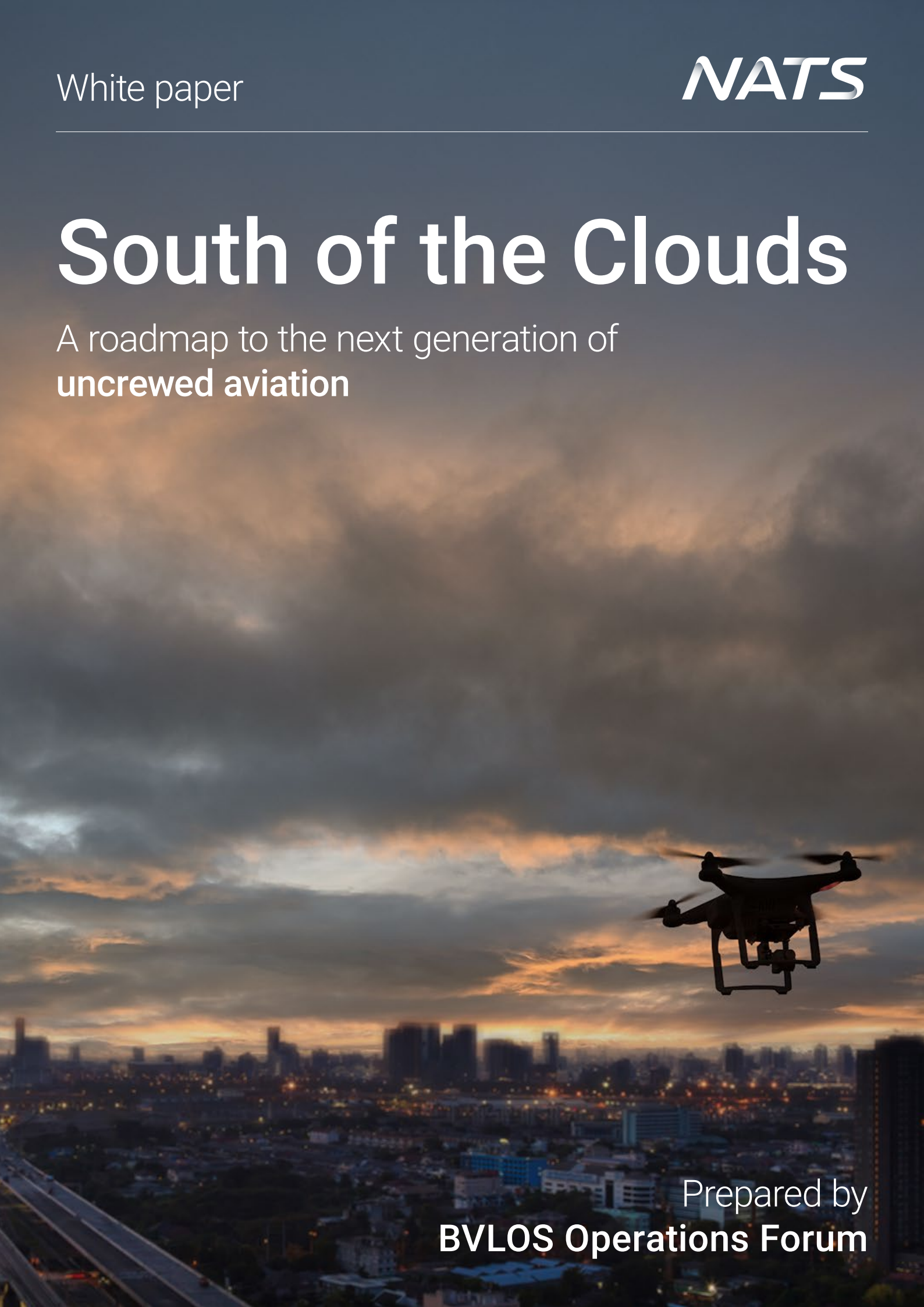
White paper

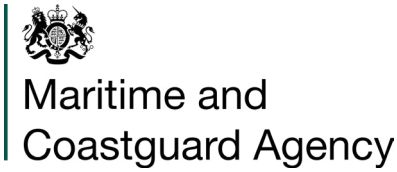
NATS

South of the Clouds

A roadmap to the next generation of
uncrewed aviation



Prepared by
BVLOS Operations Forum



The BVLOS Operations Forum includes the UK's leading commercial drone operators and industry stakeholders, all of whom share the goal of achieving sustainable Beyond Visual Line of Sight (BVLOS) operations.

