyers should also use their judgement. Stating 'just because it's legal doesn't mean you should do it', the participant described witnessing 'people buzzing around' 249 gram drones' and stressed that while drones of this weight are presently afforded more flexibility in terms of where and how they can be flown, 'you are still governed by Article 240 and 241' of the Air Navigation Order, 'so you must not recklessly endanger people or property'.²⁸ For this participant, 'considerate drone use' included 'considering a multitude of factors' and was 'not just a black and white following of the rules'.

Thorough risk assessment and flight planning

In discussion of best practice, participants described the importance of completing a comprehensive risk assessment and flight plan 'for every single job without fail'. They described a range of considerations for different flight and operational contexts, in particular highlighting 'stakeholder engagement'. Participants described the importance of both considering and 'proactively' 'coordinating' with relevant stakeholders. While communication with local communities is discussed below, participants also highlighted the importance of a thorough awareness of the flight area and beyond, including potentially sensitive locations (e.g. schools or places of worship). In addition to stressing the importance of proactive planning (e.g. 'filing a flight plan' using a relevant app,²⁹ contacting and/or having the contact information for airports or airfields and the local police, and 'having your documentation and being able to present it as needed'), participants also shared practice they felt was beneficial (e.g. monitoring weather and 'sun radar' in order to anticipate any operational and 'visual line of sight' issues).

Participants also described the value of demonstrating to clients or customers that comprehensive flight planning and risk assessment processes are in place. One participant explained that clients may be 'wary of drones', expressing concerns about whether drones may 'endanger anyone' on their site or land. They continued that going through a 'thorough flight plan shows [the client] you have considered everything' from airspace, to the public or uninformed persons, to 'what might go wrong and how you can mitigate it'. Several participants recognised this form of client engagement as important in 'demonstrating best practice' and building legitimacy around drones more widely.

Participants also highlighted the importance of additional considerations around risk assessment and flight planning where ‘subcontracted pilots’ may be brought in (e.g. due to the ‘scale of work’ taking place). Here, one participant described a requirement that before a subcontractor is ‘let loose’ they are ‘briefed on how to undertake a particular exercise’, with the aim of ensuring both ‘competence’ and that ‘they are doing it [the operation] the way we want them to’ so that the data that is captured ‘in a specific way’ and can be ‘utilized more efficiently’ and effectively. In discussion of personnel, under ‘use of contracted remote pilots’ CAP722 states ‘when authorised by the CAA to do so, UAS operators are permitted to utilise remote pilots on an individual contract basis’, but that ‘in so doing, the UAS operator maintains responsibility for the safety of the operation and for ensuring that the competence and obligations of the remote pilot are met in the same way as would be if the contracted remote pilot was an employee of the UAS operator’.³⁰

Engaging with and considering local communities

A central theme within discussions around professional, responsible and considerate drone use was the importance of considering and engaging with local communities in the area of flight. Participants described the importance of considering local communities and stakeholders (‘everyone who’s affected by’ the flight) early and ‘strictly as part of planning processes’. Different approaches were discussed, including ‘ensuring residential advisories are in place’, making up and circulating flyers to local areas and residents, ‘dropping letters’ to those within 30 metres of the flight area, and dedicating ‘a bit of extra time’ to provide information and answer questions.

Collectively, participants described communication with local communities as a key, and at times ‘lengthy’, ‘part of workflow’. They described providing information to local communities about where they’re flying, what they’re flying, and why they’re flying as an important part of building both awareness and ‘confidence that the pilot [or team] has considered the flight and is following the regulation’. Alongside suggesting that such communications may potentially aid ‘public acceptance’, participants also noted several challenges. One participant shared that the ‘one time’ they didn’t do this as they were in a rush’, a person ‘next door’ grew concerned – adding that the experience was an ‘important reminder’ that ‘there’s a reason why’ such measures are important and that best practice means doing them ‘every time’. Another participant described an occasion where ‘a few residents had not had their notices’ about some ‘night flights’ (undertaken because ‘we were still in the thermal window’) and residents confronted the team at 2am, adding that this was an important reminder that ‘communication is so, so important’.

Participants also returned to the visual and noise impacts of drones (see Impacts of drones on communities and environments). Here, participants urged a consideration of the size and type of the drone, based on the job in hand and the location or context of flight. One participant noted that when flying in busier areas with ‘more exposure to the public’ they opted to fly fixed wing drones because ‘they will get into the air with relatively less noise’ and they also ‘look and sound less daunting’. This was echoed by other participants who described the importance of ‘using the right equipment for the job in the right location’ and recalled instances of clients asking pilots to use ‘the smallest drone that you can to do the job’.

Participants also stressed the importance of being ‘mindful as an industry’ around where future ‘infrastructure that will support this technology’ (including ‘take-off and landing zones’) will be located.

Careful equipment maintenance

While risk assessment and flight planning were discussed in depth, one participant also specifically raised the ‘maintenance of equipment’ as an issue they felt was not adequately discussed across the ‘drone industry’. They described feeling that the ‘manuals’ accompanying particular equipment remained ‘very woolly’, and as such they had implemented both a ‘test before first use’ document for each system they brought in, and ‘three-monthly and twelve-monthly prompts for maintenance’. They underlined the importance of documenting such maintenance, both as evidencing that ‘you are professional and have maintained everything’, and in case of an inquiry or incident.

