UK FUTURE OF FLIGHT

Department for Transport

UK Future of Flight Action Plan

March 2024

Contents

Cover Image provided by Vertical Aerospace

Department for Transport
Great Minster House
33 Horseferry Road
London SW1P 4DR

Government-Industry Statement of Intent

A third revolution in flight is underway, bringing new ways of flying that are safe, clean and cost-efficient, offering radically new ways to connect people and transport goods. This is not science fiction. It has already started.

The UK has a strong history in aviation innovation and a solid foundation in Future of Flight vehicles, both in Uncrewed Aircraft Systems (often called drones) and electric, Vertical Take-Off and Landing (eVTOL) vehicles (sometimes referred to as 'flying taxis'). Integrating these technologies at scale into our aviation system, transport networks and aerospace industry will see us as a world leader of this nascent sector.

We want to take this opportunity to create economic, environmental and social benefits – revolutionising the way we travel, deliver goods, and provide public services here in the UK. We want to seize the business opportunities and capitalise on the export potential of a new global industry. We want to harness Future of Flight technologies as a force for good and as a driver of growth in the UK.

Through the Future of Flight Industry Group (FFIG), we – Government and industry – have come together to provide leadership by setting out a clear vision for the future and the actions needed to make it a reality.

Success will not be straightforward. Integrating these technologies into our safe and long-established aviation system will require a collective and continuous effort to:

Fly at pace

Rapidly developing a policy framework and regulatory environment that enables trials and innovation, and effectively charts a safe path from demonstration to full-scale implementation.

Innovate

Developing, testing and deploying new technologies and services that are safe, secure and provide real economic and social benefits.

Promote

Building confidence in these new technologies among customers, citizens and investors.

Our organisations are committed to working with the FFIG to provide that collective and continuous effort and to achieve a flourishing UK Future of Flight sector.

Signed by

Anthony Browne MP
Minister for Aviation

Duncan Walker
CEO Skyports & FFIG Co-Chair

Summary

This Action Plan sets out a joint plan, co-designed by industry and Government, for a Future of Flight ecosystem that will deliver maximum value to the UK: its economy, its environment and its citizens.

It sets out:

1 **What we mean by Future of Flight**

2 **Why we need a Future of Flight Action Plan**

3 **Where we want to get to: our shared vision for the sector by 2030**

4 **What we will do to realise the vision**

5 **How we will deliver this vision between Government and industry**

6 **Next steps of ensuring delivery progress**

1 What do we mean by ‘Future of Flight’?

This document presents a plan for the development and industrialisation of emerging aviation technologies and their integration into the existing civil aviation system, where they can provide material economic, environmental and social benefits.

For the purposes of this document, this refers to all Uncrewed Aircraft Systems (UAS) – more commonly known as drones – used for commercial purposes, and all electric, Vertical Take-Off and Landing vehicles (eVTOLs).

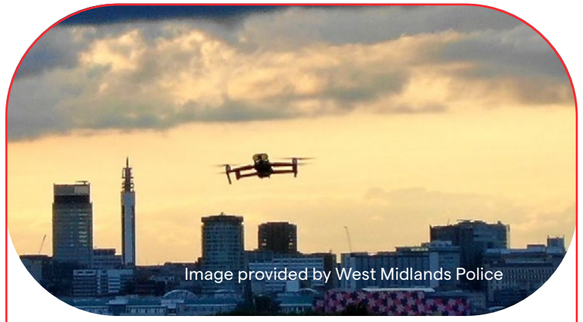


Image provided by West Midlands Police

UAS

UAS may be controlled remotely through the use of navigation systems, ground based units, or through automation, and are expected over time to be able to fly autonomously. UAS are already being used to deliver a range of utility applications including inspection, surveillance, and cargo delivery. UAS currently excludes aircraft designed to carry passengers.

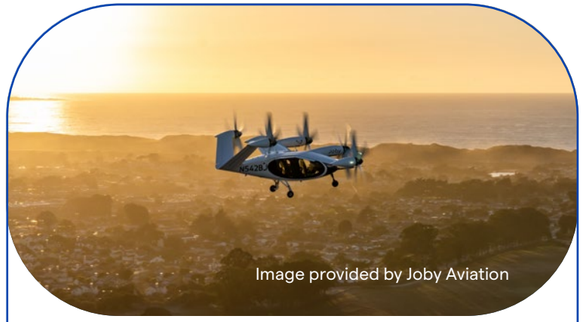


Image provided by Joby Aviation

eVTOL

eVTOLs may be used to transport passengers and cargo within, across and between urban and rural areas. eVTOLs have the potential to perform operations currently undertaken by other air and land vehicles, and offer opportunities to scale up due to forecast[1] lower levels of noise and emissions and a lower price point than helicopters. Like drones, eVTOLs will be equipped with increasing levels of automation. They will be crewed initially and are expected, over time, to be able to fly autonomously without a pilot onboard. Advanced Air Mobility (AAM) is an umbrella term used to describe an air transport system using eVTOLs.

Existing aircraft classes that are transitioning to new propulsion types such as electric, hydrogen or hybrid (for example, piloted electric conventional take-off and landing (CTOL) aircraft) are not covered within the scope of this plan, nor is military aviation. Nevertheless, the consideration of all operations is essential to the regulator, the Civil Aviation Authority (CAA), and its wider, cross-cutting goal of safely and efficiently integrating new airspace users alongside existing ones. It is also anticipated that technologies supporting UAS and eVTOLs will benefit the future operation of other aircraft.

