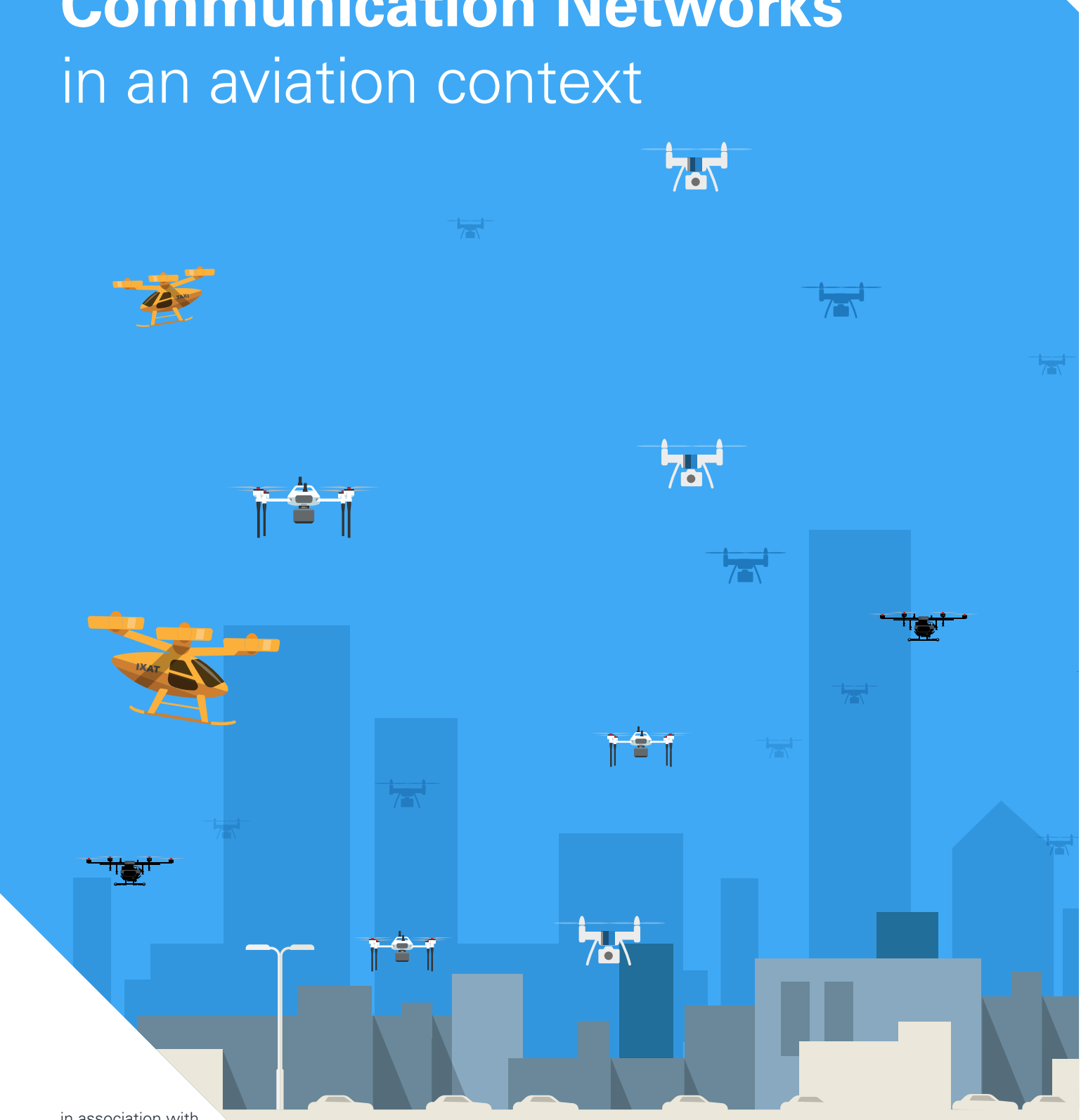
UK Civil Aviation Authority

The use of **Mobile Communication Networks** in an aviation context



in association with

UK Research and Innovation

CAP 2988

UKRI **Future Flight Challenge**

Through the UKRI Future Flight Challenge, the UK Civil Aviation Authority (CAA) was commissioned to carry out an internal study to better understand the benefits and drawbacks of using Mobile Communications Networks (MCN) in an aviation context, and, how mobile networks services could improve the safety, security, and productivity of the Remotely Piloted Aircraft Systems (RPAS) market.