Tailored and/or ongoing training

In discussion of professional, responsible and considerate drone practice, participants suggested that both tailored and ongoing training can be very valuable. The CAA details different pilot competency requirements depending on the nature of the drone flight. For flights in the Open category, in addition to requirements around obtaining a flyer ID (showing 'you've passed the basic flying test') and registering for an operator ID ('which must be labelled on your drone'),³¹ CAP2012 'Requirements for flying in the Open Category' details further requirements for some sub-categories (e.g. completing the A2 Certificate of Competency, or A2 CoC, theoretical test, with an external provider).³² Per CAP722, pilots flying in the Specific category must 'as a minimum' complete the General VLOS Certificate (GVC), a 'remote pilot competency certificate' introduced to satisfy 'the remote pilot competency requirements for VLOS [Visual Line of Sight] operations'.³³ The GVC includes a 'theoretical examination and a practical test flight' which are 'conducted at an RAE [Remote Pilots Assessment Organisations] facility'.³⁴ CAP 722 continues that due to the 'wide-ranging scope of the Specific category, the remote pilot competency requirements will vary widely, dependent on the type of operation being conducted' and 'will be set out in each individual operational authorisation document'.³⁵

While participants expressed differing views on existing qualifications (see Regulation and Regulators), one participant described the value of implementing 'additional type training' and the need 'to pass different assessments' before undertaking drone work. They described the value of developing in pilots a deeper understanding of 'not just the types of equipment, but the types of jobs' at the specific location, and as a way to both act safely and do 'everything over and above' the regulatory requirements.

While unsure about how this may be implemented, another participant 'advocated' for the creation of additional training opportunities for 'continued professional development'. Here, they drew attention to the potential value of ongoing or continuation training for 'specific use cases', given the 'nature of the industry' and the variety of contexts and operations pilots may encounter.

Visibility and transparency

Several participants raised both visibility and transparency as key aspects of professional, responsible and considerate drone use best practice. In discussion of visibility, participants described a range of digital and physical measures. This included 'going over and above' what is required in the regulations through 'inputting flight data' into Unmanned Traffic Management (UTM) services (e.g. Drone Assist)³⁶ in order to increase 'awareness of operations'. Participants also understood this as an important step towards future best practice, in anticipation of airspace change. Here, participants discussed the potential for 'our skies to be busier' and 'pretty heavily populated with drones in the future', referencing developments such as project Skyway (an 165 mile drone 'superhighway' connecting six UK cities and towns).³⁷ Participants suggested that such airspace evolution (e.g. from Visual Line of Sight to Beyond Visual Line of Sight) requires both a 'restructuring' of the existing 'regulatory framework' in terms of the Operating Safety Cases (OSCs), which they argued are presently 'predominantly structured around VLOS', and technical developments to enable all craft to be visible and 'talking to each other', in order to 'operate together safely' (see Challenges and barriers to commercial drone use in the UK).

In addition to digital visibility, participants also highlighted the importance of making both the pilot (and wider team) physically visible (e.g. through wearing high vis jackets and using cones and/or signs to demarcate take-off and landing area, and/or to set up a perimeter around the pilot). While participants described the utility of 'cordons' and the importance of 'spotters, so people don't go up to the pilot' or distract them, one participant recalled that even when areas are very clearly visually marked, they have had experiences of people 'walking right in front' of where the drone is landing 'with their phone up filming'. They thus added that it remained very important for the pilot and wider team to be aware of their surroundings and to respond as necessary. Another participant also added that an 'unintended consequence' of wearing high vis can be that 'people are attracted to you', adding that they considered this, particularly in busier urban locations.

Participants also stressed the importance of being ‘open and transparent’ about both the operation and relevant airspace rules when ‘approached’ with questions by members of the public and passersby. One participant described having a team member available to tell members of the public ‘exactly what the drone does’ as an important part of their flight/ operation. Another added that they understood this type of public engagement as a form of ‘educating stakeholders...at grassroots level’, both about what drones can ‘achieve and what societal benefits they can provide’ and to encourage (particularly young people) to consider a ‘career in the drone industry, describing them as the future of the industry’. A participant added that in the event someone ‘does have any concerns’ or appears ‘suspicious’, they remind them that they are welcome to call the police.

Thinking like an aviator

The final theme that emerged in discussion of professional, responsible and considerate drone best practice was around the value of ‘thinking like an aviator’ and development of airmanship. ‘Airmanship’ refers to the ‘consistent use of good judgement and well-developed skills to accomplish flight objectives’, and is understood as a ‘cornerstone of uncompromising flight discipline’.³⁸ Participants described developing and adopting ‘an appropriate and responsible level approach to safety’. Here, one participant with expertise in the development of operational safety cases described ‘people’s understanding of what is safe and what isn’t and how they go about risk assessment and management as quite thin’. They continued that in some cases ‘lip service’ is paid ‘to the idea of safety’ and argued that in such cases, understandings of safety should be ‘much more robust’. This view was echoed by another participant who described encountering ‘a range of different levels of professionalism’ and ‘quite stark differences in terms of how people do or don’t operate drones’. They added that one issue here was that some pilots ‘focus too much on the task and forget that they are flying something – forget that aviation angle to it’. This was echoed by other participants who stated that it can be ‘very easy to become too reliant on the kit’ and for that ‘wider awareness to be lost’, ‘particularly when the pilot gets tired on long jobs’. Here, a participant returned to the idea of the need to more fully consider what it means to ‘fly the drone over something’ and the ‘complications’ of this (e.g. ‘what happens if something goes wrong?’), and to understand how to effectively respond to an emergency.

Participants underscored that important lessons can be learned from manned aviation, with a participant stating that ‘one of the reasons aviation is so safe is because there’s a just culture’, namely it’s an industry that is ‘prepared to share its failures, so things don’t fail again’.³⁹ Describing the drone sector as a ‘fledgling industry’, participants asserted that the sector is in a ‘privileged position’ to be able to ‘try to instil these behaviours early on’. From the way we conceive of safety to the reporting of incidents, participants drew on manned aviation as an area to learn lessons ‘so that future generations will hopefully be safer’.

