Department for Transport

UK Civil Aviation Authority

Airspace Masterplan Iteration One (Southern UK): co-sponsor assessment

CAP 1884

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Chapter 1

Introduction

Note: This document was developed before the impact of COVID-19. Our original intention was to publish this report in Spring 2020, however this was impacted by the pandemic. We are publishing it now for completeness. Although this is now a historical document, where relevant we have provided recent updates to aid the reader.

1. In 2017 the government published its Strategic Case for Airspace Modernisation.[1] This recognised that redesigning airspace will affect different people in different ways, and set out the major benefits that modernisation can deliver including increasing capacity, reducing delays and providing more fuel efficient routes.

2. The Civil Aviation Authority (CAA) published its Airspace Modernisation Strategy[2] (AMS) in December 2018. Airspace modernisation will need to be delivered by a range of aviation organisations, and a wide range of stakeholders will need to be engaged throughout this delivery. The DfT and the CAA are committed to working with relevant stakeholders and those tasked with delivery to ensure modernisation happens in a coherent and consistent way.

3. The AMS sets out 15 initiatives that the aviation industry must deliver to modernise UK airspace. These initiatives will modernise: the operational concepts by which aircraft are flown; the technology used for communications and navigation in airspace; and, arguably the most complex challenge, the structural design of UK airspace.

February 2021 update: Despite the current international crisis caused by the COVID-19 pandemic and its impact on the aviation industry and air traffic levels, the need to modernise the UK's airspace design remains clear. The DfT and CAA, as co-sponsors of airspace modernisation released a statement in July 2020 confirming a continued commitment to airspace modernisation and the need to consider how individual organisations may progress airspace change in response to the Airspace Change Organising Group's (ACOG's) report on 'Remobilising the Airspace Change Programme'.

Whilst the CAA will always regularly review its AMS, the impact of the COVID-19 pandemic means that we will need to undertake a review sooner than expected. The

[1] https://www.gov.uk/government/publications/upgrading-uk-airspace-strategic-rationale

[2] CAP1711 Airspace Modernisation Strategy, December 2018

CAA intends to complete any revisions to the AMS to provide clarity to industry in early 2022.

4. Historically there has been no co-ordinated delivery plan for the airspace design changes needed for modernisation. If airspace change sponsors do not co-ordinate a scenario could be created whereby sponsors consult separately on, and then submit to the CAA for a decision, conflicting design options. This would be inefficient, confusing for stakeholders, and could cause major delays to the modernisation programme.

5. The DfT and CAA (as co-sponsors of airspace modernisation) commissioned NATS En Route PLC (NERL) to develop a co-ordinated implementation plan for airspace changes (or airspace change masterplan) initially in the south of the UK, and to create a co-ordination group (now known as the Airspace Change Organising Group (ACOG)) to lead the preparation of the airspace change masterplan.

6. The masterplan will set out where airspace change could be taken forward to provide benefits, consider the potential conflicts, trade-offs and dependencies, and set out a preferred implementation plan.

7. NERL submitted a first iteration of the masterplan in August 2019, before ACOG was formed. NERL's work helpfully moved forward one of the most complex challenges of the CAA's Airspace Modernisation Strategy[3]. Once the co-sponsors received the first iteration of the masterplan, we committed to assessing it, and to publishing it along with a summary of our feedback. This report responds to that commitment.

[3] CAP1711: CAA's Airspace Modernisation Strategy

Chapter 2

Background

8. On 2 November 2018 we wrote to NERL to commission and set out our expectations of the work of the Airspace Change Organising Group (then called the Airspace Modernisation Oversight Group). We asked NERL to set up the group to, as a matter of urgency, lead the FASI South Programme of airspace modernisation to create a single coordinated implementation plan for airspace changes in Southern England (an airspace change masterplan).

9. The letter is included in Appendix A. The expectations for the masterplan (paragraphs 5, 6 and 7 of the letter) were replicated in Chapter 6 of the CAA's AMS. These expectations were based on the factors set out in section 70 of the Transport Act 2000[4], which sets out how the CAA must exercise its air navigation functions, including giving priority to maintaining a high standard of safety.

10. The content of the first iteration (southern UK) of the masterplan, how we would assess the first iteration, and plans for future iterations were confirmed in our additional letter to NERL on 30th July 2019, which is included in Appendix B for reference.