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Foreword

The economic, environmental, health, societal and safety benefits associated with the application of drone technologies are starting to be experienced in the UK, but the full potential of their use is yet to be realised. Flying uncrewed aircraft - 'drones' - beyond the visual line of sight (BVLOS) of their pilots, creates advantage in numerous applications including health care delivery, search and rescue, connection of remote communities, Infrastructure inspection, removal of people from safety risk in industrial settings, and environmental monitoring.

However, the route to provision of services through BVLOS flight operations is currently both difficult to navigate and time consuming to complete. Airspace integration is key – enabling all to share the air and maintain the current high levels of access. Whilst the safety case for uncrewed and crewed aircraft to fly in the same airspace is being developed and evidenced through flight trials, it largely remains necessary, in the short term, to segregate uncrewed aircraft from those with pilots onboard. For most BVLOS applications, the airspace construct used to provide segregation is limited in its duration of use, time consuming to apply for and not easily repeatable. As such, routine, scalable BVLOS operations, the key step towards commercial sustainability, are currently unachievable..

Bringing BVLOS operators together to collaborate on the development of solutions to these problems, the BVLOS Operations Forum was formed. The Forum, which includes the UK's leading beyond-visual-line-of-sight (BVLOS) operators, brings together organisations at the cutting edge of uncrewed flight to learn from each other's experiences, collectively improve their operations, and jointly develop solutions to the challenges faced by this fast-growing industry.

This white paper has been co-created by The Forum to outline the imperative of BVLOS operations, and to recommend the way forward to achieve routine, scalable BVLOS operations, integrated with other traffic, making uncrewed aircraft a safe and effective option in the aeronautical toolbox.

Russell Porter - BVLOS Operations Forum Chair
Head of UTM Stakeholder Engagement, NATS

Glossary of key terms

Airspace Manager	An organisation that co-ordinates and manages the movement of air traffic within defined areas of airspace, ensuring flights can operate safely and efficiently and ensuring equal access to airspace.
ATM	Air Traffic Management. The aggregation of the airborne and ground-based functions (air traffic services, airspace management and air traffic flow management) required to ensure the safe and efficient movement of aircraft during all phases of operations.
BVLOS	'Beyond visual line of sight', drones operate at distances beyond the visual range of the drone pilot.
DAA	'Detect and Avoid' capabilities analyse the environment around the aircraft, decide whether a collision is imminent, and generate a new flight path to avoid collision if necessary. They are one option for allowing uncrewed aircraft to integrate safely into airspace, avoiding collisions with other aircraft, buildings, power lines and other obstacles.
FIS	'Flight Information Service' is a form of air traffic service which is available to any aircraft in both controlled and uncontrolled airspace and is intended to provide useful information to the pilot e.g., weather information.
SDSP	'Supplementary Data Service Providers' offer additional data services and information to inform decision-making and tailor services to the environment, sector or geography of drone operations, e.g., weather services, geographical information services (terrain and obstacle data), surveillance data and aeronautical information.
TDA	A Temporary Danger Area, or 'TDA', is an area of airspace within which activities are permitted to take place which could endanger the flight of other aircraft. For example, the majority of BVLOS operations still require the use of segregated airspace to ensure separation from traditional crewed aircraft, so TDAs are used to achieve this. It is UK specific, some other countries use different terms.
TMZ	'Transponder Mandatory Zones' are areas of airspace where the carriage and operation of reporting transponders or other approved electronic conspicuity system is mandatory, i.e., all aircraft must be equipped with technology to broadcast flight information.
UTM	A specific aspect of air traffic management which manages UAS operations safely, economically, and efficiently through the provision of facilities and a seamless set of services in collaboration with all parties and involving airborne and ground-based functions. A UTM system is a tool for managing uncrewed aircraft to ensure mid-air collisions are avoided. A UTM Provider is an organisation that provides this service.
Uncrewed Aircraft	In the context of BVLOS operations, the aircraft is an uncrewed remotely piloted system that may be operated using automatic pre-programmed flight.

Further abbreviations are defined on page 18.

The story so far

The uncrewed aviation sector is advancing rapidly. Trials, testbeds, and sandboxes, set up to test and develop concepts at a local level, have enabled the demonstration of uncrewed flights beyond the visual line of sight (BVLOS) of their pilot which have led to substantial innovations – so much so that commercial operations are now taking place, a feat which seemed implausible not long ago.

All this work has brought the industry to a crucial point of evolution. Widespread use of uncrewed aircraft, which could bring enormous economic, social, health, and environmental benefits, is within reach – but several hurdles remain.

The downside to the rapid pace of innovation is that standards and regulations lag industry. Today's real-world flights are taking place in either testbed environments, or in restricted 'Temporary Danger Areas' which are difficult to obtain, an inefficient use of airspace, disruptive to other airspace users, and were not developed to deal with the scale of requests now being seen from the uncrewed aviation industry. This arrangement has served a purpose in enabling the sector to develop and grow to such a point that it has now outgrown those constraints.