The consideration of all operations is essential to the regulator, the Civil Aviation Authority (CAA), and its wider, cross-cutting goal of safely and efficiently integrating new airspace users alongside existing ones.

Future of Flight Industry Group

The Future of Flight Industry Group (FFIG) is the sponsor of the Future of Flight Action Plan, providing oversight and approval of the plan. Co-chaired by the Minister for Aviation and a senior representative from industry – currently Duncan Walker (Chief Executive Officer, Skyports) – it includes representatives from the organisations below:

NATS
Bristow
Skyports
ADS
Joby
LOGISTICS UK
VERTICAL
UK Research and Innovation
DRONE INDUSTRY ACTION GROUP
ALTITUDE ANGEL
CATAPULT Connected Places
AEROSPACE TECHNOLOGY INSTITUTE
Local Government Association
Regional & Business Airports Group
BBGA BRITISH BUSINESS & GENERAL AVIATION ASSOCIATION
UK Civil Aviation Authority
ARPAS-UK Association of Remotely Piloted Aircraft Systems
Department for Transport

2 Why a Future of Flight Action Plan?

The UK needs to have a clear plan today to reap the rewards of tomorrow – and that is where the Future of Flight Action Plan comes in. Only through an ambitious, far-sighted, action-oriented and collaborative approach between industry and Government that is sustained over a long-term horizon, can the UK become a global powerhouse in transformational aviation technologies that deliver commercial opportunities and benefits to society and the consumer.

Creating Commercial Opportunities

The UKRI Future Flight Challenge (FFC) – a joint Government-industry Programme backed by £125million of public investment – has shown that emerging aviation technologies can bring many benefits to businesses in the UK by enabling efficient and reliable delivery of services. UAS have the potential to reduce costs for businesses, deliver new services and reduce risk to human life by replacing or improving practices across industry and public services. AAM could boost urban, rural and regional connectivity and reduce congestion.

> PwC estimates the socioeconomic benefit of AAM for the UK could be between £1 billion and £2 billion annually by 2040

Benefitting Society and the Consumer

These new methods of flying will boost the number of sustainable transport options for deliveries and passengers. They may also offer environmentally friendly journeys that evidence indicates will be quiet[2], and produce little or no air pollution and greenhouse gases. UAS could provide essential public services, including NHS transport and medical deliveries, search and rescue, monitoring the environment and new tools for the Police to tackle crime. AAM also has the potential to ease the demand for existing congested infrastructure, make journeys quicker and provide new connections and capacity, especially in hard-to-reach areas. A recent report by PwC estimates the socioeconomic benefit of AAM for the UK could be between £1 billion and £2 billion annually by 2040, including reduced costs, passenger time and carbon savings.[3]

Potential impacts of and societal concerns around Future of Flight solutions, including around safety, noise and privacy will also need to be understood and addressed, in a way that is consultative, evidence-based and consistent with wider UK policy. The FFC is investing £1.8 million in social science research through the Economic and Social Research Council, with a recent public dialogue acknowledging potential benefits of Future of Flight technologies but highlighting concerns that need to be mitigated, including governance, social and environmental impacts.[4] Government and industry are continuing to collect evidence across different social groups, and we will remain alert to public appetite for Future of Flight technologies.

Building an Industry

Forecasts and scenarios about the potential future size of the UAS market vary widely and are highly uncertain. UAS could add tens of billions of pounds to the UK economy in the next 10 years through productivity benefits and lower costs. If the UK adopts UAS at scale, PwC estimates they could contribute up to £45 billion to the UK economy by 2030, through significant cost savings to the agriculture, water, energy, transport, logistics and public sectors.[5]

Estimates of the market size for AAM also vary, though industry forecasts suggest the global market could be worth billions of pounds in the coming decades. We aim to secure for the UK a significant share of the global market, with UK specific studies indicating AAM use cases as having the potential to significantly contribute to the UK economy. Notably, regional air mobility is highlighted as an attractive option for connecting locations where the construction of large-scale infrastructure may not be cost effective. Vertical Aerospace, building on global analysis from Roland Berger, estimate UK AAM market annual revenue could exceed £1 billion from 2035.[2]

> If the UK adopts UAS at scale, PwC estimates they could contribute up to £45 billion to the UK economy by 2030

Image provided by Vertical Aerospace

Future of Flight Technologies in Action

Image provided by Skyports

Delivering mail to remote areas

In 2023, the Orkney Islands became the first location in the UK to receive mail by drone, which saw Skyports Drone Services and Royal Mail work in partnership with Orkney Council Harbour Authority and Loganair. The Orkney I-Port Project received funding as part of the first accelerator backed by the Department for Transport's Freight Innovation Fund, delivered by Connected Places Catapult.

During a three-month trial, letters and parcels were transported from Royal Mail's Kirkwall delivery office to Stromness, from where Skyports Drone Services flew mail to Royal Mail staff on the islands of Graemsay and Hoy. From these locations, postal workers carried out their usual delivery routes.

European Space Agency funding to Skyports Drone Services will enable the enhancement of the Orkney Islands operation through the introduction of 5G/6G connectivity, and drones capable of carrying heavier payloads and with higher wind tolerances.

Led by Skyports Drone Services in collaboration with partners, including Satellite Applications Catapult, Hydrogen Aircraft Services and Cranfield University, Project Connectivity for Remote Orkney Future Transport (CROFT) represents a significant step in redefining the possibilities of drone technology for everyday mail delivery and shaping the future of connectivity in challenging environments.

