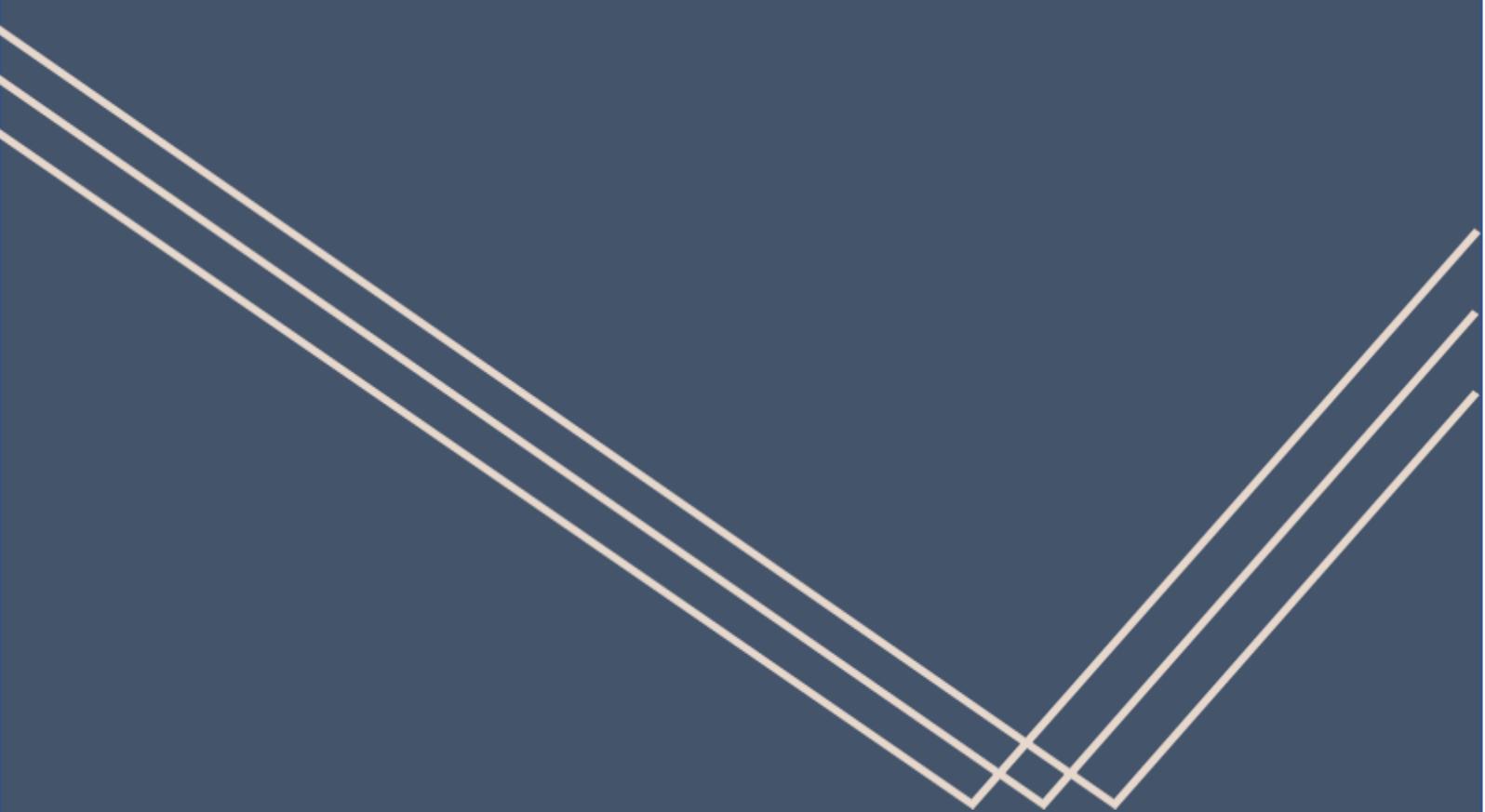


Airspace Change Organising Group

Scenarios for remobilising the UK Airspace Change Programme following the COVID-19 Pandemic

Version 1.4

July 2020



Foreword

There are currently more immediate priorities for aviation stakeholders in these turbulent times than a focus on airspace modernisation. The time will come, however, when the appetite for air travel will resume with vigour and enthusiasm across the Nations and we need to be ready. While we don't know exactly when this will be, we can be confident that at some point over the next few years, demand will once again outstrip the ability of the current network – our national infrastructure in the sky - to satisfy demand for flying without significantly increasing delays and carbon emissions. For the aviation industry and its recovery, airspace change is an important piece of the jigsaw. It will future-proof the industry by creating simpler, more efficient routes, and reduce congestion while assisting aviation to meet its climate change targets. For the UK, a strong aviation sector will be crucial to maintain its reputation as a global trading power and boost businesses and jobs.

At the heart of this lies the UK's Airspace Modernisation Strategy which recognises the need for the transformation of the network both here and abroad. Over the last 12 months, the ACOG team has been working extensively with airports to create an Airspace Masterplan, a modernisation plan that would link to the NERL programme for network modernisation in the medium and upper airspace. However, the significant investment that has been made by the industry, along with the benefits that airspace change would deliver for all airspace users, is now at risk due the effects of COVID 19. The aim of the report is to act as a catalyst to remobilise the airspace change programme at an appropriate point, acknowledging that it is unlikely to look like the original masterplan in all respects. In collaboration with NERL, we have examined 4 scenarios that set out plausible futures against which the path to airspace modernisation can be tested. We offer a series of insights into the airspace challenges that the sector will face as demand returns, look at the options available to meet those challenges and make recommendations as to how best to remobilise the programme.

I would like to acknowledge the significant efforts of the virtual team from NERL, ACOG and members of the ACOG Steering Committee who devoted so much time and expertise to drawing up this report and I commend it to you.



Mark Swan

Head of ACOG



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Executive Summary

1. By March 2020, UK airports had invested c.£10 million into the UK Airspace Change Programme, matched by NERL's contribution to the network ACPs. The Airspace Masterplan was designed to align these investments with the CAA's regulatory process to result in an eventual nationwide upgrading of the total airspace network. The intention was to decrease dependencies on out-of-date ground based navigational aids, significantly increase environmental performance and offer greater access to the modernised structure for General Aviation (GA) and UAS (Drone) operators. Overall, the passenger journey would be much improved in terms of far fewer delays and greater network resilience.
2. COVID-19 (CV19) has caused most sponsors (airports and NATS) to pause their airspace change programmes while they focus on more immediate operational priorities. In light of this, ACOG has worked up four plausible scenarios set against different recovery models for aviation and the ability or appetite to continue with modernisation in light of the devastating effects of CV19 on balance sheets. It was anticipated that the pace of recovery could take one of three likely paths. These were: a recovery where demand returned relatively quickly to pre-crisis levels; a recovery anticipating a slower phased return; and a recovery where demand was stagnant and did not fully recover. The first path has since been ruled out. In analysing these elements, core assumptions on global public health interventions, economic measures, and consumer confidence have been applied to each recovery path. The ability to proceed or participate in the programme (the Industry Appetite), given the perilous financial status of the Sector has been assessed against all of these factors to produce four possible scenarios. The resulting analysis has produced a set of predictable outcomes that have informed our assessment of the impacts on stakeholders and generated our recommendations for consideration. Finally, there are four illustrative options that demonstrate the range or breadth of activity that could be undertaken, dependent principally on the availability of funding, to remobilise the programme.
3. The ten recommendations generated by the scenario analysis are summarised below:
 - R1. Commitment:** In order to mitigate the risk of incoherence across the Programme, that ACOG and the airport ACP sponsors establish clear protocols for: the airports that resume the Programme; the engagement with those that remain paused; and the process for those that cannot continue. *By end Aug 20*
 - R2. Core set of ACPs:** That NATS re-evaluate the 2018 Feasibility Report into Airspace Modernisation to identify the core set of airport-led ACPs that will be required to support network optimisation following CV19. *By end Aug 20*
 - R3. Deployment sequence:** That ACOG and NATS re-evaluate the programme deployment plan to ensure that the airport-led and network ACPs are aligned and can be incorporated into iteration 2 of the Masterplan. *By end Oct 20*
 - R4. Interdependencies:** In the short-term absence of a Masterplan, that ACOG and the CAA develop an approach to assure that ACPs progressing to the Stage 2 Gateway do not conflict with or constrain the optimisation of the wider network. *By end Aug 20*

- R5. Additional funding support:** That ACOG examines options for external financial support for delivering the programme objectives and, if appropriate, the potential options for accessing and managing funds. *By end Jun 20*
- R6. Sustainability:** That ACOG, the airport ACP sponsors and NATS assess how best to achieve the airspace emissions savings contribution set out in the Sustainable Aviation Decarbonisation Roadmap. *By end Sep 20*
- R7. Airspace integration:** That ACOG work with GA and UAS stakeholders to explore the options for the Programme to ensure their needs and requirements are collectively coordinated with ACP sponsors, potentially leveraging additional funding support from UKRI via the Future Flight Competition. *By end Jul 20*
- R8. Airspace change process review:** That ACOG gather stakeholder feedback in the form of a lessons-learned exercise to help inform any process improvements associated with the application of the CAP1616 guidance. *By end Oct 20*
- R9. Trade-off Decisions:** That the CAA produce detailed guidance on the treatment of trade-off decisions for airspace design when one objective (e.g. sustainability) has more weighting than others (e.g. noise mitigation or additional capacity). *By end Oct 20*
- R10. European engagement:** That ACOG ensures the UK ACPs below 7000ft. progress coherently with the regional plans to remobilise operations and enhance network performance via NERL's engagement with the EUROCONTROL-led Network Management Transition Plan and Operational Excellence Programme. *(Ongoing)*