Participants also returned to the theme of qualifications. While not wishing to introduce ‘greater barriers to those entering the industry’, participants expressed that the ‘current competency standard’ may not ‘particularly address’ such issues. One participant stated that in the majority of GVC courses ‘the focus on safety is probably a presentation’ and in an OPs manual ‘it’s a section with a number of paragraphs’, so for them, being a professional, responsible and considerate drone pilot is going into ‘real depth’ on understanding safety.

Section summary: Professional, responsible and considerate drone use

- Participants stressed the importance of awareness and adherence to applicable regulation.
- Participants highlighted the importance of proactive planning, including comprehensive risk assessments and flight plans for each flight. They emphasised the value of preparing and holding relevant documentation, and of sharing this with clients as a form of demonstrating best practice and building legitimacy.

(continued)

- Participants highlighted the importance of choosing the right tool for the job (e.g. size, weight) and recognised that drones may be perceived as noisy and/or visually daunting.
- Participants highlighted the value of additional measures where subcontracted pilots are used (e.g. competence checks, briefings on operational approach to ensure consistency).
- A participant encouraged further attention to the maintenance of equipment.
- While a range of views were expressed around pilot qualifications, some participants advocated for additional type training and called for more opportunities for ongoing or continuation training.
- Visibility, both digital (e.g. entering flight info into flight planning apps) and physical (e.g. high vis jackets, use of cones and signs) was identified as important best practice.
- Participants described the importance of being open and transparent about operations and relevant airspace regulation, when approached by members of the public.
- Participants encouraged thinking like an aviator and developing airmanship. They felt lessons could be learned from manned aviation, cautioning against becoming too task-focused and encouraging the development of more robust understandings of safety.

6. Challenges and barriers to commercial drone use in the UK

Participants were asked to share challenges and barriers they'd experienced in relation to commercial drone operations in the UK. While one participant reflected that they understood these less as barriers and 'more as challenges to be addressed', participants more widely drew attention to: flight preparation (including landowner identification, blanket bans and byelaws, notifying police, and geofencing), regulation and regulators (including regulatory approvals to fly, training, BVLOS, risk assessments, and spectrum management), other airspace users (including electronic conspicuity and potential barriers with the General Aviation community), and insurance.

Flight preparation

Participants described several aspects of flight planning as challenges and barriers. For example, participants flagged **landowner identification** and ascertaining 'land ownership data' as an ongoing challenge, particularly when compared to understanding 'airspace' which is supported by 'lots of tools available'. Alongside doing 'recces' of the flight area beforehand and door-knocking to find information that you 'wouldn't be able to find on the internet' or 'digitally', participants also recommended using the Government's 'land ownership register' where users can 'pay a couple of quid' to find out more about particular 'title codes'.⁴⁰ While noting that 'it is incomplete', they added that it 'can be quite good for looking at commercial land ownership'. Participants underscored that while important, preparation such as ascertaining 'land permissions' often takes much longer than the drone flight itself.

A participant also raised **blanket bans** and **byelaws** as barriers. They described situations where 'block bans on all drone usage' had been put in place and/or encountering 'rangers driving around' and enforcing the bans. They also highlighted the challenges around ascertaining where byelaws apply, adding that a number of byelaws have 'popped up saying no drones and it's written in tiny text at the bottom of a website somewhere', meaning it can be difficult to consistently and comprehensively locate this kind of restriction.

In discussion of 'other legal considerations' CAP722 notes 'any local byelaws'.⁴¹ In its Drone and Model Aircraft Code, the CAA notes that 'byelaws may restrict when you can fly and where you can fly from', encourages pilots to 'look out for local signs for information and contact details where you can find out more', and adds that 'byelaws are unlikely to be shown on apps or drone websites'.⁴² In discussion of Flying in the Open category, the CAA adds that many 'statutory bodies' such as local authorities 'have established local byelaws' which can 'restrict the take-off/landing of drones'.⁴³ They continue that while such a restriction alone 'is not an airspace restriction' and thus 'is not

always reflected in drone specific alerts and advice', it remains important to understand both relevant 'permission required to operate' from particular land (e.g. council land) as well as wider airspace permissions and restrictions.⁴⁴ While the CAA states that it 'cannot provide advice' on the imposition of restrictions, it adds that 'any authority or regulatory body should be able to identify the specific laws, regulations or bye-laws that empower it to regulate the use of drones, or more usually, the land from which they are operated'.⁴⁵ Nonetheless, several participants expressed frustration at contacting local authorities during flight planning and receiving replies such as 'we'll need to talk to our legal team', with no clarification provided months later, delays that one participant associated with lost opportunities. It has more widely been acknowledged that drones raise both opportunities and challenges for statutory bodies such as Local Authorities. In January 2023 at the Westminster Business Forum event 'next steps for drone regulation in the UK', Councillor Keith Artus of the Strategic Aviation Special Interest Group (SASIG), a 'special interest group of the Local Government Association', discussed the role, interests and concerns of local authorities in relation to drones.⁴⁶ While outlining a range of benefits of drone use and integration, the Councillor also raised a number of 'issues impacting adoption', including that local authorities have 'little understanding of the sector and its potential relevance to them, they have no systematic assessment the issues they give rise to, they have no unified strategy for use/control of drone operations, they may not have the availability of human and financial resources to implement, and they do not have training regimes or the drones knowledge base', adding that further reflection is required on the resourcing and 'infrastructure needed'.⁴⁷

A participant also raised a potential barrier around **notifying police about drone flights**. In discussion of 'working more harmoniously' they described contacting police 'to put a CAD [computer-aided dispatch] report in place before' 'every operation' as 'part of the course'. They added that they felt more could be done 'to slicken this process so that people were more likely to put a CAD report in place before they fly'. The participant suggested that this process can be quite lengthy, describing situations where they had been 'on hold for 45 minutes to get through to certain police forces' and felt it might be more appropriate to 'fill in an online form' or to have a more automated process in place to 'fire off permissions'. They reflected that because the process can feel like 'a hassle people just don't do it so much' and this can have a 'knock on to policing costs' if police are sent out to ascertain whether the drone flight is a 'genuine operation'.