While there have been signs that the Government recognise the positive opportunities of BVLOS, not least in the recent 'Flightpath to the Future' and 'Airspace Modernisation Strategy' documents, the regulatory environment remains complex to navigate making routine scalable commercial operations difficult to achieve. The existing regulatory and airspace change framework was developed with crewed aviation in mind, making it largely inadequate for uncrewed operations and for scale. The principal barrier to commercial success is the lack of timely regulatory reform to deal with the pace of change. The UK's industry regulator, the Civil Aviation Authority (CAA), can only use the regulatory tools at their disposal, but those tools have not kept pace with the requirements of uncrewed flights.

To unlock the next step on the journey of evolution that this sector is rapidly progressing along, this needs to be addressed.

With significant investment and progress achieved, much of which was due to the Future Flight Challenge, the uncrewed sector is no longer the fledgling that it once was. Achieving routine BVLOS operations will unlock a vast array of benefits to society – increased connectivity to the places that need it most; decarbonisation, both of aviation and of the wider economy by replacing vehicles or tools with sustainable ones; improved healthcare provisions for all parts of the country; international trade opportunities; and increasing the safety of individuals during infrastructure inspections and other dangerous tasks – the list goes on. Some of these activities are already happening in temporary environments or using 'visual line of sight' flights - lives have already been saved by these services, not least by members of the BVLOS Operations Forum. But they have hitherto been heavily shackled by the constraints of the current regulatory environment - like cars with no road system to drive upon.

There is no 'silver bullet' solution, but the challenge now is for the aviation industry (both crewed and uncrewed sectors) to work together with policy makers, regulators, and the end-users to evolve seamless and scalable operations, and to jointly create a sustainable regulatory framework that enables the next phase of evolution for the industry.

Scope of this paper

Different operators have differing operational requirements, and at the more detailed level of regulation those differences will become clear. However, clear policy and ministerial direction needs to be provided which answers the broad questions around how this industry should develop in the UK, and it is those macro-level requirements that this paper focuses on.

Why we need to act

The development of beyond-visual-line-of-sight operations has created a demand for BVLOS services from industries including healthcare, energy, transportation, and power generation, all seeking to realise the long-term social, economic, and environmental benefits that BVLOS can bring. This is in part the result of an industry strategy developed by the Department for Business, Energy & Industrial Strategy (BEIS) that has channelled considerable investment into appropriate technology via the Future Flight Challenge and other initiatives.

Today, the growing commercial demand for routine BVLOS services cannot be met within the current regulatory environment, and the industry's ability to capitalise on the substantial investment by BEIS is at risk. Substantive progress is being hampered because existing policy does not account for the capabilities available or being developed for BVLOS operations, and there has been a lack of policy and regulatory evolution that would enable such operations to take place on a routine basis. This evolution must go hand-in-hand with technological evolution in order to unlock the skies while advancing the technologies capable of using them, and ensuring all stakeholders feel part of the journey so that no part of the aviation community is side-lined from the conversation.

Today's airspace challenges

- Currently, most BVLOS flights in uncontrolled airspace are required to operate segregated from other traffic.
- Segregation generally requires the establishment of a Temporary Danger Area (TDA), or utilisation of a Permanent Danger Area or controlled airspace – something for which there is currently very little precedent and guidance.
- Application for a TDA requires an Airspace Change Proposal (ACP) to be submitted to the CAA for review. This is an extensive, costly, and lengthy process with a disproportionately high burden of proof required, making it a potential inhibitor to commercial growth opportunities. This also occupies already constrained resources for the CAA.
- Once approved, Temporary Danger Areas can be used by the applicant for a maximum duration of 90 days. Once those 90 days have expired, in most circumstances a TDA cannot be applied for again in the same location, preventing sustained commercial operations or comprehensive testing in a variety of conditions.
- An Operational Safety Case is required for every BVLOS operation, each of which is different based on operational requirements, but also because they are created by operators in isolation and there isn't one set mould that they all fit into. Moreover, the safety case is heavily predicated on airspace instead of 'Detect and Avoid' capabilities, which is limiting the growth of operational capability.
- Operational Safety Cases are assessed individually on a case-by-case basis and can be inconsistent. Not only are they time consuming to develop, but the assessment timeframe can vary greatly, resulting in extremely lengthy and uncertain timelines that make it difficult to plan commercial operations. There are also no published 'gateways' – the current regulatory approach is moving to performance based-regulations, which aim to develop a faster set of protocols, but standards-based targets would provide a stepped approach.