Introduction

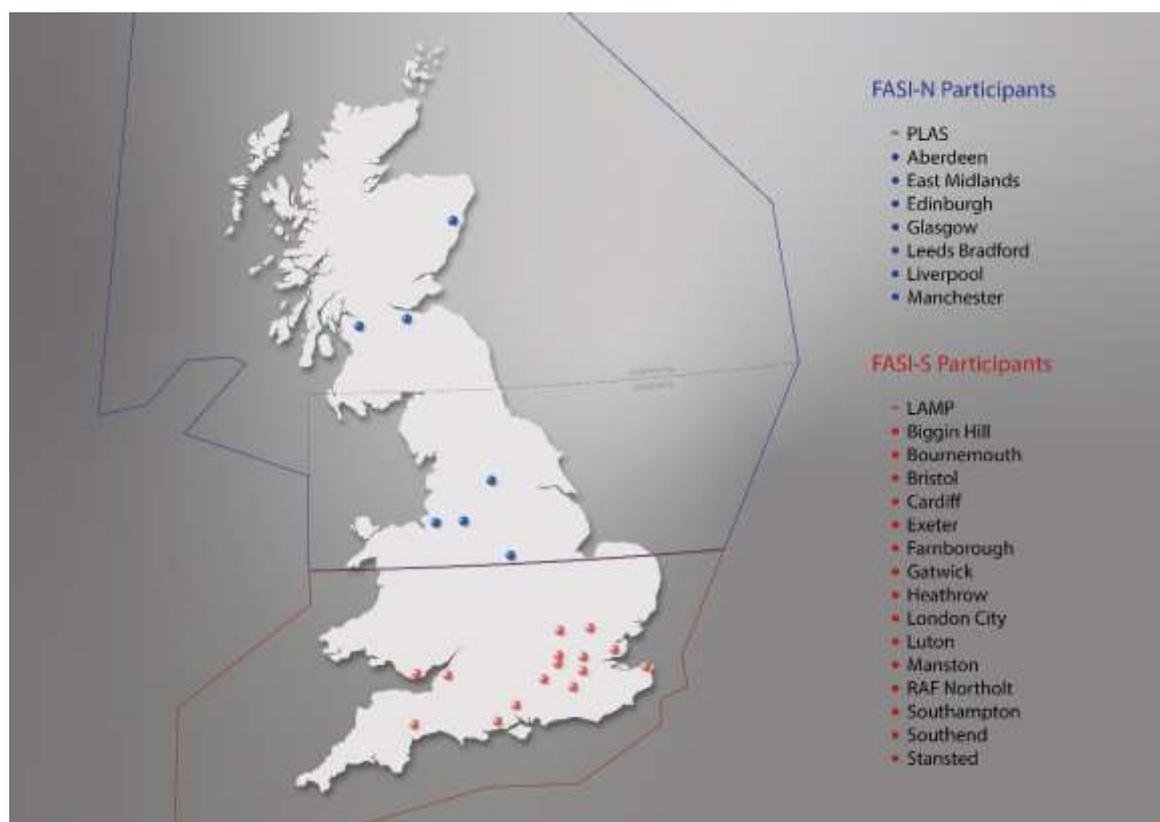
4. This report describes the outputs of analysis conducted by the Airspace Change Organising Group (ACOG) and NATS Enroute Ltd. (NERL) into the options for remobilising the airport-led components of the UK Airspace Change Programme (the Programme) following the COVID-19 (CV19) pandemic. The Department for Transport (DfT) and Civil Aviation Authority (CAA) are co-sponsors of the Airspace Modernisation Strategy (AMS) and requested that ACOG perform the analysis to inform decisions on the future direction of the Programme.

Background to the Programme

5. Aviation in the UK has grown significantly in the last 40 years driven by globalisation, the growth in real incomes and a greater desire by the public to travel abroad. The aviation sector contributes £50 billion to our economy each year and supports 960,000 jobs as well as thousands of businesses across the country.¹ Aviation is a key driver for future economic growth, especially through global trade – an increasingly important area following our decision to leave the European Union.
6. Airspace is a key component of our aviation sector with most flights in the UK's airspace being Commercial Air Transport (CAT) – that is aircraft carrying passengers and freight. The Military uses the airspace to secure our Nation's borders and train their forces. In addition, the UK has a thriving Business and General Aviation (GA) sector, including large corporate jets, helicopters, private pilots in light aircraft, gliders, and a wide range of other operators. In recent years, the rapid growth in Unmanned Aerial Systems (UAS) and the development of Space Planes has introduced new demands on the airspace. As such, the airspace has become a key part of our national transport infrastructure that is critically in need of modernisation to meet future demand and increase its resilience.
7. The UK's aviation industry has expanded enormously since the 1950s and 1960s when much of our airspace structure was first designed. Since then, airspace has been added to and adapted in response to growing traffic levels, but many departure routes at our major airports have changed little over several decades. This piecemeal approach to the development of our airspace structure has created several issues with today's airspace that limit the ability to add capacity without making some more fundamental changes.
8. The Programme to modernise the UK's airspace is a collaboration between NERL and 20 airports across England, Scotland, and Wales that each sponsor their local part of the overall network. The scope of the Programme encompasses the development and deployment of a series of interlinked Airspace Change Proposals (ACPs) to fundamentally redesign the airspace structure and route network. The way that these ACPs provide safe and efficient access for other airspace users and mitigate the impacts of aviation on the environment and local communities is also core to the Programme's scope. The Programme is split into two parts: Future Airspace Strategy Implementation (FASI) South and FASI North. Figure 1 summarises the component ACPs included in each part of the programme.

¹ Our Future Skies, 2020

Figure 1 summarises the scope of the programme, split into FASI-S and FASI-N



9. ACOG was set up to manage the Programme via the production of an Airspace Change Masterplan that sets out the order in which clusters of airports should deliver their local upgrades, harmonises them with the NERL-led network changes and oversees public/stakeholder engagement in the overall modernisation process. The Masterplan was in the final stages of the pre-submission phase to the DfT and CAA when CV19 necessitated an urgent operational pause whilst all stakeholders turned their full attention to managing the effects of the pandemic on their respective businesses. ACOG has since been working on this report with contributions from NERL and the ACOG Steering Committee to help inform senior leaders in the aviation sector on post-CV19 airspace modernisation strategies.

The impact of CV19 on the Programme

10. CV19 is devastating for aviation. The Industry is working closely with Governments and Regulators to understand the crisis and tackle the challenges it is creating, while at the same time taking steps to protect its employees, customers, supply chains and finances. At the time of writing, confirmed CV19 cases have exceeded 6.2 million worldwide. The Government's introduction of severe travel restrictions has, of necessity, grounded passenger aviation in the UK and similar restrictions have been imposed throughout virtually the whole of Europe and beyond. Most of the Programme's airports were in the second stage of the CAA's airspace change process² as the crisis hit and they were forced

² CAP1616: CAA guidance on the regulatory process for changing the notified airspace design.

to pause. The investments made to date could quickly become wasted if the proposals are not progressed further in a reasonable timeframe.

11. If the airspace change Programme collapses, there is a risk that a key part of the UK's national transport infrastructure that was already in need of attention will deteriorate further and be unable to manage efficiently when the sector enters recovery and returns towards normal operations, specifically:

- Aircraft will continue to fly longer routes and follow sub-optimal flight paths during a period of recovery when operators will need to maximise their cost efficiency and the pressure to improve their environmental performance will continue to increase.
- Airports will remain dependent on old and expensive ground-based navigation aids that airspace modernisation would have seen decommissioned. These aids are rapidly approaching the end of their 25-year lifespan. Many airports will not be able to sustain commercial operations without airspace upgrades to introduce routes based on satellite nav-aids. This process has already commenced as many of the ground-based aids are now obsolete.
- Some of the more innovative aspects of the Airspace Change Programme that would offer greater access to airspace for GA and UAS operators will be lost.
- The opportunity to create an environmentally sustainable network across the whole of the UK and integrate with reforms to the wider European network will be lost.
- Network capacity constraints, which caused high delays and resilience issues associated with 2018/19 peak traffic levels will return as traffic nears the normal range.

12. Clearly, the collapse of the Programme with the above consequences would be catastrophic. The overall objective of conducting the scenario analysis therefore is to generate a fuller understanding of the potential impacts of CV19 on the Programme as it moves forward, with a view to ensuring its continuance as soon as practical. The analysis is intended to provide insights and options regarding the approach to remobilising under different circumstances. It considers how the drivers for airspace modernisation might change following CV19 and the implications for the scope of the component ACPs. We expect the analysis to help guide the approach and methodology for creating the Airspace Change Masterplan to coordinate and assure implementation of the future programme. The outputs may also highlight opportunities to tackle some of the key challenges associated with airspace modernisation in better, more innovative ways following CV19. The communications and engagement activities that support the Programme will also be refreshed, using aspects of this analysis to help refine the messages that should be conveyed to stakeholders as the airspace modernisation process resumes.