A participant also raised 'the **roll out of geofencing around buildings**' as an unfolding issue. They described the potential challenges that this roll out posed to flight planning, asking how they could know where a geofence is, and where it might 'overlap with others'. They posed an example of planning a flight to survey a building, undertaking the relevant communications with landowners etc and confirming that an existing geofence is to be turned off during the flight. They continued that it may be difficult to ascertain whether there any other local geofences in proximity and/ or overlapping which could impact the flight. They added that they had 'already seen this happening' when flying 'near football or cricket grounds' where the geofence is extended 'from the actual ground itself', adding that this required 'going into unlocking codes' which complicated flights.

Regulation and regulators

Participants repeatedly raised UK regulation and regulators in discussion of challenges and barriers to commercial drone operations.

A recurrent theme related to **regulatory approvals to fly**, issued by the Civil Aviation Authority (CAA). A number of participants described encountering 'difficulties getting regulatory approval to fly'. One participant stated that while they understood that there was an important 'need for operating safety cases', they felt that 'there's a degree of confusion or opaqueness around the process' and 'what you need to evidence'. A number of participants raised that the process 'takes a long time', adding that this 'can delay' and add cost to operations. In one case, a participant recalled an application for operations in 'complex airspace' taking two years for a three month flight period, which ended up falling in winter meaning that they 'couldn't make all the activations needed'. In discussion of 'response times', participants argued that the 'industry is moving forward

at a different pace from the regulator' and expressed concern that 'they're going to kill a lot of innovation'. One participant suggested that previously the regulator had come from a 'relatively static model with a certain number of manned aircraft pilots that continue to come back and renew their licenses' but that we're now experiencing 'a paradigm shift' in terms of a 'drone sector that is growing exponentially'. They continued that they felt that 'the CAA model is insufficient to deal with the industry' and the 'amount of activity going on in it'. Another participant suggested that aspects of the approvals 'could be much more automated'.

Participants expressed concerns that such issues may 'stifle innovation' and potentially risk not 'attracting the newer entrants into the world of drones'. In this vein, a participant suggested that existing 'operators all over the country' are either 'sticking offshore' or are 'going to other countries' where the regulation (including for BVLOS flight) is more 'standardized'. In addition to response time (and its implications), a participant expressed a specific frustration around the 'authorization process' in relation to 'changes to assessors' during the process, adding that such changes meant they did not feel in a 'secure position'. Further, another participant raised the issue of 'invoicing' and urged more in the way of 'pre-emptive' information or quotes rather than 'billing'. In the case of flights in the specific category, the CAA's website states that 'All applications are subject to the payment of the necessary fees as defined in the CAA Scheme of Charges', adding that there are 'selected situations where it is anticipated that the time required for the CAA to process and authorise the application would be less than expected for the majority of applications' and these 'applications are charged at a lower rate'.⁴⁸ In reflecting on the regulatory process more broadly, one participant also urged for further consideration to the 'lumping together' of drones 'under 25kg', while another described a need for a greater 'division' between commercial operators and recreational users. They continued that while 'the vast majority of recreational users do want to abide by the rules, there are a few who just don't give a hoot and unfortunately they give a whole swathe of people a bad reputation'. 'Regulatory readiness' has been described as a notable 'challenge for wide adoption of commercial use cases' of drones in industry-led publications more widely.⁴⁹ It should be noted that in August 2023 the Civil Aviation Authority launched a call for input into its review of UK drone regulations (see CAP2569).⁵⁰

Several participants also again raised **training and qualifications** as an issue (see Tailored and/or ongoing training). While some acknowledged the value of the GVC, others suggested that the qualification needs to go further, particularly in relation to understandings of safety (see Thinking like an aviator). Several participants equated the GVC to 'driving a car', stating that 'you pass your driving test but don't really fully start learning until you're in that car by yourself'. Others noted that the qualification requirements had changed over time, necessitating additional investment and expense. CAP722 notes that 'NQE full recommendations are a previous version of the GVC course' and 'these qualifications have been superseded by the GVC' and the CAA will 'no longer recognise them after 1 January 2024'.⁵¹ Lastly, one participant raised demonstrating 'pilot competencies' as an issue, adding that while 'you can get your GVC and A2 Certificate of Competency (A2CoC)...there's no recognised certificate' to illustrate competency for 'flying a large fixed wing aircraft beyond visual line of sight'. In discussion of the 'remaining regulatory challenges that will enable authorised operators to operate Beyond Visual Line of Sight (BVLOS) in a scaled, sustainable way', the CAA identified 'four primary areas of work', including 'pilot competency' and the recognition that the 'industry wants a simpler, more standardised mechanism to demonstrate the competence of their pilots when flying BVLOS', continuing that 'in collaboration with industry, we are developing the next phase of formal pilot competency, beyond the GVC, to support this'.⁵²

Beyond Visual Line of Sight (BVLOS) flying was also more widely recurrently raised as a barrier. While some participants praised the 'lessons learned' through a range of 'innovative partnerships' such as Pathfinder,⁵³ others added that while there 'are people flying BVLOS' it remains 'massively in its infancy, held back predominantly by the regulations that aren't there'. For these participants 'scalability' remained a key issue, adding that 'if we want to see the increased use of drones around the UK and the world, BVLOS is the only way to enable a lot of the use cases we've been discussing already'. Another participant added that commercial drone operations need to be made

'scalable' via BVLOS 'because an organisation isn't going to pay for commercial work for us to have to keep putting a pilot or a visual observer or an airspace observer every 50 meters - it's just not commercially viable'. In discussion of BVLOS, one participant identified what they felt was a 'lack of cohesion between different parts of the regulator', adding that 'we have a regulatory framework that is supposed to be proportionate and risk based and we have a different part of the regulator that says the only way to deal with it safely is by total segregation - which is not proportionate and it's not risk based'.