In the absence of effective guidance and means of compliance, these challenges lead to significant lead times in securing the operational authorisation needed to establish BVLOS operations, making it impossible to scale operations to meet the growing demands of the industries who need and want to use BVLOS services. These obstacles have always been present but they have now reached a critical threshold. Industry stands ready to play its part and work with the CAA to move things forward, but further clarity is required in order to free up industry to innovate and do what it does best.

Policy recommendations

If we are to achieve routine BVLOS operations, a major requirement is clear policy direction from the Government that sets out what the future uncrewed aviation ecosystem will look like, including the roles and responsibilities that different actors will have. Flowing from this will need to be a regulatory environment that enables safe operations, and that fosters commercial growth.

The BVLOS Operations Forum has developed the following four recommendations for the Government and the Regulator to help the UK achieve its vision of safely integrating new types of aircraft without causing undue disruption to existing airspace users; and creating a sustainable, modernised, and integrated future for UK airspace.

1 REGULATORY FRAMEWORK

A UK regulatory framework that enables routine BVLOS operations, and that includes the definition of new services, roles and responsibilities.

2 AIRSPACE INTEGRATION ROADMAP

An airspace integration roadmap that sets out the Government's desired end-state for how airspace integration is to be achieved, and the transitionary steps required to get there.

3 FUNDING MECHANISM

An agreed funding mechanism for new services, and clarity on the funding model proposed from the regulator.

4 ELECTRONIC CONSPICUITY

Adopt electronic conspicuity by 2025, strengthening the principle of 'see and avoid' by adding the ability to 'detect and be detected' for both crewed and uncrewed aircraft.

1. Regulatory framework for integrated BVLOS operations

1 **RECOMMENDATION 1**

Develop a regulatory framework that includes clarity on future services, roles and responsibilities, and clear regulations specific to uncrewed flight that will enable routine BVLOS operations, streamline the application and approval process, and ensure fair and open competition.

While technologies and capabilities are advancing at pace, they are doing so without a clear definition of future roles and responsibilities and without full understanding of what the future regulatory framework will be. Existing regulations, and how those regulations are interpreted and enacted, are limited in respect of efficiently enabling routine integrated operations. Without this, neither mainstream rollout of those technologies, nor further pre-operational development to test their integration, will be possible.

Direction and clarity regarding services, roles and responsibilities will enable a clearer picture of the future operating and regulatory environment, which will also make it easier to attract the investment needed for further operational development. It will also create a distinct separation between aircraft operations and the provision of airspace/ infrastructure – a paradigm that has been a cornerstone of aviation for decades and ensures fair, transparent, and equitable access to the airspace.

ANSPs are already under increased demand to provide access to UK airspace to support both trials and operation of new types of aircraft – this includes all types of Air Traffic Service (Air Traffic Control and Flight Information Services) both inside and outside controlled airspace. This activity generates additional cost that is currently borne by commercial airlines, helicopter operators and airports due to the way NATS is funded and is not sustainable in the long term. This is an immediate and practical demonstration of how today's regulatory framework and cost recovery mechanism are insufficient to support the integrated airspace concepts that the market is seeking.

A new regulatory approach for BVLOS operations is required across the full scope of aviation factors, including airfield design and operation, new technologies, airspace standards, Unified Traffic Management (UTM), electronic conspicuity, Supplementary Data Service Providers (SDSP), remote control of ground movements, pilot training and competency standards, licensing, data sharing, ATS provision, aircraft airworthiness standards, and safety management. It will also be vitally important to consider wider regulations and their impact, for example, even if a healthcare professional is trained to handle dangerous goods such as pathology samples, current regulations would prevent them from loading a package into a drone at a hospital. This prevents further progress being made and risks the ability to scale when drone capability is available.

While new legislation may not be immediately required, the interpretation of regulations and the approach to enacting them needs to evolve, i.e. the way risk is assessed, reporting is done, and approvals given. A 'pro-innovation' regulatory approach needs to be embraced, so that a dynamic ecosystem can be created that will inevitably improve as it iterates and services are optimised. Members of the BVLOS Operations Forum stand ready to play their part in creating that effective ecosystem.

Considerations in developing a new regulatory framework

- **Enhancing today's constructs.** While development of the regulatory framework and associated technical capabilities takes place, it should be possible for industry to make better use of today's constructs. The regulatory framework should therefore enable continuous BVLOS operations beyond the 90-day limit of the current Temporary Danger Area regulations, accelerate the application process timescales and introduce greater agility regarding activation of the TDA. This will enable operators to enter service level contracts with end users, which will act as a funding catalyst for the development of further technology. This change could be affected through an update to CAP1616, the CAA's regulatory guidance on the airspace change process. This evolutionary approach will also enable operators, like those in the Forum, to co-create, test and validate regulatory developments proposed by the Government and the Regulator. This codified, data-delivering, shareable 'living lab' type approach will gradually increase in complexity until we arrive at 'everyone everywhere', and enable operators to stand up services, tweak them, and then standardise them.