11. Having now been established, ACOG is leading the preparation of the next iteration of the masterplan, and the co-ordination of all airspace changes, including NERL's upper airspace proposals with individual airports. ACOG will also identify opportunities for additional benefits covering areas such as fuel efficiency, reducing noise or improving access to airspace for all users[5], as set out in our commissioning letters.

February 2021 update: ACOG have taken over responsibility for the development of the masterplan, and ACOG's Steering Committee membership includes representatives of all airspace users to ensure the impact of the mastplan on all types of airspace user is taken into account.

ACOG recently published their report 'Scenarios for remobilising the UK Airspace Change Programme following the COVID-19 Pandemic' which included a number of recommendations. The timescales in which airspace modernisation will take place will change, and we also need to consider what changes may be required to how

[4] http://www.legislation.gov.uk/ukpga/2000/38/section/70

[5] Since commissioning NERL, the CAA has received new Air Navigation Directions from the Secretary of State for Transport in October 2019. The amended Directions require the CAA to regularly consider whether airspace classification should be reviewed. In the future we will work with ACOG to align the masterplan development with the airspace classification review that the CAA will carry out, and ensure the evidence and approach to both are co-ordinated.

individual organisations progress their individual airspace changes and how they will interact with NATS and ACOG.

ACOG's work has shifted the masterplan development in a new direction, rendering the content of Iteration One and the co-sponsor feedback less relevant, however we are publishing it now for completeness.

Chapter 3

Purpose of Masterplan Assessment

12. The purpose of assessing the masterplan (or assessing work in progress towards the masterplan) is to give us, as co-sponsors, confidence that our commission will be delivered.

13. In assessing this and future masterplans we will review the content and analysis to check whether it answers the questions in our commission letter, and check whether it accords with public policy and strategy. We may offer feedback on areas in which we would expect to see more detail or in which we believe further work will be necessary before we can 'accept' a more mature version of the masterplan.

14. We may assess supporting technical details that are developed in the creation of the masterplan, such as the operational concepts or assumptions. This means we may review those technical details and offer feedback. Whether the designs are technically feasible will be a regulatory decision made by the CAA's regulatory teams and not the co-sponsors.

15. Assessment may take the form of written feedback on the work ACOG/NERL shares with us. Assessment may include the co-sponsors or CAA oversight team being present at various meetings as the masterplan work is ongoing to understand decisions that are being made along the way, should that be necessary.

16. The CAA will need to 'accept' a future version of the masterplan into its strategy, to give the masterplan a statutory basis. The statutory basis is necessary because the Air Navigation Directions[6] state that the CAA must make airspace design change decisions in accordance with its statutory strategy and plan for airspace modernisation. For the CAA to know whether a proposal conflicts with, or supports, airspace modernisation it must review it against the masterplan.

17. The co-sponsors are preparing more detailed guidance on the basis for accepting future iterations of the masterplan into the CAA's strategy and plan. We expect to launch a short public engagement exercise shortly.. The process of 'acceptance' will therefore only apply to future more mature iterations of the masterplan. This is described in more detail below under **Next Steps**.

> **February 2020 update:** We launched a public engagement exercise on the criteria for assessing accepting a masterplan in February 2020[7], and expect to finalise this in Spring 2021.

[6] https://www.caa.co.uk/Commercial-industry/Airspace/Airspace-change/Legislative-framework-to-airspace-

[7] CAP1887: Proposed Criteria for Assessing and Accepting the Airspace Change Masterplan

Chapter 4

Expected content of Iteration One

18. The first iteration of the southern masterplan was intended to be a high level airspace change plan with preliminary milestones for the airspace changes required for the programme referred to as FASI-S, and supporting analysis including operational concepts. We expected that the first iteration would include the following:

- **forecast growth and bottlenecks** in airspace (bottleneck meaning features of the airspace design or operation that have the potential to restrict the flow of aircraft and thereby reduce the capacity of the airspace system as a whole);
- **operational and technical concepts** to deliver the southern masterplan ACPs (also referred to as FASI-S airspace changes);
- **a preliminary airspace change plan** based on this analysis that has been derived from submissions from all of the airspace change sponsors involved. The plan will include preliminary milestones for individual airspace changes and their progress through the CAP 1616 airspace change process, and the critical path. It will not at this stage include the interdependencies between those airspace changes.