13. The remainder of this report is presented in three parts:

- Part 1 presents the outputs of the scenario analysis
- Part 2 presents the predictable outcomes and impacts on the programme
- Part 3 presents options for remobilising the programme

Part 1: Scenario Analysis

14. The Aviation Sector is particularly sensitive to external shocks. The impact of CV19 is already more severe in aviation than any other major industrial sector in terms of the immediate decline in demand. The way that the pandemic is tackled and brought under control will have a significant influence on the future of the Sector. In the midst of many uncertainties, we have identified two main areas that will be particularly influential on the future of the UK Airspace Change Programme:

1. The pace of recovery across the aviation sector following CV19; and
2. The appetite for airspace modernisation in the UK following CV19.

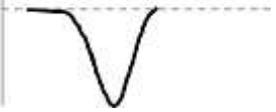
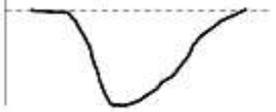
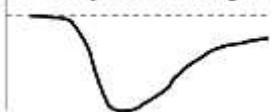
15. These uncertainties are interdependent, but the nature of the relationship between them is unclear. For example, a slower pace of recovery may suppress the appetite for airspace modernisation in the UK as the industry struggles commercially, or it may increase the appetite to upgrade the core network to tackle inefficiencies that are no longer tolerable. Our scenario analysis examines the possible effects of these uncertainties on the Programme and its key stakeholders.

The pace of recovery in aviation following CV19

16. It had been generally considered that the pace and profile of the aviation sector's recovery following CV19 will take one of three paths:

- V-shaped recovery – demand bounces back relatively quickly to pre-crisis levels.
- U-shaped recovery – demand returns in phases across different market segments.
- L-shaped recovery – demand returns slowly and does not reach pre-crisis levels.

Table 1: Potential recovery paths for the aviation sector

<p>V-shape recovery</p> 	<p>The most optimistic recovery path is V-shaped where the sharp drop in demand that began in March 2020 bounces back relatively quickly in 2021 and traffic reaches pre-crisis levels in 2022. A V-shaped recovery is now highly unlikely.</p>
<p>U-shape recovery</p> 	<p>A more likely recovery path is U-shaped, where demand returns in phases, starting with the domestic market, then the short haul and long-haul markets, so that pre-crisis traffic levels are reached in 2024/25.</p>
<p>L-shape recovery</p> 	<p>A less optimistic, but entirely possible recovery path is L-shaped, where the demand for aviation returns more slowly and remains below pre-crisis levels for a prolonged period, driven by a fundamental shift in attitudes towards aviation.</p>

17. In March 2020, at the beginning of the global phase of the crisis, ICAO forecast that a V-shaped recovery with demand rebounding to pre-crisis levels in 2022 would lead to a \$90 billion loss in gross revenues across the sector.³ Unfortunately, as the crisis has deepened, the feedback from aviation stakeholders is that a V-shaped recovery is now highly unlikely. Forecasts regarding the short-term economic impact on the aviation sector during 2020 (compared to what the industry had originally planned) are severe enough to remove the V-shape recovery path from our analysis. The overall number of seats offered by airlines during 2020 is expected to reduce by between 49% and 72% leading to an overall reduction in passenger numbers of between 872million and 1,303million.⁴
18. A central feature of the V-shaped recovery was that all forms of commercial air transport, across the domestic, short-haul and long-haul markets, rebound in similar timeframes. Analysts now expect that international travel will take several years to become fully re-established and generate pre-crisis traffic levels. A phased recovery that progresses at different speeds, depending on the market segment and region appears a more likely path. Forecasts published in April 2020 by IATA, predict an elongated U-shaped recovery that sees domestic demand rebound by 2023 and the short and long-haul markets in the years thereafter. An initial assessment of the impact on gross revenues was updated by IATA from £252 billion to £314 billion as the sector's understanding of the complexity of the recovery phase grew.⁵
19. In the medium-term (over the next 3 to 5 years), the severity and duration of the pandemic's impact is still uncertain. If global public health interventions and economic measures prove ineffective and consumer confidence in air travel cannot be fully restored, then an L-shaped recovery, where global traffic does not return to pre-crisis levels for a prolonged period, becomes a real possibility.
20. Consumer confidence will be driven in part by the measures that are put in place to assure passengers that air travel continues to be a safe environment, and in part by the severity of the recessions that the global economy is expected to face in the wake of the crisis. The industry's ability to tackle the operational challenges of resuming air travel is also a key factor. As travel restrictions ease, international carriers will be subject to a variety of bilateral and multi-lateral agreements negotiated by States. Meanwhile, airports will need to design and implement their own comprehensive health and safety measures and manage the inevitable impact on passenger throughput.
21. Table 2 summarises the core assumptions we have applied to our analysis regarding the effectiveness of global public health interventions, economic measures and consumer confidence in aviation that might drive either a U-shape or L-shape recovery path. We have used negative, moderate and positive variants of each assumption that collectively determine which of the recovery paths may be followed.

³ Financial Impacts of COVID, IATA, March 2020

⁴ Economic Impact Analysis of COVID-19, ICAO, April 2020

⁵ Financial Impacts of COVID, IATA, April 2020

Table 2: Core assumptions underpinning the different recovery paths

	L-shape recovery	U-shape recovery
Global public health interventions	Global public health response fails to control the spread of the virus for an extended period	Global public health response is effective but requires some on-going social distancing
Economic measures	Measures are unable to prevent deep recession, many bankruptcies and banking crisis	Measures effectively offset structural damage to the economy, enabling moderate recovery
Consumer confidence	Long-term fall in consumer confidence creates a c.10% reduction in demand	No lasting impact on consumer confidence. Demand returns steadily as economy grows

22. There are, of course, a range of other more specific uncertainties emerging as the crisis unfolds that have different influences on these core assumptions, for example:

- There is growing evidence of asymptomatic cases (where someone has the virus but no symptoms) that could require longer term social distancing despite the effectiveness of the global public health response, but the level of uncertainty is extremely large, with estimates that anywhere between 20% to 60% of cases could be asymptomatic.
- Seasonality seems to be less of a mitigating factor in the spread of the virus. Although the virus spreads with greater potency during the winter months, seasonality alone will not be enough to curtail the outbreak, perhaps requiring a return to more comprehensive global public health interventions as the seasons turn.
- Testing innovations may greatly expand disease surveillance capabilities. New anti-body tests may show prior exposure and ongoing immunity allowing large segments of society to resume normal activity including air travel. However, there have been recent warnings about recovery strategies becoming over reliant on some test and trace measures.
- Economic restarts in Asia demonstrate the possibility to resume normal activities by limiting local transmission, but also highlight the need for renewed travel restrictions. Hong Kong, Singapore and Taiwan showed spikes in new cases post lockdown. All three countries have since re-introduced restrictions several times.

The appetite for airspace modernisation in the UK following CV19

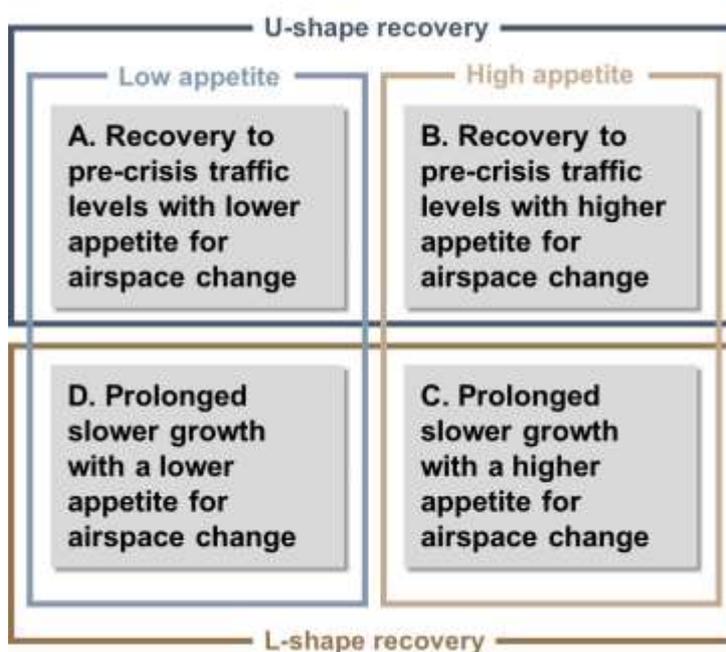
23. The second major area of uncertainty that we have identified with a potentially significant influence on the approach to remobilising the Airspace Change Programme is the appetite for airspace modernisation across the key stakeholder groups. In this context, the key stakeholder groups with an influence on the approach to remobilising the programme are:

- The DfT and CAA as co-sponsors of the AMS
- NERL as the sponsor of the network level ACPs in the programme
- Airports as the sponsors of the local ACPs in the programme
- Airlines as one of the main investors and primary beneficiaries of the programme
- General and Business Aviation as a group impacted by changes that affect access to airspace
- The UAS Sector as a group impacted by changes that enable greater integration
- Local Government, Communities and Interest Groups – as parties with an interest in how the environmental impacts of aviation will be mitigated

Scenario analysis matrix

24. The analysis combines the two main areas of uncertainty (recovery pace and appetite for airspace change) to produce four distinct scenario backdrops, illustrated in Figure 2.

Figure 2: Scenario analysis matrix



25. The analysis of the impacts on key stakeholders in each of these scenarios can generate a broad range of potential outcomes. Some outcomes fall into more than one scenario and some fall into all four. The following sub-sections describe the main features of the scenarios defined by each quadrant of the chart in Figure 2, including our analysis of how each of the possible futures may impact on the key stakeholder groups.