- **Airspace management.** It is currently unclear how airspace will be managed in the future, what service will be provided by an airspace manager, how that service will be provided, and whether it will operate in a centralised, federated, or decentralised manner.

  The preferred long-term solution would be a regulatory framework that enables competing UTM providers to offer services, while a market-neutral and regulated airspace manager ensures equal access to airspace and delivers common information services to all UTM providers in a geographic area. This will ensure all UTM providers can deliver safe services, based on accurate information from an authoritative source. The criteria by which portions of airspace can be managed and apportioned in this way must be clearly defined and regulated by the CAA.

- **Common Information Service.** This approach could be achieved through the creation of a 'single point of truth' on which safe operations, both crewed and uncrewed, can be based – a common information service. This 'Common Information Service' would be the essential component to enable exchange of information between UTM service providers and ANSPs.

  The 'Common Information Service' would capture all operations in any given piece of airspace and share this information, so that crewed and uncrewed aircraft can operate safely in the same airspace.

  This would level the playing field for multiple UTM service providers to compete on an equal footing, while ensuring they provide safe and secure information to their customers. It would equally serve those portions of the airspace centrally managed under economic regulation. Much of this service could use internet-based data transfer between parties.

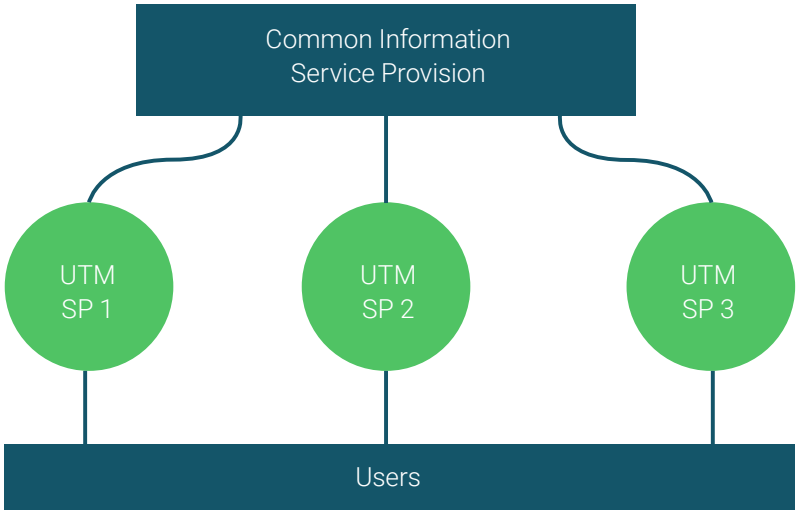


Figure 1: Illustration of Common Information Service Provider and UTM Service Providers

- **Airworthiness.** The CAA has powers to regulate the provision of ATM services and ensure the airworthiness of conventional aircraft; the same powers must apply equally to providers of UTM services and new airspace vehicles, including BVLOS drones. If operations are to be integrated then the navigational capability and operating envelope of every vehicle must also be assured to a specified degree, especially if operating autonomously – the regulator will therefore also need to define the navigational accuracy required to operate in specified volumes of airspace, as well as the airworthiness of the vehicle. This also holds true for the navigational capability of the data supplied by the SDSP.
- **Economic regulation.** The core principles of both safety and economic regulation and how they apply to service providers, operators and airfields should be extended to encompass new types of users and operation – these principles have served the industry well over a long period of time. The regulator should then determine whether the balance between efficiency, competition, and innovation is the same for UTM as it is for ATM.
- **UTM.** The term 'UTM' is often used by industry stakeholders, but there is currently no clear definition of what exactly a UTM service would provide, and where it would be required. This clarity should be provided by the CAA such that potential providers understand the scope of the requirements on them, else the CAA needs to adopt international definitions such as 'U-Space' for UTM clarity.
- **Global opportunity.** There is a real opportunity for the UK to lead the way internationally in the development and effective integration of novel aircraft. New regulations therefore need to be cognisant of, and align where possible, with the global context to enable innovation and investment to spread effectively between national markets, and for consumers and the wider public to benefit from competition between international service providers.

  The UK should be a leading contributor in the development of global standards, as we develop our own – already established and engaged bodies such as EuroCAE, JARUS and ISO should be utilised for this. This would enable novel aircraft to be operated globally without recertification for every marketplace and standards can be harmonised across boundaries.