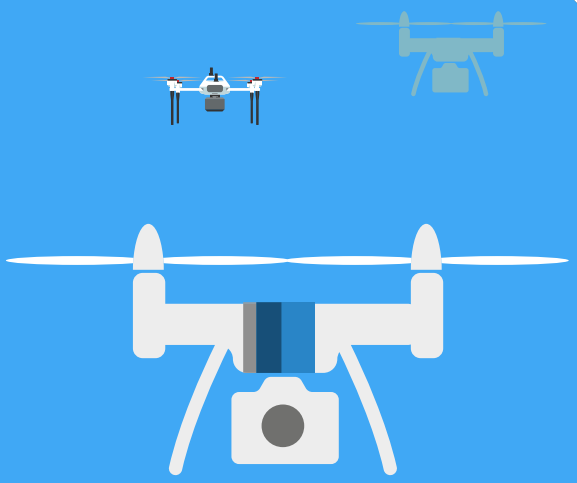
This study explored:

- Use cases for using MCN in aviation
- Future possibilities and benefits of MCN based services and their potential contribution towards scalable RPAS operations
- Network coverage and performance
- Regulatory and standardisation considerations for the use of services based on MCN for safer and more secure RPAS operations; and
- Any other dependencies

The study collated issues and challenges associated with the use of MCN, building a set of recommendations that we are now considering for implementation.

UK Research and Innovation (UKRI) Future Flight Challenge

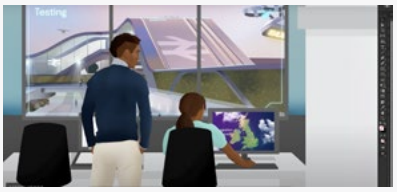
The UKRI Future Flight Challenge, delivered by Innovate UK and the Economic and Social Research Council, is a £300 million programme co-funded by government and industry, that is supporting the creation of the aviation ecosystem needed to accelerate the introduction of advanced air mobility (AAM), drones, and zero-emission sub-regional aircraft in the UK.

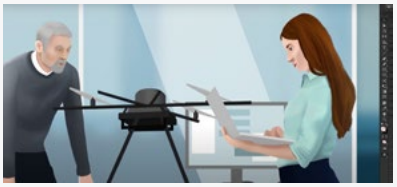


delivered by: Innovate UK | Economic and Social Research Council

The programme works with industry, academia, government, and regulators to transform how we connect people, transport goods, and deliver services in a sustainable way that provides socio-economic benefits using new types of air vehicles with novel technologies.

As part of our work with the UKRI Future Flight Challenge and more broadly as part of the Future of Flight Programme, the CAA is committed to working more closely with industry, enabling them to better develop and test the tools and technology needed to enable the next revolution in flight, a revolution taking place with a pace of change not seen since the dawn of the jet age. In order to do this, we are adapting the way we work, not only within the aviation industry but across government and the wider technology sector.





Watch UKRI Future Flight Challeng Video Here

So What?

The use of MCN in aviation has recognised benefits with the potential to enable scalable, sustainable, and routine integrated Beyond Visual Line of Sight (BVLOS) Remotely Piloted Aircraft Systems (RPAS) and Unmanned Aircraft System (UAS) flight operations, especially when used to provide multiple redundancies as a component of a Command and Control (C2) Link and Detect and Avoid (DAA) solution within a UAS Traffic Management (UTM) environment.