Scenario A: Recovery to pre-crisis levels with lower appetite for airspace change

In this scenario we assume that the global public health response to CV19 has been largely effective, but some social distancing measures remain in place. Economic measures have also been effective, reducing the operating costs for airports, ANSPs and airlines during the most challenging period of lockdown. However, the appetite for airspace change remains low as the industry concentrates on protecting the current operation from further harm.

Scenario A: Impact on key stakeholders	
	<p>Airlines</p> <ul style="list-style-type: none"> With a quicker pace of recovery, airlines again begin to feel the effects of a lack of capacity and resilience in the core network and raise concerns regarding the limited appetite for airspace change. The transition plan towards a Single European Airspace System is expected to progress rapidly in a scenario with a quick recovery. With a low appetite for airspace change, airlines may raise concerns that the European plans might disadvantage UK carriers.
	<p>Airports</p> <ul style="list-style-type: none"> With a lower appetite for change, some airports are expected to keep their ACPs paused for a pro-longed period, extending the overall timelines. Some airports may be unable to fully fund the continuation of their ACPs and exit the programme unless external financial support is provided. The low appetite for airspace change may require a formal programme management approach to coordinate the airport ACPs sponsors that are less incentivised to participate without strong governance.
	<p>Other airspace users</p> <ul style="list-style-type: none"> With a quicker recovery profile but lower appetite for change, the GA and UAS sectors may become increasingly frustrated with the lack of progress on airspace access and integration issues.
	<p>Local communities and interest groups</p> <ul style="list-style-type: none"> As traffic growth returns, local communities may become increasingly concerned about the lack of progress on noise. Similarly, environmental interest groups may challenge the lack of progress on the airspace reforms needed to contribute to decarbonisation.
	<p>The Government and Regulator</p> <ul style="list-style-type: none"> The quicker pace of recovery may enable consideration of proposals to part fund the core ACPs and incentivise airports to progress airspace changes in support of the overall network optimisation plan.



Scenario B: Recovery to pre-crisis levels with a higher appetite for airspace change

In this scenario we assume that the global public health response to CV19 has largely been effective, but some social distancing measures remain in place. Economic measures have also been effective, reducing the operating costs for airports, ANSPs and airlines during the most challenging period of lockdown. This response has increased consumer confidence that aviation will quickly return to pre-crisis operations.

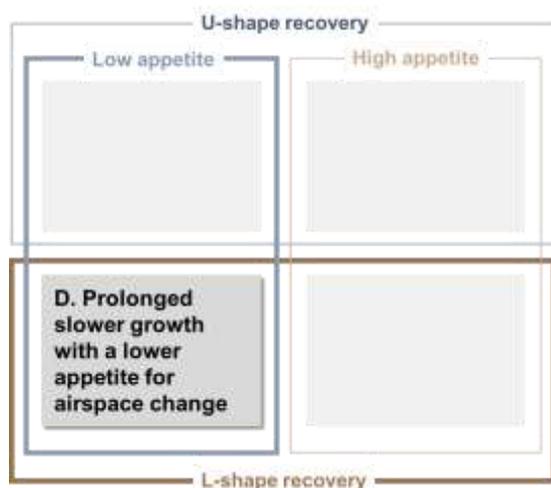
Scenario B: Impact on key stakeholders	
	<p>Airlines</p> <ul style="list-style-type: none"> Airlines may actively promote the importance of airspace change as one of the key enablers of the industry’s recovery; by creating fuel efficient routes while reducing emissions per flight.
	<p>Airports</p> <ul style="list-style-type: none"> Some ACPs are expected to experience funding issues, even in a scenario with a quicker recovery. The programme may need to identify the size and nature of the funding gaps and assess if they create risks for the wider network optimisation plan. Where these risks arise, it may be appropriate to seek funding support.
	<p>Other airspace users</p> <ul style="list-style-type: none"> With a higher appetite for airspace change there may be greater enthusiasm for all airspace users to collaborate with airports on solutions to airspace access and integration issues.
	<p>Local communities and interest groups</p> <ul style="list-style-type: none"> With a higher appetite for airspace change, the current emphasis on noise mitigation at lower altitudes is likely to come into greater conflict with network designs that seek to maximise flight efficiency and combat emissions.
	<p>The Government and Regulator</p> <ul style="list-style-type: none"> CAA may focus its attention on the risk that first mover advantage for some of the more advanced ACPs negatively impacts others and the optimisation of the overall network. Some airport sponsors are expected to progress their ACPs quickly in this scenario, creating challenges managing the interdependencies with ACPs that remain paused for a prolonged period.



Scenario C: Prolonged slower growth with higher appetite for airspace change

In this scenario we assume that the global public health response to CV19 has failed to contain the spread of the virus. Outbreaks return in different parts of the world periodically, leading to a continuous closing and opening of international borders. The UK domestic aviation sector recovers to some extent, and freight traffic continues to grow. There is a further decrease in business class travel, as organisations switch to video conferencing and look for further cost efficiencies.

Scenario C: Impact on key stakeholders	
	<p>Airlines</p> <ul style="list-style-type: none"> With sustained lower traffic growth, the airlines are expected to refocus their requirements for airspace modernisation towards near-term tangible benefits that drive cost efficiency.
	<p>Airports</p> <ul style="list-style-type: none"> The scope of the ACPs that do resume in this scenario are likely to change more significantly to meet the demand for near term flight efficiency and cost reduction requirements.
	<p>Other airspace users</p> <ul style="list-style-type: none"> With sustained low growth, but a high appetite for airspace modernisation there may be greater potential to progress airspace changes that enable GA and UAS operators to take advantage of underutilised controlled airspace.
	<p>Local communities and interest groups</p> <ul style="list-style-type: none"> The higher appetite for change may lead sponsors to focus their local ACPs on the deployment of airspace concepts to better manage aircraft noise.
	<p>The Government and Regulator</p> <ul style="list-style-type: none"> With sustained low growth, funding for ACPs is going to come under greater pressure. If there remains a high appetite to deliver airspace modernisation, there may be a case to seek external funding to cover a share of the costs of the core ACPs that sponsors are willing to progress to optimise the network.



Scenario D: Prolonged slower growth with a lower appetite for airspace change

In this scenario we assume that the global public health response to CV19 has failed to contain the spread of the virus. Economic interventions have also been ineffective. Outbreaks return in different parts of the world periodically, leading to a continuous closing and opening of international borders. Many destinations are heavily restricted, and the process of re-opening borders is complicated by quarantine measures.

Scenario D: Impact on key stakeholders	
	<p>Airlines</p> <ul style="list-style-type: none"> With sustained lower traffic growth, the airlines are expected to refocus their requirements for airspace modernisation towards near-term tangible benefits that drive cost efficiency.
	<p>Airports</p> <ul style="list-style-type: none"> More airports are likely to exit the programme with prolonged lower traffic growth and a generally low appetite for airspace change, raising questions about the overall viability of the modernisation initiative and the roles and responsibilities of the participants that may remain.
	<p>Other airspace users</p> <ul style="list-style-type: none"> A low growth and low change scenario may lead to airspace integration initiatives that primarily benefit GA and UAS operators taking priority over the network redesign as the cornerstone of the modernisation programme.
	<p>Local communities and interest groups</p> <ul style="list-style-type: none"> Local communities and interest groups that oppose specific ACPs on the grounds of aircraft noise may find more traction with decision makers because of the generally lower appetite for airspace change and weaker drivers associated with capacity and growth.
	<p>The Government and Regulator</p> <ul style="list-style-type: none"> With sustained low growth and little appetite for airspace modernisation it seems unlikely that the Programme would be able to progress without a closely controlled central budget to cover the costs of the minimum set of core ACPs needed to optimise the network.

Part 2: Predictable outcomes and impacts on the programme

26. This section describes the possible impacts of the scenario analysis on the UK Airspace Change Programme. The analysis highlights a variety of potential outcomes that may influence the way the programme remobilises. This report focuses on the more predictable outcomes that emerge in all four scenarios. Other outcomes that are specific to the conditions examined in a particular scenario may be less predictable but no less important and have been incorporated into the ACOG risk management framework that will be updated using this analysis.
27. The predictable outcomes and associated impacts are grouped into 6 themes:
1. The phased return of some airports to the programme and uncertainty about how and when to remobilise.
 2. The shortage of funding and resources to develop and deploy airspace changes.
 3. The increased importance of environmental performance as one of the main drivers for airspace modernisation.
 4. The increased importance of airspace integration as one of the main drivers for airspace modernisation.
 5. The application of the Government's aviation policy framework and the CAA's regulatory airspace change guidance.
 6. The need to maintain clear alignment between the development of the UK Airspace Change Programme and reforms to the European air transport network.
28. The sections below set out the predictable outcomes in more detail, describe the possible impacts in each scenario and recommend actions for ACOG, NATS, CAA and the industry to help inform the way forward.