2. Airspace integration roadmap

2 **RECOMMENDATION 2**

An airspace integration roadmap that sets out the Government's desired end-state for how airspace integration is to be achieved, and the transitionary steps required to get there.

UK airspace must become an entirely known environment where integration of all traffic, existing and future, across all airspace is made possible because of shared digital information – electronic conspicuity will be a critical part of this.

The structural limitations of airspace and regional boundaries should eventually be dissolved, leaving a single unsegregated airspace in which all users and types of aircraft can operate safely and fly their preferred routes at all levels.

Integrating, not segregating, different types of aircraft will ensure the skies remain accessible to all types of user and operation, and avoid the unnecessary inefficiencies (and increased emissions) that would result from flights having to travel further to avoid segregated areas of airspace. This known and integrated environment will rely upon electronic conspicuity, and it's vitally important that all parties involved are engaged in solving this problem. Plans for how electronic conspicuity can be more fully integrated need to start now.

How can airspace integration be achieved?

Reliance upon use of segregated airspace to ensure separation between crewed and uncrewed aircraft is an inefficient use of airspace. To progress towards unsegregated operations transition steps are needed, including more flexible forms of segregation.

To escape the captivity of TDAs, more Transponder Mandatory Zones (TMZs) should be introduced. This could begin on a trial basis in limited and low complexity areas, before progressing to more complex areas on a permanent basis.

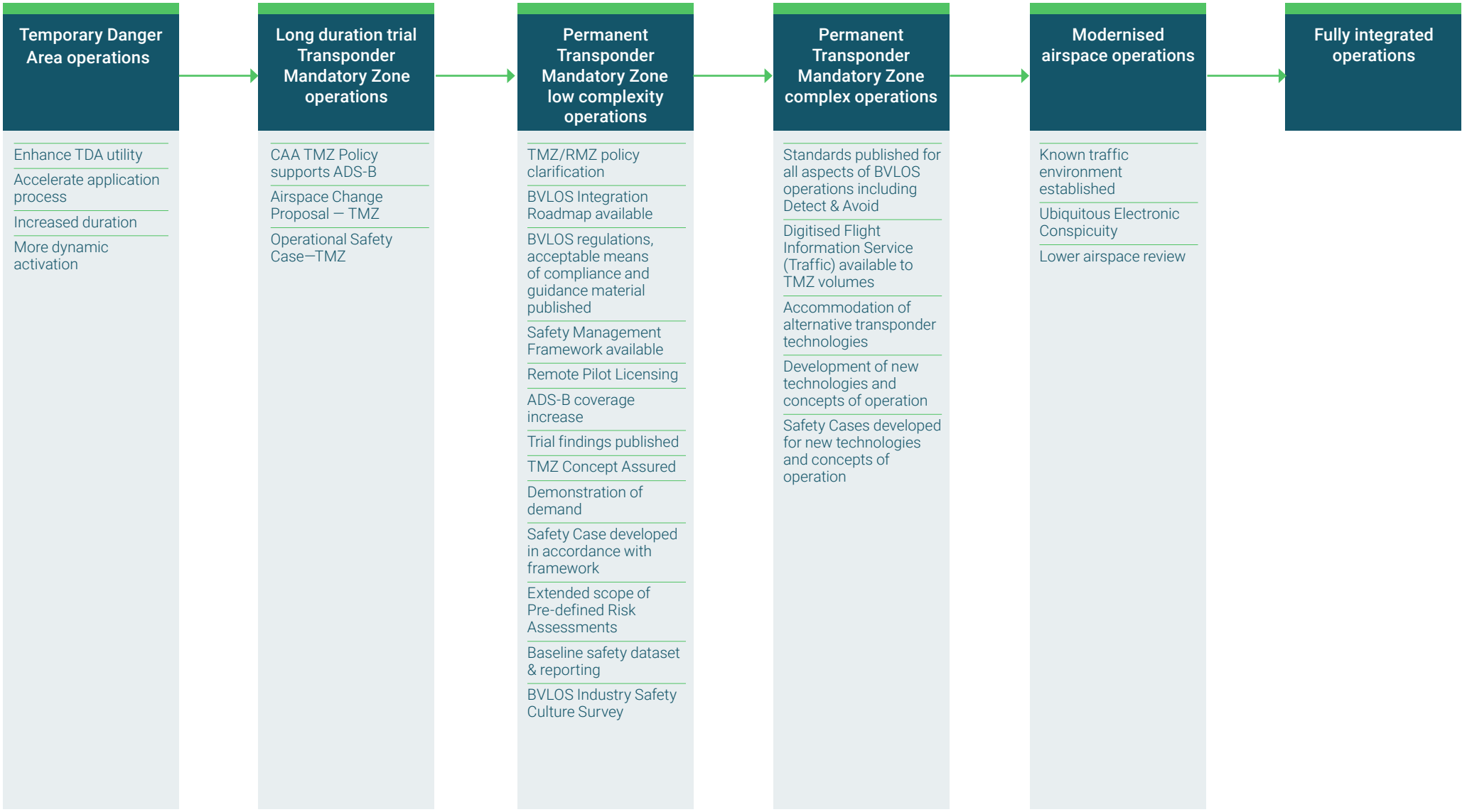
Beyond that there are other airspace constructs that reduce the level of airspace service needed within alternative Conspicuity Zones such that each operator assumes a degree of risk in their operations, which is the exact situation in uncontrolled airspace and builds on current Rules of the Air. There are also overseas SESAR projects that validate some of these ideas, but these ideas and approaches are not being widely promulgated.