19. We also agreed that:

- The first iteration may not include detail on conflicts and interdependencies at this stage, but a more mature version of the masterplan will need to.
- This first iteration may not include potential airspace changes identified by NERL that are driven primarily by the potential to reduce noise or reduce controlled airspace (or the other factors listed in the original commission letter), but will help to inform airspace change sponsors on opportunities that may be included in their designs aimed at accommodating additional runway capacity and/or making best use of existing runway capacity. Once published, it may also give wider stakeholders an opportunity to engage on whether and where such opportunities may exist.

20. In anticipation of this work, we expected that this first iteration of the masterplan would include some initial, top down analysis that could help to identify those additional airspace changes, specifically:

- all **controlled airspace usage** in the south east of the UK below 10,000 ft would be reviewed and visualisations of the airspace created, indicating areas where controlled airspace is being used less intensively. This will highlight any geographical areas within the current operation where controlled airspace could be reduced through an airspace change, though any decision to do so would require a full airspace change process including a safety analysis. This analysis would be updated when airspace change designs below 10,000 ft are at a mature stage.
- **heat maps of aircraft noise** below 7,000 ft for the airports involved in the masterplan will be provided. This will highlight areas subject to two or more traffic routes that could potentially be alleviated through airspace changes identified in the masterplan.

Chapter 5

Assessment of Masterplan Iteration One

21. This section provides our assessment of the first iteration of the masterplan covering southern UK airspace, which is included in Appendix C for reference. We have a number of strategic issues to highlight, as well as some specific recommendations below.

> **February 2021 update:** Please note that the masterplan and co-sponsor assessment was written before the COVID-19 pandemic, and therefore may now be less relevant.

Forecast growth and bottlenecks in airspace (Masterplan chapters 4 and 5)

22. A range of different future forecasts for growth have been presented in the masterplan. NERL's own forecasts are at the lower end of the range, whilst considering airports own individual growth aspirations provides a higher end of a forecast range. Based on NATS' forecasts, capacity increases of more than 20% will be required in a number of sectors in order to accommodate demand. This increases to 30% when airport forecasts are considered.

23. We consider that the inclusion of forecasts of airports' growth aspirations are consistent with the intent of the Airports National Policy Statement (ANPS)[8] regarding making best use of runways. We agree that reflecting a forecast range is therefore prudent.

24. NERL have illustrated the likely areas of network growth in the South of the UK in their Figure 7. This highlights significant levels of network growth with many congested routes projecting increases of more than 50%. Demand vs capacity bottlenecks within different airspace sectors have been illustrated in their Figure 8.

25. The potential projected benefits presented include a 30% increase in capacity to deal with 'expected levels of growth' across Southern UK airspace.

26. NERL have provided sufficient infomation in response to this request. However, the operational concept described suggests a likely phased deployment as aircraft capability evolves. We recommend that future iterations illustrate the level of capacity provided for the

[8] https://www.gov.uk/government/publications/airports-national-policy-statement

different phases of deployment, with a comparison of expected forecasts, describing where constraints may be present.

27. It would also be useful for the co-sponsors and stakeholders to understand the extent to which the growth included in the forecasts has already been determined by the planning system, or is new growth yet to be approved in planning policy decisions. This is important because growth will benefit consumers and the UK economy, but might – in some circumstances – need to be carefully managed to deliver other airspace objectives such as fuel efficiency, noise reduction or improved access for other airspace users.

Operational and technical concepts to deliver the Masterplan (Masterplan chapter 3)

28. NERL have described the operational and technical concepts envisaged to deliver benefits across southern UK in chapter 3, building on their feasibility study.[9] This set out a vision for a systemised network of separated 3D tubes in the sky, reducing air traffic controller intervention, increasing capacity and providing continous climb and descent opportunities.

29. The operational concept described in Chapter 3 essentially remains the same, however the suggestion is that a phased delivery is required as it relies on the evolution of aircraft capability. For example, moving from separated 2D routes to 3D tubes within a systemised network, and also the use of an interim 'transition' airspace (i.e. traditional airspace with conventional air traffic control), linking the lower level systemised network with upper level Free Route Airspace.[10] NERL have made a number of useful comparisons with existing operations in Germany and the USA.