On a webpage discussing 'scalable beyond visual line of sight operations', the CAA identifies 'how we safely integrate BVLOS operations into the UK's busy and compact airspace' as 'one of the key challenges', adding that 'initially, we are exploring the use of an atypical air environment to sufficiently address the mid-air-collision risk when operating in non-segregated airspace. In the medium to long term our focus is on enabling a regulatory landscape which supports the adoption of detect and avoid technologies, as well as electronic conspicuity'.⁵⁴ The 2023 revision of the 'Airspace Modernisation Strategy' foregrounds the 'integration of all airspace users...including accommodating new types of vehicle' such as drones.⁵⁵ Identifying the Department for Transport (DfT) as responsible for developing 'national aviation policy' on airspace modernisation and the CAA's 'focus on the technical policy framework required to enable the changes and to identify and propose new rulemaking activities', the strategy describes 'a transition towards greater integration of air traffic, where it is safe to do so'.⁵⁶ It continues that 'the integration of new airspace users such as BVLOS remotely piloted aircraft systems and advanced air mobility operations will normally be accommodated within the airspace classification, except when capacity is constrained because airspace user emergencies or exceptional circumstances dictate otherwise. It will utilise an overlay of air traffic services where additional digital services are provided to achieve safe integration, rather than relying on segregation from other airspace users'.⁵⁷ Lastly, the CAA asserts that they 'are committing to making the safe flight' of drones 'BVLOS of the operator, an everyday occurrence' and as part of 'addressing the regulatory challenges of scaled and sustainable BVLOS flight' are working with the Department for Transport to 'run a BVLOS challenge'.⁵⁸

A participant also raised **risk assessments**. Reflecting on 'the process of changing the qualitative approach into a more quantitative' one, they opened a discussion of Specific Operations Risk Assessment (SORA), a methodology 'for the classification of the risk posed by a drone flight...and for the identifications of mitigations'⁵⁹ and which the 'UK will be adopting' in the form of the 'slightly amended version of the JARUS 2.5 SORA'.⁶⁰ The participant noted that in previous versions of SORA 'the biggest problem for operators in practice was that they had to assess the weight of the drone, the type of operation, whether it was VLOS or BVLOS, and the number of people impacted by their operation' and within the consideration of 'three different flight geographies' there were 'problems with the terminology, for example terms like populated area, concentrated crowd, unpopulated or sparsely populated area, and these terms were not clear enough'. They added that the updated versions are 'introducing some numbers, so it should be much easier for operators to do their assessments'. Identifying risk assessments as one of four 'primary areas of work' moving forward, the CAA recognises SORA as a 'more suitable mechanism to assess and mitigate risk' to facilitate 'authorising more complex UAS operations at scale'.⁶¹

Lastly, in discussion of regulators, a participant added that 'Ofcom have got a part to play in this around **spectrum management**'. They continued that while they were aware of 'work going on' in this area, they had concerns that 'perhaps they're not speaking to the right stakeholders in understanding what to do, what people want to do, need to do, etc'. While the CAA 'is responsible for aviation safety and determining policy for the use of airspace', Ofcom is the 'spectrum regulator in the UK' and 'has the role of authorising the use of radiocommunications equipment'.⁶² The 'use of radio spectrum is essential to the operation of drones' which require radio spectrum 'to perform a number of different tasks, including command and control, relaying of payload data, electronic conspicuity, detect and avoid, and communications, navigation and surveillance'.⁶³ In a 2022 report on 'spectrum for Unmanned Aircraft Systems (UAS)', Ofcom noted that 'for many years' they have 'authorised the use of spectrum' for drones and model aircraft 'through a licence exemption

regime'. They continue that as 'the operational range and altitude of UAS flights are increasing, sometimes going beyond visual line of sight (BVLOS), this brings with it new challenges' as the 'licence exempt equipment we authorise is not suitable for this use as it does not provide the necessary coverage'. Working in conjunction with the 'CAA, Government and stakeholders', Ofcom reviewed their 'framework for authorising equipment that can be used on a drone' and have decided 'to introduce a new spectrum licence', known as the 'Unmanned Aircraft System (UAS) Operator Radio licence', for 'drone operators, especially those looking to fly beyond visual line of sight'.⁶⁴ They add, 'the new licence does not replace the current licence exemption regime for low power 2.4 GHz and 5 GHz equipment which most drones on the market currently fall under'.⁶⁵

Other airspace users

Participants also discussed other airspace users, noting both ongoing work and outstanding barriers around **electronic conspicuity**. The CAA identifies 'electronic conspicuity' (an 'umbrella term for the technology that can help pilots, remotely piloted aircraft systems and air traffic service provides be more aware of what is operating in surrounding airspace') as a key aspect of and 'vital aid' to 'better sharing and access among different users of airspace'.⁶⁶ In October 2021 the Department for Transport (DfT) and the CAA announced the convening of a 'task force to work with manufacturing industry to develop and publish electronic conspicuity specifications to enable interoperability between airspace users' and taking into account 'future requirements for all aviation' including drones.⁶⁷ In December 2022, the CAA and DfT updated on the 'development of a national standard for electronic conspicuity (EC)', stating that the 'aim of a new EC specification is to enable the delivery of the Airspace Modernisation Strategy, integrate new airspace users while reducing the associated risk of mid-air collision in UK airspace, enhancing safety', adding that a study was commissioned by the DfT and is comprised of three phases of work.⁶⁸ Next steps include the DfT and CAA agreeing a 'programme of work to deliver a new EC specification in the UK', while in the interim they 'strongly encourage voluntary use of EC devices in all airspace to enhance visibility to other traffic'.⁶⁹