Image provided by Joby Aviation

Urban air taxi

As our towns and cities grow, and economic activity shifts to reflect changing trends, it will prove increasingly challenging to travel across some regions seamlessly and sustainably without significant infrastructure costs. Future of Flight technologies can provide a cheaper, greener and faster solution to these connectivity gaps.

Joby's five-seat, piloted, electric aircraft is designed to deliver fast, quiet, and emissions-free journeys of up to 100 miles, at speeds of up to 200 mph. With only a simple landing pad required at each end of the journey, Joby's technology will allow travellers to move rapidly around large metropolitan regions, without creating negative environmental impacts, with Joby's evidence finding that a Joby take-off generates nearly a third less noise than a helicopter, whilst in-flight this is measured as being less than a conversation.[6]

Image provided by West Midlands Police

Rapidly & efficiently tackling crime

On the evening of Saturday the 15 July 2023, a call was received reporting a conflict between two groups in Stourbridge, West Midlands.

West Midlands Police (WMP) Drone Team were nearby and quickly deployed a UAS to search for the offenders. After two people matching the description of the offenders were located leaving the woods by the drone, firearms officers arrested them.

The drone continued to search and a further suspect was spotted escaping from the woods, into a back garden, before disappearing into a house. Officers surrounded the premises whilst the drone kept constant watch. The suspect was called out of the address and arrested.

In this example, the use of UAS was calculated by WMP to be quicker and more cost-effective than deploying a helicopter. Success stories like this result from a greater range of tactical options afforded to police forces by drones' use and contribute to efficient allocation of resources to improve interoperability cross-emergency service.

Image provided by Skyfarer Ltd.

Reliably improving NHS efficiency, whilst cutting carbon

In the period between October 2022 and March 2023, Skyfarer – a UK drone service provider – partnered with University Hospitals Coventry and Warwickshire (UHCW) NHS Trust and Medical Logistics UK, a private medical supplier – to explore the use of Uncrewed Aerial Vehicles (UAVs) as a method of transport between the Trust's sites, specifically for ad hoc medical deliveries.

Over the course of 30 hours of beyond visual line of sight (BVLOS) day and night flights, taking place throughout the winter months (weather dependant) and totalling 1,900km, UAVs were used to deliver surgical implants and pathology samples between UHCW NHS Trust's sites in Coventry and Rugby.

The drone solution was able to reduce surgical implant delivery times from University Hospital, Coventry to the Hospital of St Cross, Rugby to a reliable 18-minute transfer, down from 30–45 minutes by road, in rush hour. Crucially, the trial evidenced CO_2 emission savings against existing logistics solutions of up to 99.8% compared to a diesel van and 90.5% compared to an electric van. Pathology samples were flown on the reverse route from Rugby's Outpatients department to the Coventry pathology lab. This pilot initiative, carried out at no cost to the NHS, is being used to educate and inform the Trust on the feasibility of medical drones moving forward.

Image provided by Vertical Aerospace

Regional air mobility

Many places across the UK find themselves disconnected due to aging infrastructure and a lack of sustainable, affordable transport solutions.

Bristol-based Vertical Aerospace is pioneering a solution to this problem. Its battery-powered eVTOL aircraft, the VX4, will carry four passengers over a 100 mile range with no operating emissions.

In the UK, the VX4 will be able to join Liverpool and Leeds in just 26 minutes (as opposed to 1.5hrs by car) or Brighton and Heathrow Airport in only 20 minutes (currently 80 minutes).

This will deliver desperately needed transport improvements to regions and locations suffering from a lack of connectivity.

Image provided by Sees.Ai

Safely, accurately & efficiently managing national infrastructure

When delivered with a helicopter, aerial inspections of the electricity transmission network cost time, money, and are relatively carbon intensive. Moreover, on-site inspections carry safety risks for employees. In 2023, Boeing-backed autonomous flight technology developer, sees.ai, became the first UK company to secure routine permission from the CAA to fly drones BVLOS in non-segregated airspace. These flights are being used for aerial survey and inspection missions on a stretch of National Grid's transmission network.

This use case enables grid operators to more efficiently, effectively and safely determine asset conditions and develop optimal maintenance plans at a lower cost and with reduced carbon emissions. It also provides evidence for a potentially huge global market for this technology. Notably, PWC[5] found that BVLOS powerline inspection would provide a 35% cost saving compared with VLOS, along with benefits to efficiency, staff safety and quality.

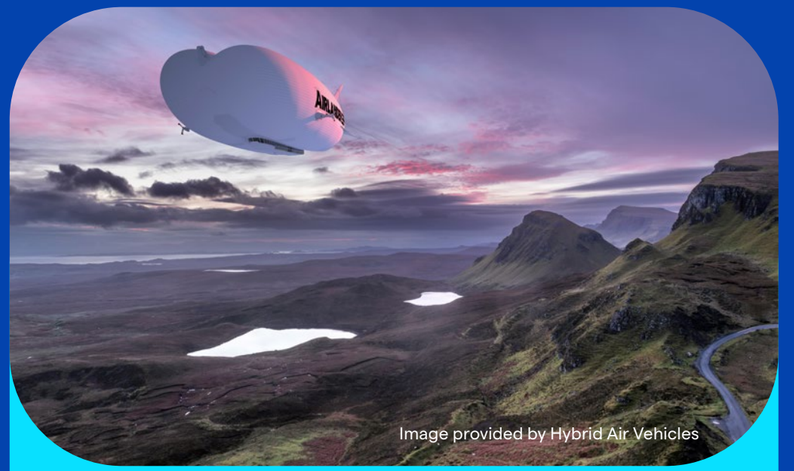


Image provided by Hybrid Air Vehicles

Connecting Scotland's highlands and islands

Due to its collection of outlying islands, sparse population density and challenging weather conditions, the Highlands and Islands of Scotland have a unique set of challenges to overcome in providing cost effective and efficient means of transportation to its communities with sufficient capacity to encourage economic growth.