Outcome #1: Phased Return

The phased return of some airports to the programme and uncertainty about how and when to resume

29. As the aviation sector enters recovery, in whatever form that takes, the airports participating in the Programme pre CV19 are likely to return to their ACP projects in phases. In all scenarios, a phased return raises questions about how the Programme should remobilise and how the interdependencies between live ACPs and paused ACPs could be managed. Four illustrative options for remobilising the Programme are set out in part 3.
30. Some airport sponsors will choose to resume their ACPs relatively quickly because the long-term strategic goals that their proposals support have not changed significantly. Other sponsors, including Heathrow Airport, may remain paused for a prolonged period while they re-evaluate how the investment in their airspace may best support a new strategic direction. Some ACPs may not return to the Programme at all because the sponsors' business cases to continue investing in airspace change are no longer valid.
31. Each sponsor's decision to resume is likely to be influenced by the choices made about other co-dependent proposals. The ACPs that do resume may do so with changes to their scope. As a result, the Programme will need to re-evaluate the core set of ACPs that are required to optimise the network element and deliver the overall goals of airspace modernisation. The 2018 NATS Feasibility Study identified the airport-led ACPs needed to support network optimisation amid concerns about rising delays if additional airspace capacity was not deployed to meet forecast traffic growth.⁶ An update to this analysis is likely to be required to inform decisions about the core set of ACPs that are now required following CV19.
32. A phased return creates challenges for the development of the Masterplan. The purpose of the Masterplan is to coordinate the core set of ACPs and manage the interdependencies between them. ACOG was developing the second iteration of the Masterplan when the crisis hit. The aim of Iteration 2 was to set out the design options developed as part of the core ACPs, identify the nature of the interdependencies and examine the solutions available to resolve them. In due course, a third iteration of the Masterplan would have described the impacts associated with the preferred options and the outputs of stakeholder engagement and consultation on the overall network proposal.
33. To increase the performance of the network, some ACPs may resume quickly. However, it is important that they do not progress unless the interdependencies they share with other proposals are managed effectively to optimise the future network as a whole. As a result, Iteration 2 of the Masterplan in some form is still required to provide coordination and assurance of Programme integrity across the core ACPs. Notwithstanding, it is also essential for the ACPs that choose to progress quickly to release the benefits of their investments as soon as possible in all scenarios. In the short term, an additional mechanism may be needed that enables ACPs to progress before a Masterplan is produced, providing that an independent assessment of their interactions with other

⁶ Feasibility Report into Airspace Modernisation in the South of the UK, NATS, June 2018

proposals demonstrates that they will not constrain the overall optimisation of the network. Other stakeholders such as GA and UAS will also need to be protected from future ACPs that might seek to increase local controlled airspace as a result of this suboptimal approach.

34. The deployment sequence for the ACPs that do return to the Programme will also need to be re-evaluated in all scenarios. Pre CV19, the main influence on the deployment sequence for the core ACPs was the timelines for the airspace changes required to support Heathrow expansion. The Programme was broadly split into the component ACPs that could be deployed before the expansion airspace changes and those to be deployed alongside. Following CV19 (and the successful legal challenge to the Airports National Policy Statement in late February 2020), Heathrow's airspace programme is deferred and the influence of the expansion ACP on the timelines for other deployments has reduced significantly.
35. Table 3 summarises how the phased return of airports impacts the programme in each scenario.

Table 3: Phased return of airports in each scenario

<p>A: U-shape recovery / low appetite</p> <ul style="list-style-type: none"> • With a quicker recovery profile but low appetite for airspace change, many ACP sponsors are expected to remain paused for longer, extending the timeframes across multiple years and making a Masterplan and an updated deployment sequence for the programme difficult to develop and agree. 	<p>B: U-shape recovery / high appetite</p> <ul style="list-style-type: none"> • In a scenario with a quicker recovery profile and high appetite to progress airspace changes the interdependencies between live ACPs and paused ACPs may become particularly difficult to manage effectively. • There is also greater risk that the first mover advantage for some more advanced ACPs negatively impacts others and/or the optimisation of the overall network.
<p>L-shape recovery / low appetite</p> <ul style="list-style-type: none"> • More airports are likely to exit the Programme with prolonged lower traffic growth and a generally low appetite for airspace change, raising questions about the overall viability of the initiative and the roles and responsibilities of the participants that may remain. 	<p>L-shape recovery / high appetite</p> <ul style="list-style-type: none"> • The scope of the ACPs that resume is likely to change more significantly in a scenario with prolonged lower traffic growth but a high appetite for airspace change. This may include new network connecting points and more diversity in the airspace concepts that are progressed, making it harder to align and integrate the changes.

36. Recommendations linked to the phased return of airports to the programme are set out below:

- R1. Commitment:** In order to mitigate the risk of incoherence across the Programme, that ACOG and the airport ACP sponsors establish clear protocols for: the airports that resume the Programme; the engagement with those that remain paused; and the process for those that cannot continue. *By end Aug 20*
- R2. Core set of ACPs:** That NATS re-evaluate the 2018 Feasibility Report into Airspace Modernisation to identify the core set of airport-led ACPs that will be required to support network optimisation following CV19. *By end Aug 20*
- R3. Deployment sequence:** That ACOG and NATS re-evaluate the Programme deployment plan to ensure that the airport-led and network ACPs are aligned and can be incorporated into Iteration 2 of the Masterplan. *By end Oct 20*
- R4. Interdependencies:** In the short-term absence of a Masterplan, that ACOG and the CAA develop an approach to assure that ACPs progressing to the Stage 2 Gateway do not conflict with or constrain the optimisation of the wider network. *By end Aug 20*

Outcome #2: Funding and Resources

The shortage of funding and resources to develop and deploy airspace changes

37. When CV19 restrictions were imposed in March 2020, the airports had invested c.£10 million into the programme, developing and assessing options for their parts of the new network. NATS had invested a similar amount on progressing the network ACPs. The funding for airspace modernisation comes via airline charges and private investment from the airports. With flights grounded and the industry shrinking, there is less funding for airspace modernisation in the short-term as organisations conserve liquidity and concentrate on surviving the crisis. Even in a more optimistic scenario with a quicker recovery, capital expenditure will be under extreme pressure across the aviation sector for some time. When operations begin to return towards normal, some airport sponsors may not be able to afford the resources required to remobilise their ACPs. There is concern that the work conducted to date risks becoming obsolete if the ACPs are not progressed at least through to the Stage 2 Gateway - a point where the proposals are sufficiently comprehensive, independently validated and can be further refined for public consultation. The airports' proposals vary in size and were each paused at different points in the process so any funding gaps will vary across different ACPs.
38. ACOG is currently working with the industry to develop a framework for estimating the overall benefits and costs of the individual airport ACPs and the overall network optimisation plan. This information should demonstrate that funding to support airspace modernisation can generate significant multiplied returns for both the environment and the wider economy, far beyond the consumers of aviation products and services directly. The CAA has recent experience of administering an airspace funding scheme, known as the FAS Facilitation Fund. The scheme saw £5 million allocated to airports, airspace users and other aviation stakeholders between 2015 and 2019 to address gaps in the business case for airspace modernisation. If funding were to be made available to tackle the short-term ACP funding gaps created by CV19, the governance arrangements and oversight process designed for the FAS Fund may provide a model for administering the scheme.
39. Table 4 summarises how the shortage of funding and resources impacts the Programme in each scenario.

Table 4: Shortage of funding and resources in each scenario

U-shape recovery / low appetite	U-shape recovery / high appetite
<ul style="list-style-type: none"> With a lower appetite for airspace change, it is likely that comparatively more ACP sponsors are unwilling to fully fund their proposals. A quicker return to pre CV19 traffic levels that helps to drive the economic recovery may provide the impetus for a proposal to part fund the core ACPs and incentivise sponsors to progress in support of the network optimisation. 	<ul style="list-style-type: none"> Some ACPs are expected to experience funding issues, even in a scenario with a quicker recovery. The Programme may need to identify the size and nature of the funding gaps and assess if they create risks for the wider network optimisation plan. Where these risks arise, it may be appropriate to seek support funding to close some of the specific gaps.

<p>L-shape recovery / low appetite</p> <ul style="list-style-type: none"> • With sustained low growth and little appetite for airspace modernisation it seems unlikely that the Programme would be able to progress without a closely controlled central budget to cover the costs of the minimum set of core ACPs needed to optimise the network. 	<p>L-shape recovery / high appetite</p> <ul style="list-style-type: none"> • With sustained low growth, funding for ACPs is going to come under greater pressure. If there remains a high appetite to deliver airspace modernisation, there may be a case for support funding for the core ACPs that sponsors are willing to progress to optimise the network.
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40. A recommendation linked to the shortage of funding and resources is set out below:

- R5. Additional funding support:** That ACOG examines options for external financial support for delivering the Programme objectives and, if appropriate, the potential options for accessing and managing funds. *By end Jun 20*

Outcome #3: Environmental Performance

The increased importance of environmental performance as one of the main drivers for airspace modernisation

41. There are several key drivers for airspace modernisation. Continuous improvements that enhance aviation safety are treated with the highest priority. The other drivers often compete with one another in terms of priority. Airspace changes can be optimised for: capacity to accommodate growing demand; reduce emissions; better manage noise impacts; and increase access for GA, Business jets and UAS operators. In all scenarios, the drivers to add capacity shrink significantly following CV19 (at least in the short term). Traffic levels will track below the 2019 peak for several years (even in the more optimistic scenarios) and the impetus to expand runway capacity in the South East has been deferred into the next decade.
42. At the same time, many stakeholders expect the pressure to reduce aviation emissions and better manage aircraft noise will intensify to a level that demands attention and more importantly, investment. The Programme will be met with a stronger challenge to reduce CO₂ emissions by 2050 by optimising airspace design, while accommodating long-term traffic growth. Some local communities that are experiencing quieter skies during lockdown will push ACP sponsors to speed up the deployment of innovative airspace concepts to retain some of the peace and tranquillity. Others may step up their general opposition to airspace change.
43. The aviation sector has an excellent track record for innovations that help to mitigate its environmental impact. Between 2010 and 2016, passenger numbers in the UK increased by 27%, while total emissions only grew by around 0.2%.⁷ Better engines and airframes have delivered the majority of the performance improvements so far. Airspace modernisation at lower altitudes remains a hugely untapped opportunity to deliver significant reductions in future emissions as traffic levels return to (and in due course) surpass 2019 levels.
44. The management of aircraft noise is a similar story. Aircraft entering service today create a noise footprint that is on average 30% to 50% lower than the aircraft they replace.⁸ Airspace modernisation offers the significant potential to deploy new routes that capitalise on improvements in aircraft performance. More precise and flexible flight paths can be designed to avoid noise-sensitive areas and offer predictable relief for those that are overflown.
45. Table 5 summarises how the increased importance of environmental performance as one of the main drivers for airspace modernisation impacts the programme in each scenario.