In discussion of different **airspace users**, one participant suggested that there also remained 'a bit of a barrier' between the General Aviation (GA) community and the drone community, with some GA pilots wanting 'their plane in uncontrolled airspace' and not wanting 'to have electronic conspicuity', describing a perception that this is 'their God-given right'. Another described 'manned aircraft stakeholders' as 'traditionally quite resistant to drone technology. They don't like the idea that there's a new player on the block and one that will probably negatively impact or certainly force them to shift the way that they do things. And so when it comes to consultation activity they can at times be confrontational or suspicious of drone technology'. Another participant responded, saying that they imagined the GA community 'have the same view of the drone industry' and the focus needs to be on airspace as shared, 'nobody has a God-given right, you can access it if you meet the rules of the air'. They also added that the drone industry is 'new tech' that is a 'big disruptor' and that the GA have 'a lot to lose and not a lot to gain', so the careful and considered facilitation of further communication between different communities is required.

Insurance

The CAA states that 'all commercial drone flights require valid insurance cover',⁷⁰ adding that 'you must have third party liability insurance' if you receive payment for your drone use, 'use your drone for work', or if your drone is '20kg or more...no matter what you use your aircraft for'.⁷¹ One participant described previously encountering a challenge around 'finding a proper insurance partner' in the context of the development of complex prototypes, rather than the use of off the shelf drones. They added that additional support 'educating insurers about the industry' and it's diversity of drones and operations would be beneficial and would reduce the risk of companies developing complex prototypes that 'cannot be utilized to their max'. The 2022 'Advancing airborne autonomy' report describes that the Government will 'help drive the sector forward' through delivering a 'Future of Flight Plan' which includes 'milestones and targets for' 'developing licensing, data and insurance requirements for Unified Traffic Management (UTM) systems to support the introduction of increased numbers of aircraft'.⁷²

Section summary: Challenges and barriers to commercial drone use

- Participants identified a range of challenges and barriers during flight planning. These included landowner identification, navigating blanket bans and local byelaws, processes for notifying local police about drone flights, and navigating the roll out of geofencing.
- Participants raised UK regulation and regulators as challenges and barriers to commercial drone operations.
- Issues raised in relation to the Civil Aviation Authority included: difficulties and (cost incurring) delays associated with regulatory approvals to fly, lengthy response times, changes to assessors, frustrations around both changes to qualification requirements and the lack of competency certification for flying larger drones BVLOS, and BVLOS regulations remaining in their infancy (impacting and impeding scalability).
- In addition to expressing a desire for more regulatory division between commercial operators and recreational pilots, some participants also expressed concerns that innovation was potentially being stifled and talent lost to other countries.
- Participants also raised issues around the regulation of spectrum management by Ofcom.
- Participants raised concerns around airspace users, noting both ongoing work and outstanding barriers around electronic conspicuity, and what some participants understood as wider tensions between the General Aviation and drone community. Participants supported further communication between different airspace communities.
- One participant described encountering a challenge with finding appropriate insurance for the development of a complex prototype and encouraged further educating insurers about the diversity of the industry, platforms, and applications.

7. Ambitions and desires for commercial drone use in the future

Participants from the UK drone industry were asked about to share their thoughts on what they'd like future UK airspace to look like and what they'd like to see possible. Participants described developments in visibility (e.g. electronic conspicuity and detect and avoid), desires for drones as business as usual (e.g. routine BVLOS, mitigating risks of talent loss), desires for greater resourcing (e.g. research and development), prioritising societal benefit and public engagement, and scaling (e.g. automation, one pilot to multiple aircraft, learning from global events).

Developments in visibility (electronic conspicuity and detect and avoid)

Stating 'there's lots of stuff in the sky and we need to see what's in the sky, to see what's cooperative, what's uncooperative, what's squawking and what's not squawking', participants described the importance of the visibility of all aviation communities and the adoption of 'electronic conspicuity' moving forward. One participant stated that drone operation at scale will 'fail if the existing methodologies continue', adding that a 'more digitally capable ecosystem' needs to be developed to 'share information' more comprehensively and effectively and to allow it to be 'managed at scale', given the 'volume of drones that are forecast or should be operating'.

Electronic conspicuity refers to an 'umbrella term for the technology that can help pilots, remotely piloted aircraft systems and air traffic service providers be more aware of what is operating in surrounding airspace' - such technologies "strengthen the principle of 'see and avoid' by adding the ability to 'detect and be detected'".⁷³ As is explored under other airspace users (Challenges and barriers), work in the area of electronic conspicuity is presently driven by the DfT and CAA through a task force and the development of a national standard. The Government's 2022 ambition statement and vision for commercial drones also highlights work undertaken by the 'CAA's Innovation Hub', including 'Sandbox testing' 'exploring the use of detect and avoid systems and procedures' and 'the use of transponders and conspicuity to test airspace integration'.⁷⁴

The ambition statement continues that ‘a detect and avoid capability is central to removing reliance on temporary danger areas (TDA) for routine BVLOS flight outside of segregated airspace’ and aids the testing of ‘solutions that detect noncooperative aircraft’.⁷⁵ It also adds that the ‘Government and the CAA have been working closely on assessing the current landscape for electronic conspicuity and considering what the future approach should be, including the possibility of using Transponder Mandatory Zones (TMZ) to integrate all airspace users’.⁷⁶ This is expanded upon in the CAA’s Airspace Modernisation Strategy (AMS), which under ‘future integration of air traffic’ states that ‘a vital aid to better sharing and access among different users of airspace is electronic conspicuity of UK airspace users between each other and with air navigation service providers as required, to ensure that this integrated air operation is safe’.⁷⁷ It adds that a ‘roadmap of electronic conspicuity deployment will be developed in conjunction with the Department for Transport’ and that the AMS ‘ambition is to enable the widest possible use of electronic conspicuity, supporting a range of information and separation services by ground service providers’.⁷⁸

Drones as business as usual (e.g. routine BVLOS)

Building on the above, participants described desires to ‘connect the nation with unmanned aviation’ and to develop more ‘business as usual’ commercial drone applications. In order to do so, they described the central need for **opportunities to ‘test and validate’** their operations through initiatives such as drone corridors or highways, rather than submitting lengthy ‘applications for Temporary Danger Area (TDA) periods’ to facilitate testing (see resourcing below).