Hybrid Air Vehicles (HAV) is the British company behind Airlander, an ultra-low emissions hybrid aircraft family.

HAV undertook a study with SATE (Sustainable Aviation Test Environment) consortium partners in Scotland's Highlands and Islands to determine the feasibility and benefits of introducing Airlander 10 to support transport across the area. The study found that Airlander would complement the existing ferry and small aircraft network, bringing much greater passenger and freight capacity to the region with minimal infrastructure adaption and capital expenditure required.

3 Where we want to get to

Our Shared Vision for 2030

By 2030, the UK will be a leader in emerging aviation technologies, with a sustainable industry and thriving ecosystem at home and UK companies providing a range of services around the world.

UK industries and the public will enjoy economic, social and environmental benefits thanks to the widespread availability of these technologies within our economy, communities and transport networks.

Image provided by Joby Aviation

4 How we will deliver: Roles & Responsibilities

Collaborative action is key to realise the benefits. Through the development of this Plan, FFIG members have agreed to adhere to shared principles and their roles & responsibilities to contribute to the success of the Plan.

Central Government

Central Government has a key role to play, in both enabling the vision and actualising it through use of the technologies that result:

Policymaker
Developing a clear cross-governmental policy framework and articulating this to industry; making access requirements clear; making and communicating prompt, clear decisions.

Champion
Actively and visibly backing the UK Future of Flight sector, at home and on the world stage.

Problem Solver
Anticipating and overcoming barriers, pinch points and market failures.

Customer
Implementing solutions in the public sector as an end user; fostering a market; demonstrating emerging technologies' ability to save time, costs and lives.

Convenor and Investor
Using the Government's Future Flight Challenge to bring the ecosystem players together to jointly develop the system of systems and funding with £125m of public investment.

Civil Aviation Authority

The CAA has a key role in delivering the regulatory frameworks and processes that will enable the UK Future of Flight vision, whilst continuing to keep the public and all aviation users safe:

Regulator
Maintaining effective regulations enabling Future of Flight technologies to safely develop, integrate and operate in the UK; developing new regulations as technology progresses.

Coordinator
Ensuring that authorisation and oversight of operators and services is timely, commensurate with risk, and clearly communicated with providers and those affected.

Overseer
Ensuring the ecosystem is developed and functions in a way that is safe, secure and protects the consumer.

Industry

If enabled, industry can deliver the UK Future of Flight vision, by successfully acting in the following capacities:

Innovator
Continuously developing newer technologies and solutions.

Constructor
Developing physical and digital infrastructure; contributing to the development of regulation and standards.

Operator
Bringing to life the uses and benefits of Future of Flight technologies through real-world applications and provision of services.

Skills trainer and employer
Making the UK Future of Flight industry an exciting, rewarding and accessible place to work with wide-ranging and diverse opportunities.

Communicator
Communicating plans and progress to the public, Government and regulator; responding to consultations.

Our Shared Principles

Safety and Security
Safety within the aviation system remains the highest priority; adoption and integration of emerging technologies will require risk-based proportionate regulation and technology. Safety is complemented by a robust approach to information and physical security.

Sustainability
We are committing to putting an effective regime in place with robust standards which will prevent adverse community and environmental impacts from arising.

Pace
Many of these technologies are ready for industrialisation. We will work at pace to ensure the UK is an early adopter and rapid innovator, deriving benefits from real world applications.

Transparency
Government and industry will communicate with one another (and the public) honestly about plans and proposals.

Evidence-based
Potential impacts of and societal concerns around Future of Flight solutions including around safety, noise and nuisance, and privacy will also need to be understood and addressed, in a way that is consultative, evidence based, and consistent with wider UK policy.