⁷Decarbonisation roadmap: A path to net zero, Sustainable Aviation, 2019

⁸Noise roadmap: A blueprint for managing noise from aviation sources to 2050, Sustainable Aviation, 2017

Table 5: The increased importance of environmental performance in each scenario

<p>U-shape recovery / low appetite</p> <ul style="list-style-type: none"> • With growing traffic levels and a lower appetite for airspace change, the programme will need to manage the risk that 2019-like capacity issues re-emerge in the 2023-25 timeframe and the necessary airspace changes that strike a balance between growth and environmental performance have not progressed. • As growth returns, community groups may also become increasingly concerned about the lack of progress on local noise issues. 	<p>U-shape recovery / high appetite</p> <ul style="list-style-type: none"> • In a scenario with a comparatively quicker recovery profile the trade-offs between capacity, emissions and noise are expected to come under greater scrutiny. • With a higher appetite for airspace change, the emphasis on noise mitigation at lower altitudes is likely to come into frequent conflict with network designs that seek to maximise flight efficiency and combat emissions.
<p>L-shape recovery / low appetite</p> <ul style="list-style-type: none"> • The capacity and congestion drivers for airspace modernisation shrink most significantly in this scenario. • Local communities and interest groups that oppose specific ACPs on the grounds of aircraft noise may find more traction with decision makers because of the generally lower appetite for airspace change. 	<p>L-shape recovery / high appetite</p> <ul style="list-style-type: none"> • With traffic growth suppressed in the short to medium term, attention may turn to a more expansive, technology led and environmentally focused vision for airspace modernisation. • The higher appetite for change may lead sponsors to focus their local ACPs on the deployment of environmentally friendly airspace concepts.

46. A recommendation linked to the increased importance of environmental performance is set out below:

- R6. Sustainability:** That ACOG, the airport ACP sponsors and NATS assess how best to achieve the airspace emissions savings contribution set out in the Sustainable Aviation Decarbonisation Roadmap. *By end Sep 20*

Outcome #4: Airspace Integration

The increased importance of airspace integration as one of the main drivers for airspace modernisation

47. One of the main drivers for modernisation is to secure the efficient use of airspace by enabling greater integration of GA and Business jet operations with commercial air transport. In this context, the term airspace integration refers to the deployment of innovative solutions to create a sustainable and equitable air traffic environment. Airspace integration solutions may be technology-led, procedural or involve changes to the structure and classification of volumes of airspace. The goal of airspace integration is that all user groups can access the airspace they require safely and efficiently. It does not mean that all user groups should co-exist in all volumes of airspace all the time. Rather, that users are able to conduct their operations effectively, in volumes of airspace that are suitably sized and sited for their needs, and that controlled and segregated airspace should be proven necessary and maintained equitably.
48. The UK has a thriving GA community, with many sports, leisure and business aircraft operating predominantly in uncontrolled (Class G) airspace. The GA community is expected to resume the majority of their operations quickly in all scenarios following CV19. There are also indications that business operators may experience an increase in passenger demand following CV19 as they seek to fulfil some of the connections no longer supported by scheduled airlines. The recent growth in commercial UAS, which has expanded further following CV19, is adding a third important dimension to the integration challenge. Airspace integration is a standard design principle for the airport-led ACPs. For some ACPs, greater integration is the subject of a trade-off decision with capacity and environmental drivers. As the capacity driver shrinks (in the short term at least) the ACPs are expected to come under greater pressure from the GA community to deploy designs that enhance their access to the airspace and to release underutilised controlled airspace as part of the Programme.
49. Airspace integration is considered an essential enabler for the widespread use of UAS to deliver a range of new aviation products and services. UAS operators offer solutions to a variety of societal needs that are emerging more rapidly following CV19, mainly due to the ongoing requirement for social distancing. These include transporting medical supplies, surveillance of major incidents and gathering data to direct stretched public services. In the long term, airspace integration will be required to support the growth in Urban Air Mobility. Currently, to operate safely, UAS flying Beyond Visual Line of Sight require segregated airspace that excludes all other aircraft (usually in the form of a temporary danger area). The need for segregated airspace generally arises from the lack of a shared surveillance picture for the aircraft operating in the same area and the airspace structures to enable effective integration. There is concern that the growing demand for UAS will create a patchwork of airspace segregations that will quickly become unsustainable because of the impact on safety and efficiency.
50. Table 6 summarises how the increased importance of airspace integration as a main driver for airspace modernisation, impacts the Programme in each scenario.

Table 6: The increased importance of airspace integration in each scenario

<p>U-shape recovery / low appetite</p> <ul style="list-style-type: none"> • With a quicker recovery profile but low appetite for change, the industry may come under greater pressure from the GA community frustrated with the lack of process on access and integration issues. 	<p>U-shape recovery / high appetite</p> <ul style="list-style-type: none"> • In a scenario with a quicker recovery profile the trade-offs between capacity, sustainability and access are likely to be more acute. With a higher appetite for airspace change there may be greater enthusiasm to develop integration solutions that can optimise these trade-offs.
<p>L-shape recovery / low appetite</p> <ul style="list-style-type: none"> • A low growth and low change scenario may lead to airspace integration initiatives taking priority over the network redesign as the cornerstone of the modernisation programme. 	<p>L-shape recovery / high appetite</p> <ul style="list-style-type: none"> • With sustained low growth, but a high appetite for airspace modernisation there may be greater potential to progress airspace changes that enable GA and UAS operators to take advantage of underutilised controlled airspace.

51. A recommendation linked to the increased importance of airspace integration is set out below:

- R7. Airspace integration:** That ACOG work with GA and UAS stakeholders to explore options for the Programme to ensure their needs and requirements are collectively coordinated with ACP sponsors, potentially leveraging additional funding support from UKRI via the Future Flight Competition. *By end Jul 20*

Outcome #5: Application of Policy and Regulation

The application of the Government's aviation policy framework and the CAA's regulatory airspace change guidance

52. Airspace modernisation is a shared policy and regulatory objective between the DfT and CAA. The overall goal is to deliver quicker, quieter and cleaner journeys. The AMS sets the ends, ways and means of modernising airspace through 15 initiatives.⁹ The UK Airspace Change Programme focuses on the implementation of 2 initiatives (FASI-S and FASI-N). The strategy also established a new governance structure which sets out the industry's responsibility for its delivery and how affected stakeholders will be engaged.
53. Following CV19, the policy and regulatory objectives for airspace modernisation may be subject to review. Some refinements to the strategy are required to realign the timelines for AMS implementation in response to the inevitable delays that will arise in all scenarios. However, a fundamental shift in the modernisation objective may risk undermining the FASI ACPs (and other AMS initiatives) that were part way through when the crisis hit. In addition, the successful legal challenge to the Airports National Policy Statement (which is subject to appeal at the time of writing) has left a policy gap regarding the core ACPs that are focused on enabling the expansion of runway capacity.
54. The CAA is obliged to evaluate ACPs and make decisions on whether to approve them in accordance with the airspace change process, known as CAP1616. The process sets out the stages and activities involved from the conception of a change, assessing different design options, consulting and engaging with those potentially impacted, and ultimately a regulatory decision. Various aspects of CAP1616 may constrain a sponsor's ability to alter the scope of their existing ACPs following CV19, without returning to the beginning of the process. Moreover, pausing or changing ACPs due to CV19 may generate more compelling challenges from opponents to airspace change on the grounds that the process was not followed appropriately. A review and assurance methodology are required that enables the ACPs developed to date to be retained, repurposed if appropriate in response to CV19 and progressed intelligently within the bounds of the CAP1616 process.
55. Table 7 summarises the how Government's aviation policy framework and the CAA's regulatory airspace change guidance impacts the Programme in each scenario.

Table 7: Application of the aviation policy framework and regulatory guidance in each scenario

U-shape recovery / low appetite	U-shape recovery / high appetite
<ul style="list-style-type: none"> With a quicker recovery profile but lower appetite for change, the Government and CAA might re-examine the drivers and incentives to progress airspace modernisation to ensure capacity, environmental and access drivers are addressed in the required timeframes. 	<ul style="list-style-type: none"> In a scenario with a quicker recovery profile and high appetite for airspace change the aviation policy framework and CAA regulatory guidance may only require small adaptations to enable the Programme to progress.