C2 Links are a critical enabler for BVLOS, because they are the means by which RPAS and UAS are controlled, and how they report their status, flight plan, position and trajectory to the remote pilot and potentially also to a UTM system and, hence, other airspace users. C2 Links are also likely to be a key enabler for off-board Detect and Avoid (DAA) for smaller RPAS/UAS that are not capable of carrying on-board sensors with sufficient performance to permit flight in unsegregated airspace.

Because of the complexity of the engineering, safety, regulatory, oversight and logistical challenges involved, we know that no one organisation can solve all the complex issues that need to be addressed. The CAA is acutely aware that to make routine BVLOS RPAS operations a reality, joint efforts will be required by the CAA, industry and government, hence opportunities for engagement are crucial.

A proper understanding of the safety performance capabilities and resilience of MCN and associated equipment is essential to realise the opportunities that MCN present for aviation. This is crucial so that safety risks, including cyber security risks can be managed proportionately. Industry and the CAA will need to understand the applicable values for key safety parameters for MCN, such as;

3 dimensional network coverage

availability

continuity

latency

transaction expiration time

connection drop-out rates

time required to reconnect

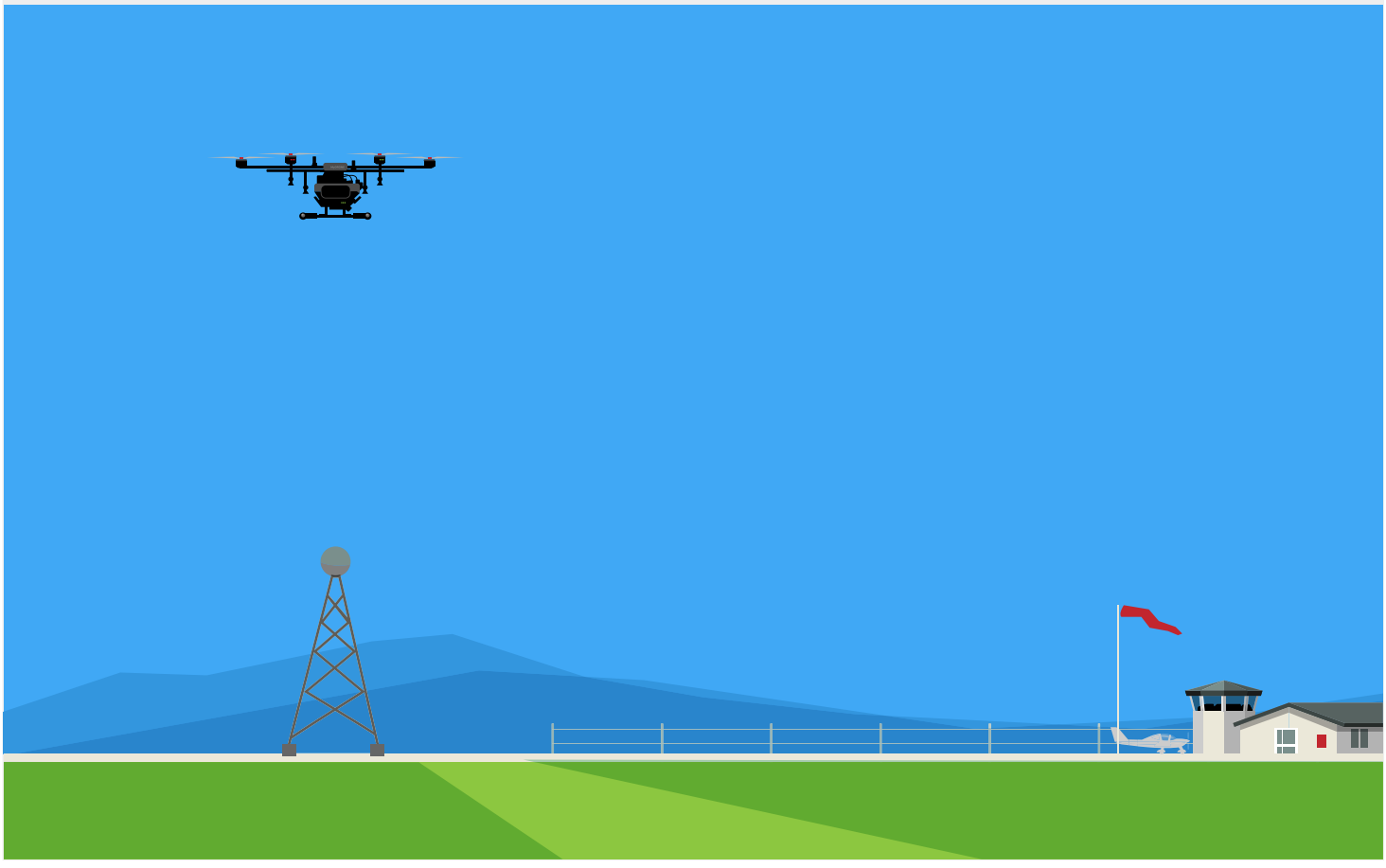
This will enable the MCN capability to support safety-related functions to be evaluated properly, which can then be used to support the safety cases for BVLOS RPAS operations.