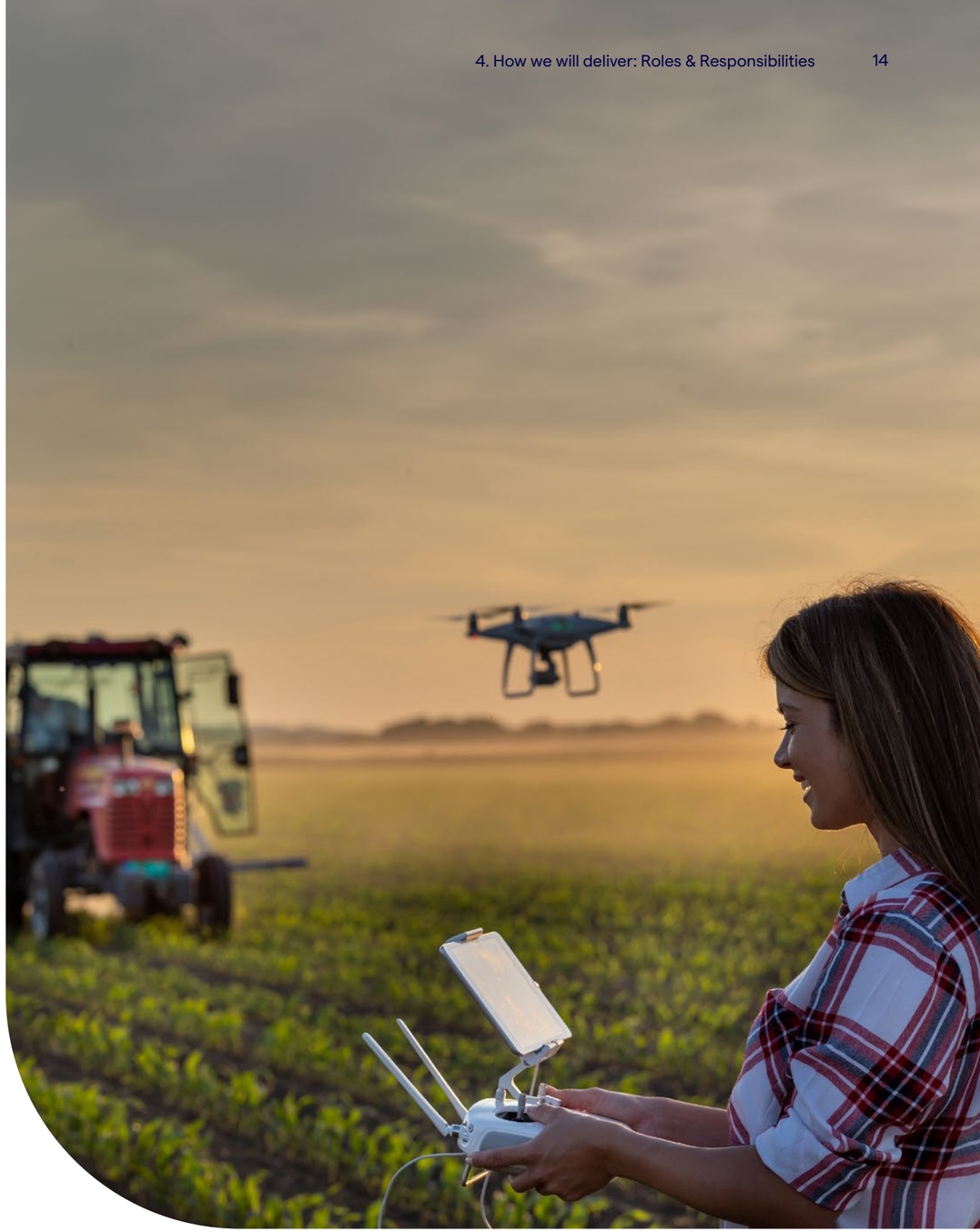
Inward-supporting
We will look to support UK industry in our approaches, pursuing co-benefits in skills, jobs and supply chains, and harnessing our world-class aerospace sector wherever possible.

Outward-looking
The UK will play an active role in convening, integrating and delivering a new aviation ecosystem, furthering international collaboration, creating international harmony of rules, pursuing smooth validation and production in different markets.

Collaborative
Government and industry will work collaboratively – including through the FFIG and cross-government communication channels, and in the development of regulations and guidance – and secure the buy-in of as diverse a range of stakeholders as possible.

Informative
We will inform and involve local communities and their representatives, listening actively to concerns and making technologies, operations and benefits available nationwide.

Solutions-focused
Anticipating and overcoming barriers, pinch points and market failures.



5 Delivering the Vision

Strategic Outcomes

Achieving our vision of unlocking the full range of services and benefits offered by Future of Flight Technologies entails collaborating to deliver key Strategic Outcomes (SO).

Airspace

At the core of the Airspace Modernisation Strategy (AMS) is the safe integration of all future airspace users alongside existing users. We will continue to work closely with the delivery of the AMS to ensure the requirements of new owners and operators are fairly considered and supported to meet the timescales sought by industry

UAS

For UAS, our SOs relate to achieving routine operations beyond the pilot's visual line of sight (BVLOS). These operations are currently only carried out in segregated airspace, due to unmitigated risk of mid-air collision resulting from the lack of approved solutions for UAS to see, be seen by and avoid other aircraft in the absence of an onboard pilot. Enabling BVLOS operations at scale by mitigating this risk will broaden the range of potential uses and deliver the significant benefits of UAS.

SO 1 **Demonstration**

BVLOS UAS operations in non-segregated airspace

UAS operating BVLOS will move away from segregation from other airspace users to accommodation alongside them in new airspace structure and existing ones supported by new services, expanding UAS potential applications and uses.

SO 3 **Routine**

BVLOS UAS operations in integrated airspace at scale

BVLOS operations will be routine across the country, using significant blocks of controlled, uncontrolled and service supported airspace, providing UAS' full potential range of applications including inspections, surveillance, critical health care and emergency response.

2024 2025 2026 2027 2028 2030

eVTOL

For eVTOL, our SOs are focused on delivering initial, and then routine operations carrying passengers or cargo and achieving demonstrations of autonomous operations – during which the aircraft is operating without pilot intervention in the management of the flight. These SOs set out a clear pathway from the current innovation phase to an industry delivering services at scale.

SO 2 **In Operation**

Piloted eVTOL flight

The UK will see cargo and passenger operations by eVTOL aircraft for the first time, capitalising on new infrastructure, regulation and technology supported by existing airspace operating and aerodrome rules.

SO 4 **Routine**

Piloted eVTOL flight operations

Commercial cargo and passenger operations by eVTOL aircraft will occur at scale from nationwide networks comprising adapted existing aerodromes and new vertiports.

SO 5 **Demonstration**

Autonomous eVTOL flight

These operations will offer a path to scaled commercial activity and longer-term sustainable operations.

The Plan

The delivery plan set out overleaf is a high-level summary of the major commitments and deliverables that need to be achieved on the way to reaching our Strategic Outcomes.