⁹Airspace Modernisation Strategy, CAP1711, CAA, December 2018

<p>L-shape recovery / low appetite</p> <ul style="list-style-type: none"> • Sustained low growth and a low appetite for modernisation may require a comprehensive reform of the aviation policy and regulatory guidance that supports airspace change. 	<p>L-shape recovery / high appetite</p> <ul style="list-style-type: none"> • With sustained lower growth the capacity and environmental drivers that underpin key aspects of the aviation policy framework may require review. Industry stakeholders are expected to actively contribute to the review because of their high appetite for change.
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56. Recommendations linked to the application of the Government's aviation policy framework and the CAA's regulatory airspace change guidance are set out below:

R8. Airspace change process review: That ACOG gather stakeholder feedback in the form of a lessons learned exercise to help inform any process improvements associated with the application of the CAP1616 guidance. *By end Oct 20*

R9. Trade-off Decisions: That the CAA produce detailed guidance on the treatment of trade-off decisions for airspace design when one objective (e.g. sustainability) has more weighting than others (e.g. noise mitigation or additional capacity). *By end Oct 20*

Outcome #6: European Alignment

The need to maintain clear alignment between the development of the UK Airspace Change Programme and reforms to the European air transport network

57. There is a broad consensus across European States and aviation stakeholders that the exceptional circumstances created by CV19 require a joined-up response. EUROCONTROL is providing a consolidated view of traffic demand, the delivery of services during the crisis and recovery planning. The EU framework for reforming European airspace (known as Single European Sky or SES) is helping the recovery by aligning airspace modernisation plans across the individual States. SES projects have delivered a range of airspace and ATM improvements over the past decade to add capacity and reduce delays. However, European airspace is still highly fragmented. 37 ANSPs maintain 60 control centres, creating a patchwork of complex airspace sectors, boundaries and interactions. The result is that on average each flight in Europe is 49km longer than the direct route.¹⁰
58. To maximise efficiency during the crisis, the European Network Manager has removed many of the existing restrictions that were in place to protect sectors from overloading. Without restrictions, the flights that are operating can follow the shortest most direct routes. Recent figures have indicated a saving of 26,000 track miles per day across the network, albeit with much reduced traffic – and therefore fewer aircraft to accommodate.¹¹ An integrated programme of airspace changes and operational improvements, coordinated at the European level, has the potential to lock in these benefits by avoiding the reintroduction of restrictions as traffic returns. Prior to CV19, the European Commission had developed a new transition plan towards the implementation of a Single European Airspace System – as envisaged in the European Airspace Architecture Study.¹² The plan proposes a way forward with a focus on the next five years to set in motion the broader transformational changes needed longer-term. One of the key measures set out in the plan is an airspace re-configuration plan supported by an operational excellence programme to achieve quick wins. The approach to remobilisation of the UK Airspace Change Programme should be closely aligned with the European transition plan to maximise the potential benefits across the region as a whole. Table 8 summarises how the need to maintain clear alignment with European airspace reforms impacts the Programme in each scenario.

Table 8: Alignment with European airspace reforms in each scenario

U-shape recovery / low appetite	U-shape recovery / high appetite
<ul style="list-style-type: none"> The transition plan towards a Single European Airspace System is expected to progress rapidly in a scenario with a quick recovery. With a low appetite for airspace change there is a risk that the European plans progress without adequate UK involvement. 	<ul style="list-style-type: none"> The transition plan towards a Single European Airspace System is expected to progress rapidly in a scenario with a quick recovery. With a high appetite for airspace change it will be important that key UK stakeholders are embedded in the European plans from the outset to maximise the benefits and avoid structural inefficiencies.

¹⁰ Modernising the European Sky, SESAR Joint Undertaking, 2015

¹¹ European Network Operations Plan (NOP) – 2020 Recovery Plan

¹² European Airspace Architecture Study, SESAR Joint Undertaking and EUROCONTROL, 2019

L-shape recovery / low appetite	L-shape recovery / high appetite
<ul style="list-style-type: none"> • With sustained low growth and a low appetite for airspace change the transition plan may be re-evaluated and the potential for quick wins may focus primarily on cost efficiencies. 	<ul style="list-style-type: none"> • With sustained low growth but a high appetite for airspace change the transition plan may be re-evaluated and the potential for quick wins may focus on innovative new concepts that can improve environmental performance.

59. A recommendation linked to the need to maintain alignment with European airspace reforms is set out below:

R10. European engagement: That ACOG ensures the UK ACPs below 7000ft. progress coherently with the regional plans to remobilise operations and enhance network performance via NERL’s engagement with the EUROCONTROL-led Network Management Transition Plan and Operational Excellence Programme. *(ongoing)*

Part 3: Options for remobilising the Programme

60. This section considers four illustrative options for remobilising the Programme. The options are described in general terms and assume that the recommendations presented in Part 2 are adopted. The way that some recommendations are enacted may differ depending on the option.

61. The four options are:

1. **A targeted Programme** of 'must do' and 'quick win' ACPs
2. **A decentralised Programme** following a market-led 'ink spot' strategy
3. **A centralised Programme** implementing an agreed Masterplan
4. **An innovation Programme** focusing on new technologies and business models

62. Options #1 and #2 may be delivered in advance of a coordinated Masterplan. Options #3 and #4 require the development of the Masterplan to manage the interdependencies and mutual impacts of the component ACPs. The main features of remobilising the Programme in each option are set out in more detail below. The options are not intended to be mutually exclusive. A combination of features from different options may be combined to reach an agreement on the actual way forward.

Remobilisation option #1: A targeted Programme

63. One option is to remobilise the Programme by targeting a set of relatively simple 'must-do' and 'quick win' ACPs. The scope of the targeted Programme would be limited to ensure it is deliverable in the near term with fewer resources and less funding. Some of the targeted ACPs may be drawn from existing FASI proposals, others may be new to the Programme. The must-do and quick win ACPs would aim to maximise the benefits of airspace upgrades with minimal changes to aircraft tracks over the ground. Following this principle, the ACPs would focus on four main areas:

- Removing dependencies on ground-based navigation aids.
- Raising the climb and descent profiles of arrival and departure procedures where possible to deliver efficiency and environmental improvements.
- Releasing underutilised controlled airspace to improve access for GA/UAS operations.
- Network upgrades above 7000ft. that improve the flow of traffic and enable future lower altitude changes.

64. ACPs in these areas would create minimal noise impacts and have very few interdependencies with other proposals so the targeted Programme could progress without (or in advance of) the central coordination provided by a Masterplan.

65. The main features of a targeted Programme may include:

- A national review to identify an appropriate group of must do and quick win ACPs that can progress with fewer resources and less funding.

- A business case to quantify the full economic costs and benefits of implementing a targeted Programme and identify any funding gaps.
- An integrated deployment plan for the targeted Programme that aims to streamline the development of the ACPs, minimise duplications of effort across the sponsors, and generate economies of scale (for example by batching up standard design and analytical tasks).
- Integration with the outputs of the recent airspace classification review.

66. Table 9 summarises the strengths, weaknesses, opportunities and threats associated with remobilising a targeted Programme for airspace change.

Table 9: SWOT assessment of remobilising a targeted Programme

	A targeted Programme of must-do and quick win ACPs
Strengths	<ul style="list-style-type: none"> • Releases early benefits, in a relatively low risk programme that does not face the challenges associated with significant noise impacts and complex interdependencies • Requires fewer resources, fewer costs, and less change management to develop and implement • Can be delivered in advance of a Masterplan (some aspects would be folded into the Masterplan in due course)
Weaknesses	<ul style="list-style-type: none"> • The total benefits of the Programme are more modest (suboptimal) than large-scale modernisation, leading to limited support from the commercial air transport community that may rather drive forward with the FASI programmes • Environmental targets would not be met
Opportunities	<ul style="list-style-type: none"> • Opportunity to build trust and confidence across the industry and with external stakeholders that airspace change can be delivered effectively and generate benefits for different airspace user groups, communities and the environment • Opportunity to learn lessons from the end-to-end application of the CAP1616 process that can be transferred to the larger scale modernisation programme in due course
Threats	<ul style="list-style-type: none"> • It will be important to manage some of the larger-scale FASI ACPs that are eager to progress but may not fit with the minimal noise/interdependency principle of a targeted programme • In the course of the route redesign for network optimisation, many of the lower altitude airport ACPs would have released some controlled airspace for use by GA operators – some of these enhanced access benefits would be put at risk with a decentralised programme

Remobilisation option #2: A decentralised Programme

67. This option relies predominantly on the market forces that underpin competition in the UK airports sector to drive airspace modernisation at lower altitudes. Providing there is sufficient incentive for airports to invest in upgrading their local arrival and departure routes and the long-term vision for modernisation is clear, then the central coordination of a Masterplan may not be needed in the very short-term. ACOG's role in the decentralised Programme would focus on setting the right conditions for the airports to deliver successful outcomes through their local ACPs. Pockets of lower altitude airspace change would emerge across the UK like 'ink spots' to a scope and timeline that the airports making the investments consider to be most commercially viable.