We will work with UAS Operators and UK Mobile Network Operators in their test and evaluation activities. Data outputs and analysis will develop both industry and regulator's understanding of safety performance. Ultimately leading to development of performance standards, regulations, acceptable means of compliance, and an approval/oversight regime. This will enable MNOs to provide BVLOS C2 Link services to RPAS operators in accordance with a CAA approval.

The ultimate aim is to have a safe and proportional set of regulations and standards in place that enable MNOs to provide routine C2 Link services, with safety oversight from the CAA, so that the BVLOS RPAS sector can grow and operate within a known and consistent regulatory environment, just as manned aviation does today.

We are working towards a coordinated CAA/Industry approach across our business, especially where shared issues are identified e.g. spectrum allocation, technical standards, and implementation. We have established a Delivery Group which will develop a strategic test and evaluation programme for operational evaluation and assessments of C2 Link technologies. This will enable the CAA to determine how best to use MCNs in a manner commensurate with the level of safety they can provide (e.g. as part of a C2 Link system with two or more RF links, providing both path redundancy and frequency redundancy). This strategic approach will enable evaluation of industry's proposed solutions and will inform policy-making to enable routine, integrated BVLOS operations to happen as soon as reasonably practicable.

We have also joined the recently formed Community of Practice for Telecoms and Digital Connectivity of Transport Research and Innovation Board, one of several steps we are taking to improve our understanding of using telecoms and digital connectivity to enable safer, more efficient RPAS and airspace operations. We anticipate that the telecoms and digital connectivity sector already has much of the expertise and knowledge needed to successfully integrate technologies such as MCN into the aviation sector. However, our responsibility as aviation regulator means we must ensure this is done in a way that ensures the safety of all airspace users, and in particular the safety of the general public.



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Next steps

The costs associated with enabling the use of MCNs in aviation will need to be modelled and funding options explored, taking into consideration the necessary engineering, safety, regulatory, oversight and logistical challenges. We intend to extend our collaboration with industry, leaving us better equipped to anticipate the many challenges and changes which could arise as a result of combining new and existing infrastructure into the wider aviation sector. Our hope is that by adapting we will produce more innovative, high-quality risk-based regulation to ensure safe design, operation and integration in the sector.

As part of our work on the CAA Future of Flight Programme, we will be running a series of industry workshops for C2 Link and C2CSP stakeholders. Attendees will have the opportunity to attend briefings and participate in workshops where we will share our recent work and policy concepts, guests will be invited to discuss the opportunities, issues and challenges to overcome as well as next steps towards implementation.

We hope that these workshops will provide industry, associated government agencies and industry bodies with a better understanding of what operators and the UK CAA might require from C2 Link systems in a regulated, aviation safety environment, and for us to better understand C2 Link equipment and service providers latest thinking, concerns and developments. This will enable us to plan a way forward that works for all stakeholders, ensuring barriers to progress are identified and plans put in place to mitigate them and move forward.