One participant described the importance of ‘a drone superhighway’ underpinned by ‘detect and avoid’ and acting ‘as almost a bubble around the drone that you’re flying in, and it’s protected from everything else and everything else is protected from it’. Their vision was not about ‘separating drones from manned aviation’ but rather a future in which ‘drones can play in the same airspace as everybody else...everybody is collectively in the bubble and safe’. This vision, they continued, ‘enabled everybody and everyone’s use cases without putting anybody out’. While acknowledging that there were a range of approaches that could be adopted, they felt utilising ‘detect and avoid towers on the ground so that the drones in the air aren’t encumbered by the heavy bits of kit’ may be ‘the only way to bring manned aviation into the party’ because they ‘don’t need to do anything’ and can ‘carry on flying as normal’ (see other airspace users in Challenges and Barriers). They contrasted this with ‘transponder mandatory zones’ and ‘checking’ that manned aviation has the relevant transponder, which they felt would ‘add cost’ and encounter ‘push back’.

Other participants also shared ‘hopeful ambitions’ for **‘business as usual Beyond Visual Line of Sight (BVLOS)’ flight**. One participant noted that ‘by the very definition of the term, a temporary reserved area is temporary, so it can never really be a service that an end client can procure because it’s going to last’ for a short period and then has to be repeated. Here, participants referenced developments around the world from Zipline flights in the African continent and Matternet’s medical deliveries in Geneva to ‘BVLOS waivers’ in the United States,⁷⁹ which they hoped would filter down to the UK – with one participant described the UK as ‘a little behind, probably around 5 to 10 years behind’.

A number of participants expressed the **importance of being competitive**, both underscoring desires for routine BVLOS flight and describing risks of talent loss if this aspiration is not reached. Participants described BVLOS as a crucial and ‘necessary next step’. Here they detailed the lengthy processes they had gone through ‘to get a TDA to cover’ a fixed period and this impacting their ability to ‘fly’ and ‘demonstrate’, with others describing ‘looking at Plan B’ overseas as ‘if operators want to do BVLOS maybe it’s cheaper, it’s faster, it’s easier to go and talk to regulators’ elsewhere ‘than it is to try and do it in the UK. That’s as we stand today’.

To this end, another participant added that if ‘in five years certain things aren’t unlocked’, they felt ‘a lot of BVLOS industry will exit the UK because it’s not commercially viable. VC backers will pull out, small businesses won’t be able to continue to fund because the grant projects will stop, other VCs will pull out and we’ll be left with a very healthy VLOS industry, but not what we could achieve

as a country. So in a pretty binary way, if we nail it it'll be great but in an unfortunately quite bad way if it won't be if we don't'. This sentiment is echoed in industry reporting, with BT's (2023) report on **'drone readiness in the UK'** asserting that there is 'a 12–24 month window of opportunity, as most unmanned aerial vehicle (UAV) sector participants expect drone regulations to be in place by 2024–2025 in advanced economies' and 'this sets a marker for a modernised drone regulatory system to be in place by to ensure it can remain competitive in developing home-grown technology for domestic use and in export markets – and not risk UK talent and innovation moving to other countries'.⁸⁰

Desires for greater resourcing

Several participants expressed desires for 'more of a **research and development (R&D)** aspect to the innovation team and the CAA' in order to enable the commercial drone industry to 'show them this technology works'. Another participant added that they aspired for 'increased amounts of designated test R&D areas for new and developing technologies'.

The Government's 2022 ambition statement and vision for commercial drones notes that 'since 2019, the Innovation Hub has supported development and testing of ideas and products by establishing three new capabilities', namely the Innovation Gateway, the Regulatory Sandbox, and the Regulatory Lab.⁸¹ It also details the resourcing of '£70m commitment from government into Phase 3 of the Future Flight Challenge to support the new technology testbeds and demonstrations that enable evidence-based safety frameworks to be built'.⁸² Further, in discussion of 'driving the sector forward by supporting collaboration and co-creation of new solutions for the sector' through the collaborative delivery of a 'Future of Flight Plan', it states that it will 'provide a clear direction on key milestones, to help businesses understand where to focus their resources and investment' and 'establish airspace requirements for testing certifiable drones and advanced air mobility vehicles'.⁸³

Several participants also expressed a desire to see and foster the **involvement of more women in the UK's commercial drone sector**. It is 'estimated that the percentage of women drone pilots in the UK is just 4%'.⁸⁴ As the industry itself acknowledges, while 'what can be achieved with drones is evolving on a daily basis', the 'industry itself look a little outdated'.⁸⁵ One interesting international initiative in this area is 'Women Who Drone' – an online group and 'community that inspires, educates and empowers women and girls with drone technology'⁸⁶ and who are facilitate an Facebook group connecting international female pilots.⁸⁷

Lastly, one participant asserted that 'the way that we plan airspace and set up technology has to change quite dramatically' in order to facilitate such aspirations, because it's presently 'very long winded' through 'CAP 1616' (Airspace Change) and 'needs to be more dynamic because at the moment it doesn't lend itself, to our ability as an industry to test BVLOS activities'. In addition to needing a more 'proactive' and 'streamlined way to do this', the participant suggested that this also raised challenges 'from an **air traffic control perspective**', as 'the way the air traffic control is done by humans sat in front of radar consoles is going to have to fundamentally change, because cognitively, air traffic controllers will not be able to manage the amount of inputs that that are going on with all the drones there. So there's a good level of automation that needs to be applied'.