There will no doubt be further iterations required, but these evolutionary steps would enable uncrewed vehicle 'detect and avoid' onboard capabilities, and UTM services, to be further developed before being more widely rolled out. It would also significantly improve the development process, as more operational experience is accumulated. It is a short-term solution that allows equitable access to airspace and doesn't block progress in the way that TDAs do.

Long term, TMZs are not the panacea – they are a short-term steppingstone to test certain operations and procedures. The end state must allow for fully integrated operations of uncrewed aircraft without the need for a TMZ. Until this becomes viable the full benefits of BVLOS will not be realised, resulting in a two-tier airspace economy.

An example integration roadmap, developed by the BVLOS Operations Forum, is included overleaf. It is an indicative example and there will be other considerations to include in a comprehensive roadmap from the Government. Feedback loops should be included throughout.

‘Shared Airspace’ integration roadmap



3. A funding mechanism for new services

3 **RECOMMENDATION 3**

Development of an agreed funding mechanism for new services, and clarity on the funding model proposed, to enable the investment required for further progress and the development of infrastructure and services that will be needed for UAS integration.

Most aspects of aviation follow the 'user pays' model. However, the emerging UTM market is currently too small to warrant the significant investment that will provide some of the new services likely to be required and, in many cases, there is no mechanism or incentive for users or infrastructure providers to contribute to the cost of the required services.

Moreover, the lack of revenue from sustained commercial operations has resulted in the industry becoming heavily reliant on limited grant funding. While this funding has been helpful, sole reliance on this type of funding rather than being able to generate significant revenue has limited the ways in which the industry has been able to develop. In some instances this has discouraged collaboration due to the highly competitive nature of grant applications, and shifted focus away from the user-needs to technology and research.

Ambiguity over responsibility for service provision and absence of a viable funding model will continue to hamper investment in the development of infrastructure and services to enable UAS integration. This is already having a detrimental impact on the market as there is a lack of funding to invest in the infrastructure necessary to support the early stages of growth in the industry. Some ANSPs (e.g., Spain, Australia) have already commenced the implementation of services necessary to support early growth.

Any certified airspace user can operate freely in Class G airspace, but BVLOS operators cannot as they are unable to 'see' other airspace users under the current regulatory requirements. The Forum believes that widespread adoption of electronic conspicuity technology (such as ADS-B) will help to resolve this issue, but this technology does not come without cost. A new infrastructure will also be needed to support these new air vehicles to overcome some of the conspicuity challenges mentioned in the previous section, but there is no means of funding that and the Government has not addressed it. An airspace management type service, like a 'Common Information Service Provider', would help to solve this problem and enable BVLOS flights in all types of airspace, but there are currently no means of funding that either.

For example, ANSPs are already under increased demand to provide access to UK airspace to support both trials and operation of new types of aircraft. This activity generates additional cost due to the way NATS is funded and is not sustainable in the long term. Other organisations building the sensor infrastructures to support BVLOS operations are facing similar challenges, and there is currently no incentive for key enablers like airports to support the integration of drone operations within or near their control zones. This is an immediate and practical demonstration of how today's regulatory framework and cost recovery mechanism are insufficient to support the integrated airspace concepts that the market is seeking.

Development of a funding model as part of the wider regulatory framework is needed urgently to attract the investment required for progress.

4. Electronic conspicuity

4 **RECOMMENDATION 4**

Adopt electronic conspicuity by 2025, strengthening the principle of 'see and avoid' by adding the ability to 'detect and be detected' for both crewed and uncrewed aircraft.

Conventionally crewed aviation is dependent either upon Air Traffic Management (ATM) services, or a pilot's ability to see and avoid other aircraft to avoid a mid-air collision. With no pilot onboard to see and avoid other aircraft, uncrewed aircraft such as BVLOS drones need to be handled differently.