For more information and to register interest for these events contact C2link@caa.co.uk

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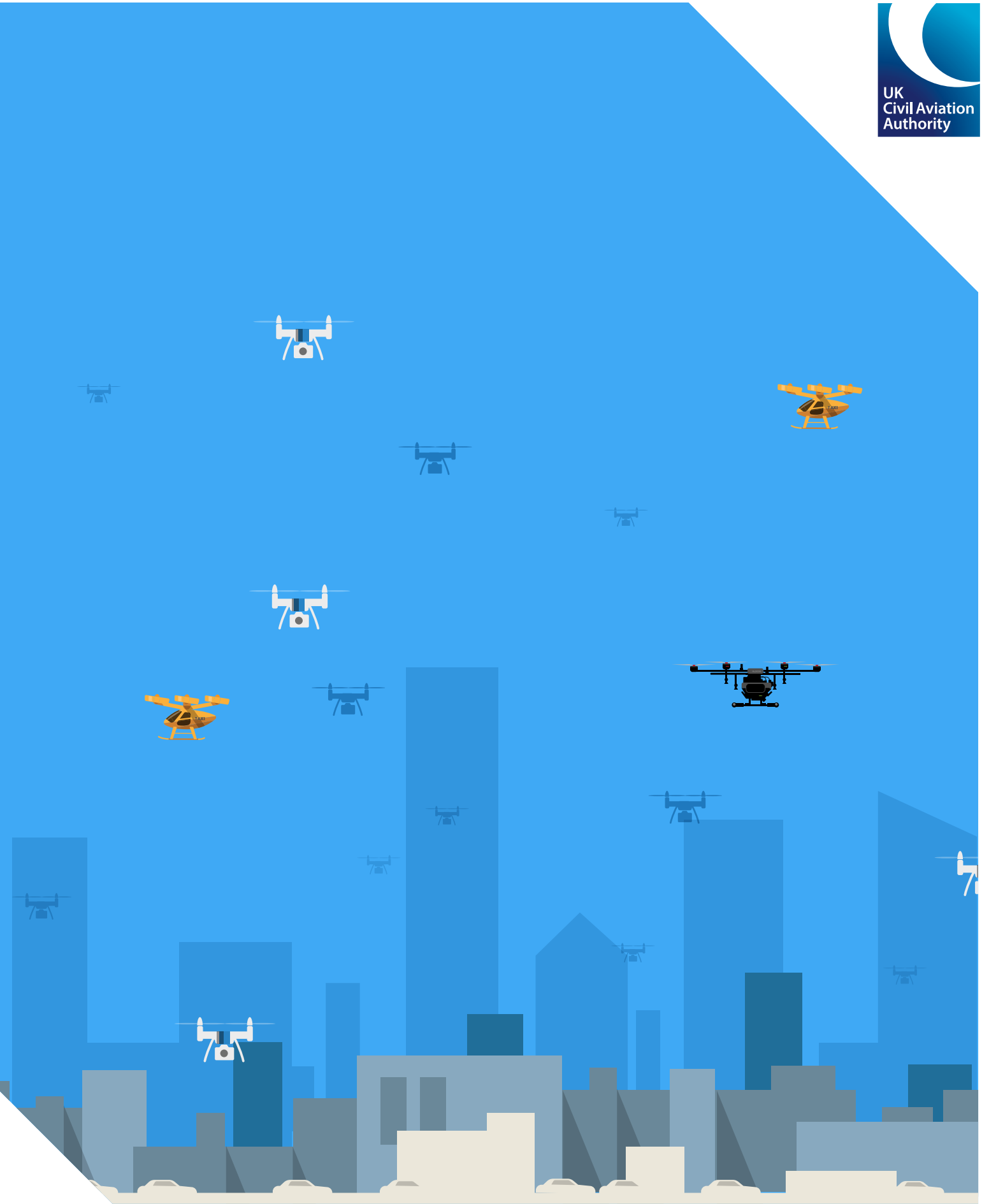

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