Prioritising societal benefit and public engagement

In discussion of future aspirations, participants underscored the importance of engaging with and 'getting communities on board', which several asserted should begin with getting '**societally beneficial use cases**' 'up and running first'. As is discussed in Impacts of drones on communities and environments, use cases such as emergency service and medical delivery drones are often perceived more favourably by the public.⁸⁸ One participant added that such applications may aid people to 'accept the increased risk of having drones flying above their heads if they are benefiting society'. They continued that the same might be said of use cases such as drone-assisted postal delivery in remote areas, as this 'helps communities in their everyday life'. They felt that getting these societally-focused use cases 'up and running' and appropriately 'tweaked' would assist the

wider commercial drone sector to 'use the lessons learned to enable other use cases that are maybe more business oriented'.

In addition to noting the 'size of the country and the congested level of the airspace' as ongoing challenges, one participant continued that as airspace changes, they anticipate a growing number of both 'operators' and 'stakeholders' in 'the same three dimensional space'. They continued that the commercial drone industry needs to 'find a way to make that work', and to be both 'more proactive in the way that we do it', as well as 'much more consultative and inclusive of all the people that are going to use the airspace in the future'. The Government's 2022 ambition statement for commercial drones advocates for 'drones for all' and states that the 'Government, led by the CAA, and the sector will continue to work together to inform and support public debate on drone use, ensuring end users across the economy have the confidence to adopt drones and the public understand the important role commercial drones can play in our future society'.⁸⁹

Scaling (e.g. automation, one pilot to multiple aircraft, learning from global events)

In order to enable the scaling of commercial drone activity and support commercial viability, participants raised several desires for the future in relation to the further 'automation of flights' and the ability of pilots to operate more than one drone (i.e. 'one-person-to-multiple-aircraft'). Describing a scenario with 1000 drones undertaking 'medical deliveries from one hospital to another', one participant stated that 'we don't want 1000 pilots', 'that's just not going to work, so there to be some form of automation' to support this. While they felt that the 'CAA is definitely not ready for that yet', they considered 'BVLOS and automated' flights as 'quite key' for the future. In discussion of the 'comment that the commercial business is not based on one person flying one aircraft', in addition to 'debate' surrounding 'the descriptors' (e.g. 'autonomy' and 'high authority automation' – see CAP722) another participant added that there's a 'legal basis that has to change' to underpin a shift from 'one-person-to-one-aircraft to **one-person-to-multiple-aircraft**'.

While the majority of participants aspired for change (regulatory, technical or otherwise), one participant cautioned that 'looking forward' to the 'next five years', they thought that 'within the industry there needs to be a bit of internal pacing of ourselves with technology'. They continued that while 'there's lots of innovation out there', they felt 'automation is going to take time' and 'there's going to be have to be use cases, there's going to have to be mountains of gathered data' and as such, 'for the foreseeable future' they saw the 'future of drone operations' as 'one aircraft, one operator or flight crew'.

Another participant also added that our discussions of professional, responsible and considerate drone operations had predominantly focused and/or 'been based on a pilot being co-located with the drone'. They raised that question of how 'you bridge the gap' in terms 'of public perception of what that drone's doing' in the case of remotely operated and/or automated BVLOS drones. They added that it will be interesting to see how to 'maintain or improve the public perception when you haven't got the person' visible, as with a visible pilot there's a face, 'there's a voice'.

Lastly, one participant asserted that when considering the future of scaled drone operations, it remained important to learn lessons from global contexts. In addition to considering **lessons learned from international contexts** (e.g. BT Race to the top),⁹⁰ the participant drew attention to the current Russian invasion of Ukraine, in which drones have featured prominently,⁹¹ arguing that 'unfortunately it does take a conflict' to 'drive technology forward'. They continued that 'the use of drones out there is changing daily' and added that they believed lessons could be learned with regard to drones and 'counter UAS' that will 'filter out' from the conflict zone more widely.

Section summary: Ambitions and desires for commercial drone use in the future

- Participants described the importance of the visibility of all aircraft and adopting electronic conspicuity, which was deemed as crucial to allow drones to operate at scale.
- Participants described desires to develop and normalise business as usual drone operations and routine BVLOS drone flight. They described the need for opportunities to test and validate their operations, and the need for progression beyond lengthy applications for Temporary Danger Areas (TDAs) and Temporary Reserved Areas (TRAs).
- Participants argued that if not realised, the UK risked commercial viability and the loss of considerable drone business and talent to more established overseas markets.
- Participants expressed desires for greater resourcing, particularly in relation to research and development (R&D), and the automation of aspects of air traffic control.
- Participants expressed a desire to see and foster the involvement of more women in the UK's commercial drone sector.
- As drone activity grows, participants underscored the importance of engagement with local communities and stakeholders. Some participants felt that prioritising societally beneficial drone applications would assist fostering public support and enable lessons learned for the wider drone industry.
- To enable the scaling of drone activity, participants expressed desires for increasingly automated flight, and a shift from one-person-to-one-drone to one-person-to-multiple-aircraft in the future, though recognised legal and social challenges around this.
- A participant highlighted the utility of learning lessons from global contexts and events, such as the Russian invasion of Ukraine, the drone and counter-drone implications of which they felt would filter out into the wider world.

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