68. The main features of remobilising a decentralised Programme may include:

- The production of a full vision and roadmap that can be used by the airport sponsors as a guide for how new airspace concepts, technologies and procedures should be deployed at lower altitudes to modernise airspace
- A longer deployment timeline where individual airports progress at their own pace
- A process for individual airports to engage with the NERL airspace programme directly to secure efficient access to the network, where and when they require it
- The responsibility placed on individual airport ACP sponsors to demonstrate how their proposals ensure the efficient use of airspace, having engaged with all affected stakeholders including NERL and the other airports
- Airports with co-dependent ACPs become external stakeholders in each other's proposals
- The identification of market failures where the incentives to invest in airspace modernisation are not sufficient and access to funding sources to close the gap
- An efficient process for resolving conflicts where competing demands for the same volumes of airspace cannot be resolved by the individual sponsors
- Potential for a mechanism whereby NATS step in to deliver specific lower altitude ACPs that are required for network optimisation if the airports do not progress

69. Table 10 summarises the strengths, weaknesses, opportunities and threats associated with remobilising a decentralised Programme for airspace change.

Table 10: SWOT assessment of remobilising a decentralised Programme

A decentralised Programme following a market-led ink spot strategy	
Strengths	<ul style="list-style-type: none"> • The airspace changes with the most obvious benefits case are likely to progress soonest • The scope of the decentralised programme is inherently aligned to the airports willingness to pay and ability to resource the changes that are progressed • The resource requirement and costs associated with maintaining collaboration forums with other airports is removed

Weaknesses	<ul style="list-style-type: none"> • A series of incremental changes may not deliver a fully optimised network. The NATS-led network ACPs will require some airports to reposition their routes at lower altitudes to operate efficiently. The decentralised Programme offers no assurance that the airports will progress the ACPs required by the network • Environmental targets would not be met • The ability to strike efficient trade-offs between co-dependent ACPs may be limited if individual proposals progress to different timescales • First movers may gain an advantage over other airports that delay their investments • Some airports may not progress any form of airspace modernisation ACP
Opportunities	<ul style="list-style-type: none"> • The main opportunity associated with a decentralised Programme is to release early benefits for airspace users where there is a clear business case to upgrade routes at lower altitudes; and to minimise the costs of developing ACPs that are not considered commercially viable by the relevant airports in the current economic climate
Threats	<ul style="list-style-type: none"> • One of the main threats to a decentralised programme arises if a large number of existing ACP sponsors do not consider their proposals to be commercially viable in the short term and choose not to progress – undermining the network ACP • Releasing control over the scope of the programme in a decentralised model may place additional cost and risk on the NATS systemisation programme that is aligned to the core FASI-S and FASI-N ACPs • In the course of the route redesign for network optimisation, many of the lower altitude airport ACPs would have released some controlled airspace for use by GA operators – some of these enhanced access benefits would be put at risk with a decentralised Programme

Remobilisation option #3: A centralised Programme

70. This option is a continuation of the FASI-S and FASI-N initiatives. It concentrates on comprehensively upgrading the core of the UK's air transport network as a national infrastructure programme with component ACPs at airport and network level, individually optimised and then combined into an overall Masterplan. The main features of remobilising a centralised Programme would include:

- A clear mandate for the centralised Programme (supported by a Masterplan) that is set within a stable policy and regulatory framework
- A commission from the DfT and CAA (as AMS co-sponsors) for NATS to revise the airspace modernisation feasibility study and identify the location and scope of the core ACPs that should now be delivered over the next five years to upgrade the network
- A Masterplan process that ensures the core ACPs are developed in a manner that optimises the overall environmental performance of the network, but can be deployed in a flexible sequence, cognisant that some proposals are more advanced than others
- The phased return of existing FASI-S and FASI-N ACPs into the Programme
- Independent assurance of the FASI ACPs that are able to progress beyond Stage 2 of the CAP1616 process before the production of an agreed Masterplan
- Support funding arrangements that appropriately incentivise the sponsors of the core ACPs to progress the proposals they are responsible for in a complementary timeframe and address business case gaps and environment targets
- A lessons learned exercise on the application of CAP1616 during its first two years of use, focusing on the requirements, costs and benefits of the process and the means by which the gaps identified for large scale co-dependent ACPs with cumulative impacts can best be addressed

71. Table 11 summarises the strengths, weaknesses, opportunities and threats associated with remobilising a centralised Programme for airspace change.

Table 11: SWOT assessment of remobilising a centralised Programme

	A centralised Programme implementing an agreed Masterplan
Strengths	<ul style="list-style-type: none"> • A phased continuation of the pre CV19 Programme capitalises on the airports' investment to date through the FASI ACPs and on the efforts of DfT, CAA and ACOG to create and agree the associated governance structures and a Masterplan process • The requirement to progress the core set of ACPs to a common timeline maximises the efficiency of trade-off decisions to optimise the network for achievable environmental performance (because all the co-dependent routes are subject to change / open to trade-off in the same timeframes)

Weaknesses	<ul style="list-style-type: none"> • Coordinating all the core ACPs needed to optimise the network to a common timeline is a major sequencing and resourcing challenge • A centralised Programme where the component ACPs are optimised at a local level and then integrated into a separately created network is highly complex. There is a risk that the overall system (although theoretically optimised through local and network integration) is too complicated to implement in practice.
Opportunities	<ul style="list-style-type: none"> • There is an opportunity following CV19 to use the relatively quiet period as the sector recovers to implement the centralised programme • The ability to prioritise the environmental targets attributed to airspace modernisation that are set out in the Sustainable Aviation Decarbonisation Roadmap is greatly enhanced • The centralised Programme is an opportunity to build on the existing FASI-S deployment plan that needs to be refined following the recent delay to Heathrow expansion
Threats	<ul style="list-style-type: none"> • Experience pre CV19 demonstrated that a centralised Programme is a large, resource intensive initiative with numerous technical complexities in the development phase and a major change management effort in the deployment phase • One of the main threats to the centralised Programme is that the industry participants no longer have the funding or resources to develop and deploy ACPs of the scope and nature envisaged • The centralised approach also creates a tendency to develop overly bureaucratic processes that (although well meaning) reach from the centre out to the programme participants, creating additional workload and costs

Remobilisation option #4: An innovation Programme

72. Remobilising an innovative, technology-led airspace change programme, would focus the scope of the core ACPs (and possibly new ACPs) on the airspace changes required to enable a broader set of modernisation goals looking out to 2040. These goals may include the creation of a fully integrated airspace environment where different user groups (CAT, MIL, GA/Business and UAS) can coexist without segregation. Initiatives that focus on the creation of a fully known electronic surveillance environment and the deployment of flexible use airspace structures to enhance GA/UAS access would be key to the scope of an innovation programme.

73. The main features of remobilising an innovation Programme may include:

- A review conducted by the CAA and ACOG that considers how the broader goals of airspace modernisation may be delivered quicker and better through an innovation programme
- The adaptation of the Masterplan approach to incorporate the deployment of key initiatives that enable airspace integration
- An application from ACOG to lead an industry consortium in the Future Flight competition, concentrating on airspace readiness for GA and UAS integration
- A review of the ACOG business model and funding structure, focusing on the Group's scope, capabilities and the stakeholders it is intended to serve

74. Table 12 summarises the strengths, weaknesses, opportunities and threats associated with remobilising an innovation Programme for airspace change.

Table 12: SWOT assessment of remobilising an innovation Programme

	An innovation Programme focusing on new tech and business models
Strengths	<ul style="list-style-type: none"> • Incorporating the initiatives that enable airspace integration would broaden the mix of airspace users that benefit from the Programme • An innovation Programme would put airspace modernisation at the centre of the research and development needed to provide the next generation of aviation products and services, including Urban Air Mobility • Delivering airspace integration initiatives alongside the redesign of the air transport network offers the opportunity to future proof both developments and avoid the risk that aspects of the new network would need to change again following implementation
Weaknesses	<ul style="list-style-type: none"> • Some of the more innovative concepts and technologies associated with airspace integration are still in the R&D/ pre-industrialization phase • It may be difficult to combine R&D activities with the core network redesign aspects of the Programme that are based on mature concepts and technologies

	<ul style="list-style-type: none"> Some aspects of the Programme may also draw attention away from the core delivery of FAS-I N and S
Opportunities	<ul style="list-style-type: none"> An innovation programme offers the opportunity to use the downturn in conventional traffic levels to incorporate new cutting edge initiatives Broadening the programme to include innovation offers the opportunity to access new sources of funding from the UAS, UAM, Aerospace and R&D sectors (in the UK, much of this funding is coordinated through the UKRI Future Flight Competition) Some of the concepts and technologies under development to support airspace integration may offer opportunities to improve the approach to redesigning the core network
Threats	<ul style="list-style-type: none"> Broadening the Programme to include innovation risks adding more complexity to an already highly complicated initiative The additional scope would need to be accompanied by additional funding and specialist resources for ACOG and the ACP sponsors to access – existing teams focusing on the network redesign may not have the capacity or capability to deliver the innovation aspects

Glossary

Acronym	Description
ACOG	Airspace Change Organising Group
ACP	Airspace Change Proposal
AMS	Airspace Modernisation Strategy
ATM	Air Traffic Management
CAA	Civil Aviation Authority
CAT	Commercial Air Transport
CV19	COVID-19 (Corona Virus Disease 2019)
DfT	Department for Transport
FAS	Future Airspace Strategy
FASI	Future Airspace Strategy Implementation
GA	General Aviation
ICAO	International Civil Aviation Organization
IATA	International Airline Trade Association
LAMP	London Airspace Management Programme
NERL	NATS En Route plc.
PLAS	Prestwick Lower Airspace System
SES	Single European Sky
SESAR	Single European Sky ATM Research
SWOT	Strengths, Weaknesses, Opportunities, Threats
UAM	Urban Air Mobility
UAS	Unmanned Aerial Systems
UKRI	UK Research and Innovation

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