A critical part of enabling all aircraft, crewed and uncrewed, to detect and avoid one another is to ensure all airborne vehicles and ground-based obstacles are electronically conspicuous or 'detectable' in a trusted manner. This capability will be key to the safe and efficient integration of uncrewed aircraft into the same airspace as crewed aircraft. Electronic conspicuity also brings well documented safety benefits to the wider aviation community. In a fully integrated airspace, flying without electronic conspicuity would be like driving a car at night with no headlights on.

Electronic conspicuity (EC) can help pilots, uncrewed aircraft users and air traffic management service providers to see where other aircraft are. This means all airspace users can not only 'see and avoid' other aircraft, but also 'detect and be detected' by others in a trusted manner – in current situations there is always a pilot on board to verify the information and make decisions, but that facility will not exist in a future airspace state.

Increased situational awareness in the skies and on the ground will be especially important when uncrewed aircraft have different flying characteristics from the crewed aircraft they operate alongside – for example flying lower or higher, slower or faster – and no pilot on board to look out for other aircraft. Moreover, studies have shown that human pilots find it difficult to visually detect small drones, so having such vehicles electronically detectable would greatly assist with collision avoidance.

The implementation of electronic conspicuity in the skies will require not only equipment onboard aircraft, but also the installation of ground-based technologies to interact with airborne data sources. To ensure a complete solution, interoperability between different vendor equipment will also be necessary.

Electronic conspicuity is not a full solution, nor do we expect equipment to be fitted to all aircraft (for instance Model Flyers often have several models, and to assume each of those would have EC is disproportionate for the airspace volume they occupy VLOS). But as a starting point it does mean airspace users would fly safely, and is an enabler, rather than a tool for constraining operations. Electronic conspicuity is not a means to increase the volume of controlled airspace.

In accordance with the CAA's Airspace Modernisation Strategy, increased levels of situational awareness, coupled with modernised flight information services and sharing of airspace data, can enable services that would provide a digital airspace picture that could lead to the safe integration of both crewed and uncrewed aircraft without impacting today's level of airspace access.

While there will be other requirements to ensure BVLOS operations can take place safely and efficiently, electronic conspicuity is a critical part of the solution.

Recommendations & conclusions

The 4 policy recommendations put forward in this paper are not a 'silver bullet' solution that will completely solve the challenge of integrating BVLOS operations. But they are a start, and with the pace of innovation already racing ahead of the current regulatory picture, it's a start that is needed now if we are to capitalise on the drone opportunity.

The list of benefits that BVLOS can bring could fill a paper of its own. Members of the BVLOS Operations Forum are already working on ways to deliver cancer treatments, organs, and vital medical supplies to patients in remote areas; improving the rail network and reducing delays to passengers by using drones to inspect hard to reach areas of track; conducting environmental monitoring, both on and offshore, and replacing polluting vehicles with more sustainable ones to support net zero ambitions; saving lives at sea in HM Coastguard rescue missions; the list of remarkable work already happening goes on.

With reduced emissions, reduced cost, and improved safety, uncrewed aircraft can achieve extraordinary things that all of us, in all parts of the UK, will benefit from, and BVLOS is the key to unlocking that full potential.

The recommendations made by the BVLOS Operations Forum in this paper, if adopted and acted upon, will be a giant leap forward in that journey.

- A regulatory framework that includes clarity on future services, roles and responsibilities, and clear regulations specific to uncrewed flight.
- An airspace integration roadmap that sets out the Government's desired end-state for how airspace integration is to be achieved, and the transitionary steps required to get there.
- An agreed funding mechanism for new services, and clarity on the funding model proposed, to enable the investment required for further progress and the development of the infrastructures and services that will be needed for UAS integration.
- Adopt electronic conspicuity by 2025, strengthening the principle of 'see and avoid' by adding the ability to 'detect and be detected' for both crewed and uncrewed aircraft.

Abbreviation glossary

ACP	Airspace Change Proposal
ADS-B	Automatic Dependent Surveillance – Broadcast
ANO	Air Navigation Order
ANSP	Air Navigation Service Provider
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Air Traffic Service
BVLOS	Beyond visual line of sight
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CISP	Common Information Service Provider
Class G	Uncontrolled airspace, designated as Class G airspace
DAA	Detect and Avoid
EC	Electronic conspicuity
FRZ	Flight Restriction Zone
ICAO	International Civil Aviation Organisation
OSC	Operating Safety Case
RMZ	Radio Mandatory Zone
RPAS	Remotely Piloted Aircraft System
SMS	Safety Management System
TDA	Temporary Danger Area
TMZ	Transponder Mandatory Zone
UAS	Uncrewed aircraft system
UTM	Unified Traffic Management
UTMSP	UTM Service Provider
VLOS	Visual Line of Sight

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