Image provided by Apian

UAS Pathway

The UAS Pathway leads to two Strategic Outcomes focussed on allowing BVLOS operations in non-segregated airspace: SO1 will see the demonstration of such operations by 2024, and SO3 will unlock widespread BVLOS operations by 2027.

The pathway overleaf focusses on what's needed to deliver these, specifically:

Operational capabilities

Emerging aviation technologies currently operate in controlled environments to ensure safety of people on the ground and aircraft in the air. These controlled environments are currently known as Temporary Danger Areas which are valid for testing for up to 90 days. It is planned to expand testing environments to longer durations (of up to 12 months), where the emerging aviation technologies will operate alongside other forms of air traffic in a non-segregated airspace environment. These longer-duration testing environments, known as Temporary Reserved Areas, are made possible through various means: communicative on-board technologies, ground-based systems, or facilitation in environments which are deemed lower risk. This Action Plan moves emerging aviation applications from initial testing to scaled routine operations, advancing on the level of integration with other forms of existing air traffic.

Technological developments

New industry-led technological developments are needed to support airspace integration including electronic conspicuity (EC) devices enabling aircraft to identify others' locations, uncrewed traffic management (UTM) to support integrated air traffic management, and systems to allow UAS (and other airspace users) to detect and avoid (DAA) one another. These industry-led solutions need to undergo trials firstly in simulated regulatory sandboxes and then physical trials, leading ultimately to their certification. Industry will deliver these solutions, regulators (and British Standards Institute – BSI) will establish specifications for their performance, and Government will set policies and legislation for their widespread adoption.

Access and regulation improvements

For quicker and easier assessment of operations' applications using new digital platforms and methodologies. We will adopt a UK version of the Specific Operating Risk Assessment (SORA); a new, standardised way to assess and manage the risk posed by a UAS operation. We will review, refresh, and digitise the most common existing pre-defined risk assessment (PDRA) for VLOS operations to enable quicker access to routine operations, and explore the introduction of further PDRAs following SORA implementation based on industry demand and evidence. The recently updated airspace change process to make applications easier will be supported with new CAA guidance for applicants and a portal for applications. These improvements from the CAA depend on evidence and collaboration from industry.

Building an Industry

That works for the UK and its communities. This includes supporting the UAS manufacturing industry to develop by providing new frameworks for assessing and establishing aircrafts' flightworthiness and manufacturing standards. These frameworks will provide confidence to individuals and communities affected by UAS services that safety and security has been appropriately considered. It also includes setting Government policy to support the development of operations that considers communities by defining noise and planning policy, anticipates and addresses legal implications, and develops UK skills by setting a framework for remote pilot competency. Government has a role in championing industry through public procurement for the many UAS services that benefit public services.

Through the implementation of this plan, we expect UAS operations to move from 90-day trials to every-day usage in surveying, business-to-business logistics, last mile deliveries, and in supporting more efficient delivery of health, policing and emergency service.

UAS Pathway to Achieving Strategic Outcomes 1 & 3

Operational capabilities

2023

- BVLOS in temporary (90-day) and segregated airspace (Temporary Danger Areas (TDA))
- VLOS in uncontrolled airspace

2024

SO 1 Demonstration of BVLOS UAS operations in non-segregated airspace

Trials:

- in uncontrolled airspace supported by ground infrastructure;
- in 'atypical' air environments presenting low risk of collision;
- in temporary (6–12 months) Reserved Areas (TRAs) using communicative technology with other users in Transponder Mandatory Zones (TMZ)

2025

- BVLOS in uncontrolled airspace, supported by ground infrastructure demonstrated
- Scaled BVLOS in 'atypical' air environments
- Increased BVLOS in TRAs
- BVLOS in TMZs in uncontrolled airspace and controlled below 500ft

2026

- Increased BVLOS in TMZs

2027

SO 3 Routine BVLOS UAS operations in integrated airspace at scale

Technology development

...to support airspace integration

Industry-led development of traffic management, detect and avoid, and electronic conspicuity solutions – key technological developments providing visibility and the ability to avoid other aircraft so UAS can safely integrate into airspace

Certifiable ground-based DAA solutions – industry-led solutions providing the ability to detect and avoid other aircraft using ground-based infrastructure

Uncrewed Traffic Management (UTM) sandbox – CAA-led simulated trials of industry-led traffic management services that allow UAS to be safely integrated into airspace

Certifiable on-board EC & DAA solutions – industry-led solutions providing the ability to detect and avoid other aircraft and provide visibility to other users

Technical, authority and organisation requirements for UTM providers – pending successful trials and demonstrations of technical ability, regulations will be implemented to govern UTM provision

Physical trials of system-wide information management (SWIM) solutions – physical trials of industry developed solutions will support integrated management systems by enabling the management of Air Navigation Services provided to users

Access and regulation

...for quicker and easier assessment of operation application applications

Updated airspace change process – Process established in October 2023 came into force to Jan 2024. This improves the process for operators to sponsor changes to airspace and accommodate new operations using appropriate standards

Updated airspace management policy – using evidence gathered from trials, we will pave the way for sustainable BVLOS through the use of TMZs

Future Flight Challenge Phase 3 project demonstrations and collection of evidence by Industry on routine operations – An evidence base of the most common operations is necessary to inform the regulators to development of predefined risk assessments

Refreshed and digitised Predefined Risk Assessment (PDRA) available for repeatable UAS operations – PDRA01 – Which provides a path to routine VLOS operations – is being reviewed to make the application process quicker and easier for operators. Once reviewed PDR01 will become the first type of operational authorisation hosted on the CAA's new digital application platform