30. NERL have responded to the commissioning letter question regarding operational concepts, but we would value further detail on both their maturity and on the new approach to phased delivery. We would like future iterations to build on this further describing the expected implementation timeframes for each phase and setting out which other operational and technology deployments are critical enablers. For example, the masterplan describes a reliance on Flight Management Systems, Performance Based Navigation capability, Air Traffic Control tools and agreements with other neighbouring States on speed or flow control procedures. The next iteration of the masterplan should describe how these critical enablers are being developed and deployed, including details of any risks and potential short-term mitigation strategies if these are unachievable. The implications for Transition Altitude[11] should also be described.

[9] The DfT published NERL's feasibility study, and the CAA's assurance of it, alongside the Aviation Strategy Green paper in December 2018.

[10] The aim of FRA is to provide airspace users with the ability to flight plan and fly the most efficient route of their choice through high-level airspace without being constrained by a network route structure.

[11] The transition altitude is a published height above sea level at which pilots climbing to their cruising level change their

31. We would also like to know whether the amendment to the tubes concept will have any impact on any of the airspace modernisation objective parameters i.e. the extent of commercial traffic growth, the access for other airspace users, and/or noise reduction.

32. The masterplan states that where aircraft equipage is an issue, it may be possible to create specific corridors for aircraft departing from or arriving to smaller airfields that sit outside of controlled airspace. It is unclear if these potential corridors are being considered as part of existing airspace change proposals or whether these may require additional airspace change proposals to be brought forward. Our view is that these potential changes, including any trade-offs, need to be considered as part of the masterplan process, co-ordinated by ACOG.

A preliminary ACP plan (Masterplan chapter 2)

33. We note that the programme plan has not been co-ordinated at this stage, and it is NERL's view that this would be possible when all airspace change sponsors have developed their design options identified during Stage 2 of the CAA's CAP1616 process. The current plan involves individual sponsors reaching gateway 2 (at the end of Stage 2) at different times between February and July 2020. The CAA is expected to make decisions at these gateways, but needs to understand the conflicts and interdependencies between changes in order to make those decisions. For example, before allowing an airspace change design to progress, we will need to understand whether other design changes are needed to enable it, or whether there are any conflicts with other airspace that will need to be resolved.

34. In order to address this, the CAA wrote to FASI-S sponsors to explain why we need to see coordination before the proposals can pass through gateways in the process. We explained that an individual airspace change proposal will not proceed through gateway 2 unless the sponsor can demonstrate the options developed though stage 2 are the product of co-ordination with other sponsors and that this co-ordination should be carried out under the masterplan. This means that we would like to use the masterplan to understand the extent to which our regulatory decisions on individual airspace changes need to be made in a coordinated way, i.e. the masterplan should tell us whether there is an interdependence between two or more changes. More information on airspace change decision making in the context of the AMS can be found on the CAA's website.[12]

35. NERL's concurrent approach to all airspace changes in Iteration One of the masterplan carries increased risk to the successful planning and implementation of modernisation by requiring that all airspace changes progress at once. If one airport's airspace change is delayed, the entire programme could be delayed. We believe alternative approaches should

barometric altimeter pressure setting from regional to common international standard setting.

[12] https://www.caa.co.uk/Commercial-industry/Airspace/Airspace-change/Airspace-change-proposals-in-the-FASI-S-and-FASI-N-programmes/

be considered, including developing the masterplan as a series of sequenced airspace changes grouped together in batches or modules of interdependent airspace changes, concentrating on the government policies outlined in the AMS. Evidence-based prioritisation and co-ordination of modules of airspace changes and their sponsors should take place before change proposals reach gateway 2 of the airspace change process.

36. One of the government policies in the ANPS is for a third runway to be built at Heathrow Airport. It may be necessary for airspace designs to integrate new traffic for this runway, and therefore co-ordination between different airspace change proposals is vital. The next iteration of the masterplan will need to include more detail on those changes that are necessary to enable this policy to be delivered. This will need to include a critical pathway that we can monitor to determine whether Heathrow's third runway will be operable by 2030 as set out in the Airports National Policy Statement.

> **February 2021 update:** shortly before the COVID-19 pandemic resulted in a UK lockdown, the Appeal Court ruled Parliament's Airports National Policy Statement (ANPS) had no legal effect unless and until the Secretary of State has undertaken a review of it. This ruling has since been overturned by the Supreme Court following an appeal by Heathrow Airport Ltd.

37. We would also like to know whether other policies and objectives are also deliverable, including growth at other airports, environmental mitigations including noise reduction, and improved access for other users. In short, it is essential that we understand whether the masterplan is delivering all policies and objectives, and whether there are any trade-offs between their delivery at both a local and masterplan-wide level.