Adoption of UK Specific Operation Risk Assessment (SORA) methodology – A new way to classify the risk posed by UAS operations, and then identify mitigation and safety objectives to counter those risks

Updated airspace change portal – The portal will be updated routinely, allowing for new users to sponsor airspace change requests necessary for UAS operations

Potential development and publication of further PDRAs based on evidence base and industry demand – Pending a comprehensive understanding of demand supplied by industry. The most common applications will be used for Predefined Risk Assessments to speed up access to repeatable operations

Fully digitised SORA process for operational authorisations – The CAA Digitising Specific Category Operations (DiSCO) project will digitise the application and risk assessment process for UAS operators, allowing for greater transparency and a better customer experience

Building an industry

...that works for the UK and its communities

Expanding scale of UK UAS manufacturing – A growth in scale and variety of commercial operations will increase demand

Consultation and publication of framework for UAS flightworthiness – Standards of flightworthiness will be established as a means to assess the suitability of aircraft to perform operations, providing greater assurance of safety

Consultation and publication of Advanced Remote Pilot Competency – Establishing the future pilot competency requirements needed to enable more complex and scalable UAS operations

Framework for addressing the legal implications of Future of Flight technologies – Following research commissioned by Future Flight Challenge, Government will have a framework for addressing legal implications of Future of Flight technologies, including over privacy and overflight

A network of CAA-accredited Flightworthiness Assessment Entities – An industry of competent organisations will be used to assess the robustness of aircraft being operated supporting the increased scale and complexity of uses

National noise policy for UAS – To ensure UAS services are safe and acceptable for communities

Production of UAS at scale, meeting flight, worthiness, standards and trialing of certified and/or autonomous UAS – Using existing and updated regulatory frameworks, trial conditions will be used to advance and certify the autonomous capabilities of UAS

Implementation of manufacturing standards for UAS – UKCA markings will testify to UAS on the market being safe and secure

Public sector procurement for UAS services – Blueprints for delivery of non-military public services using UAS, including in health, coastal monitoring and search & rescue

Planning System – Consider how the planning system can support delivery of infrastructure needed to enable the Future of Flight and make it work for communities

Key

- Government
- CAA
- Industry

eVTOL Pathway

The eVTOL pathway leads to 3 Strategic Outcomes for the initial and then routine commercial operation of piloted passenger-carrying eVTOLs, and then initial demonstration of autonomous capabilities offering a route to the full scale of a sustainable AAM ecosystem. The activities outlined in the UAS pathway that support integrated traffic management of uncrewed aircraft and crewed aircraft remain key to achieving the eVTOL strategic objectives but are not repeated in the eVTOL pathway.

The pathway overleaf focusses on what's needed to deliver these, specifically:

Operational capabilities

The demonstrations necessary to prove the viability of eVTOLs and the ecosystem, and their operational capabilities that will – pending successful trials and certification – see us meet our Strategic Outcomes. Currently there is initial flight testing of eVTOL prototype vehicles that will develop through flight tests to certify the vehicle types and then demonstrations of piloted journeys. In particular, there is the Government-Industry Advanced Mobility Ecosystem Consortium that is working to understand mission demonstrations to prove eVTOL as a viable, functional and secure technology and passenger option. This will support achievement of the first and then routine piloted eVTOL flights in operation in 2026 and 2028, respectively. Concurrently, trials of remotely-piloted flights will begin as an important stepping stone to demonstrations of autonomous flights by 2030.

Physical infrastructure

Establishing the physical infrastructure to support eVTOL flights is a key area of activity to enable the Strategic Outcomes. This involves work that is industry-led, whilst supported by Government, the regulator and local communities, to develop a network of vertiports using existing aerodromes and airports as well as new sites. These will need to develop the charging infrastructure and appropriate electrical energy provision. The CAA will support the development of vertiports by setting out the technical and operational requirements for adapting existing sites, then new bespoke sites, and adopting the international standards to support international business.

Building an industry

Industry-led technological developments on eVTOL to improve their capabilities and specifically battery technology and autonomous navigation are key to increase the range, applications and costs of eVTOL services. CAA will support the industry to develop by outlining the requirements: for vehicles to be certified and their airworthiness; operations for airlines; and for pilots. Also necessary is the setting of Government policy to support the development of operations that considers communities by defining planning policy, and considering legal implications and security requirements.

Through this plan, we expect to see operational networks grow in scale and range from initial routes to large scale networks between nodes comprising both established aerodromes and new vertiports, offering urban and regional transport options to the consumer.

eVTOL Pathway to Achieving Strategic Outcome 2,4 and 5

Operational capabilities

2023

Initial flight testing of eVTOL prototypes has been carried out

2024

Type Certifcation Flight Tests using adopted certification conditions

2026

SO 2 Initial passenger-carrying piloted eVTOL operations

2027–28

SO 4 Routine commercial passenger-carrying piloted eVTOL operations

2029–30

SO 5 Initial autonomous eVTOL operations

Demos of passenger-carrying piloted operations

Trials of remotely-piloted flights as a step to autonomous flights

10–20 trials of autonomous flight

Technology Development

...to support airspace integration

Selection and early preparedness of Vertiports – Identified by industry, working with Government and communities supported through Future Flight challenged demonstrations

First vertiport operationally ready in the UK

Requirements for existing aerodromes and heliports, wishing to accommodate eVTOL – To support the development of the adaptation of existing sites for eVTOL use

Initial development of charging infrastructure – Integration of charging infrastructure will be critical in ensuring vertiports' ability to accommodate efficient and low carbon services

Technical and operational requirements for bespoke vertiports – To support the development of bespoke sites

Electrical energy provision known and planned – Vertiports will need appropriate grid access and supply to service the eVTOL

Integration of interoperable energy infrastructure into vertiports

A network of 20 commercial vertiports in regional clusters – To include a combination of new and adapted sites

Adoption of international standards and recognised practices for vertiport design – ICAO's standard and recognised practices will be followed supporting international potential of UK businesses

A network of more than 80 vertiports nationwide

Building an industry

...that works for the UK and its communities

Vehicle certification requirements – We are adopting EASA's Special Condition for VTOL standards that will allow an internationally informed approach to be taken to aircraft certification by the CAA

High-level requirements for eVTOL airlines – To provide clarity to prospective commercial operators in support of their operations' development

Security policies for Vertiports and VTOL – Government and CAA will develop physical and cyber security policies based on risk assessment

Framework for addressing the legal implications of Future of Flight technologies – Following research commissioned by Future Flight Challenge, Government will have a framework for addressing legal implications of Future of Flight technologies, including over privacy and overflight

Planning System – Consider how the planning system can support delivery of infrastructure needed to enable the Future of Flight and make it work for communities, including vertiports

Continued airworthiness policies and requirements – Standards of airworthiness will be established as a means to assess the suitability of aircraft to perform operations, providing greater assurance of safety

Updated Air Operations procedures and rules – to support the development of eVTOL service operators

Aircraft specific pilot requirements for existing commercial, aeroplane and helicopter pilots – The process for accreditation of existing pilots to operate eVTOLs will be tied to certification of the specified aircraft

eVTOL pilot training processes for new pilots – establishing competencies and developing an appropriately skilled workforce

Continued advancements in electric/ battery technology – Industry-led technological development that will increase range and payload for aircraft as well as driving cost reduction in manufacturing

Development of autonomous navigation capabilities – Industry-led technological development for autonomous vehicles and operations

Regulatory framework to support autonomous passenger aircraft operations – Building on evidence of demos and supporting market developments in ways that work best for the communities affected

Additional competency and licensing requirements for remote eVTOL pilots – Supporting the development of remote, piloting and ensuring safety remains a high priority

Key

- Government
- CAA
- Industry

Building Blocks

As well as the technology-specific activity needed to deliver our Strategic Outcomes, UAS and eVTOL flight technology will need to be supported by further cross-cutting systems and structures. Delivering our vision for a thriving industry and sustainable ecosystem depends on these building blocks being in place:

Community Integration

Engage communities early and consistently. Ensure technologies deliver the benefits and concerns are addressed.

Actions

Government will support local authorities in introducing Future of Flight into planning and communities. The Government intends to consult on the introduction of new National Development Management Policies and corresponding changes to the National Planning Policy Framework this year, which will be subject to a public consultation and Strategic Environmental Assessment. The Department for Transport will work closely with the Department for Levelling Up, Housing and Communities (who are responsible for national planning policy) and expect that any future aviation and planning policy we consider will continue to build on the existing framework.

Industry will work with Local Authorities on locally-appropriate solutions.

Industrialisation

Support UK industrialisation of UAS and eVTOL supply chains through access to scale-up and export finance.

Actions

Government and **Industry** will develop joint industry-government mechanisms to support industrialisation post Future Flight Challenge.

Skills & People

Create a community of professional staff including pilots, engineers and designers, through world-leading training programmes and education pathways supported by standards.

Actions

Industry will invest in UK aviation skills and pilots continuously.

Government will publish a skills gap analysis and acquisition strategy in 2024.

Digital Infrastructure

Connect stakeholders digitally, across a secure UK-wide network that supports a safe and efficient ecosystem.

Actions

Industry will undertake a consultation in 2024 and deliver digital services to support safe airspace integration in 2025.

Government will explore introducing ‘Digital’ flight rules for digital operation of aircraft.

Standardisation

Develop industry-wide interoperability and harmonisation of solutions, using new standards.

Actions

Industry will steer the creation of effective standards through BSI’s Future Flight Standards Programme.

Government will ensure consideration of industry standards by regulatory and legislative frameworks.

Autonomy

Develop autonomous capabilities offering the ability for aircraft to safely deliver function and services at maximum scale with a diminishing level of human involvement.

Actions

Industry will continuously develop safe autonomous capabilities and systems, working with the CAA to trial and certify these.

Government will review the legal challenges of autonomous flight by 2025 and update the legal framework accordingly in response to findings.

6 Next Steps

This Action Plan sets out a clear vision, Strategic Outcomes and deliverables against which we can measure progress.

We will work together collaboratively to deliver the Strategic Outcomes in line with the pathways set out in this plan. Industry will continue to progress the required technological developments and trials. Government and CAA will support the trials, set direction and policy to clarify the regulatory framework. We will communicate achievement of the policies, legislation and regulation through the existing CAA and GOV.UK websites.

We will hold ourselves and each other accountable to the roles, responsibilities, principles and actions defined in this plan through the FFIG. Regular updates on progress against delivery of these actions and progress towards the Strategic Outcomes will be delivered at least annually.

Image provided by Joby Aviation

Endnotes

1 ‘Acoustic Flight Test of the Joby Aviation Advanced Air Mobility Prototype Vehicle’: https://ntrs.nasa.gov/api/citations/20220006729/downloads/Aeroacoustics2022_Pascioni_STRIVES5.pdf

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4 Sciencewise, Future Flight Challenge – Mini Public Dialogue, 2022. Available at: https://www.ukri.org/publications/future-flight-social-science-considerations-and-research/

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Department
for Transport