38. The masterplan describes military requirements in general, but no specific military led airspace change proposals are included on the programme plan at present. In the next iteration we would expect to see any military airspace changes included in the co-ordinated programme plan. Alternatively the masterplan could offer confirmation that there are no specific airspace changes required in Southern UK in these timescales, or that other sponsors airspace changes are addressing military requirements adequately.

Controlled airspace usage (Masterplan chapter 6)

39. We welcome the initial analysis of controlled airspace usage at c3,000ft and c10,000ft showing flight density radar plots. It is likely that most users of uncontrolled airspace operate at lower levels, and where most opportunities would be sought to release controlled airspace as part of the design. However, we would also note that although low or no usage suggests potential opportunities to release controlled airspace, stakeholders should be made aware that the airspace may still be required for safety reasons, which will need to be taken into account when considering specific opportunities.

40. As the masterplan is developed further the co-sponsors will require that a specific section covering an assessment of the potential impacts on general aviation and potential mitigations is included in each iteration of the masterplan.

41. Since commissioning NERL, the CAA has received new Air Navigation Directions from the Secretary of State for Transport in October 2019. The amended Directions require the CAA to regularly consider whether airspace classification should be reviewed and carry out a review which includes consultation with airspace users. This enhances initiative 10 of the AMS.

42. As a first step, the CAA launched a public consultation in December 2019 to identify priority volumes of airspace that could be amended to better reflect the needs of all airspace users on an equitable basis.[13]

> **February 2021 update:** Since this document was written, the CAA has also consulted on and published it's new airspace classification procedure.These documents can be found here:
>
> CAP1935: Outcome of the consultation on the Airspace Classification Review 2019/20 http://publicapps.caa.co.uk/modalapplication.aspx?catid=1&pagetype=65&appid=11&mode=detail&id=9673
>
> CAP1991: Procedure for the CAA to review the classification of airspace https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=9865

43. The masterplan includes radar data to show controlled airspace use to help inform our review. In the future we will work with ACOG to align the masterplan development with the airspace classification review that the CAA will carry out, and ensure the evidence and approach to both are co-ordinated.

Heat maps of aircraft noise below 7,000 ft (Masterplan chapter 8)

44. We welcome the presentation of heat maps in figures 11 and 12 as a proxy for noise concentration below 7,000ft. However, it is unclear over what period of time the radar plots have been produced, and we recommend that future analysis should cover at least one year to cover seasonal differences.

45. Figure 11 provides an overview of traffic patterns below 4,000ft in Southern UK. The maps depict high concentrations of traffic around airfields. It is stated that the distribution of traffic

[13] CAP1935 Outcome of the consultation on the Airspace Classification Review 2019/20

is indicative of the current methods of operation. Systemising the airspace should act as an enabler for traffic to be handled in an increasing predictable manner, with the opportunity for defined periods of respite for local communities.

46. Moving forward we recommend that consideration is given to using noise data to engage stakeholders, and to invite views on opportunities to reduce noise. This could include making the heat maps available in a more user friendly format to allow stakeholders to interrogate them in more detail. This should be capable of highlighting areas subject to two or more traffic routes that could potentially be alleviated through airspace changes identified in the masterplan.

47. In due course ACOG will need to consider how best to assess potential opportunities to bring forward noise improvements, including a means of prioritising them. This might include identifying areas where an airspace change could be initiated to reduce noise, and advising us of potential sponsors of that change.

Other recommendations

48. NATS Environmental Best Practices – Noise, Emissions and Air Quality (Masterplan chapter 10) – We recommend that the next iteration of the masterplan includes references to the Government's altitude based priorities as set out in the Air Navigation Guidance 2017.[14]

49. Evidence of Stakeholder Management (Masterplan chapter 11) – Given the concept of operations as described relies on aircraft performance we recommend that the programme of engagement includes aircraft manufacturers to test the main features of the concept and the implementation timelines from a flight operations perspective. As set out in the AMS and governance annex, we would also like to see an engagement plan that takes account of all entities included in the airspace modernisation governance structure.

50. ACOG Setup, ToRs and Governance (Masterplan chapter 13) – Given that the concept of operations relies on aircraft performance and relevant enabling technology to fly through 2D and ultimately 3D tubes, we recommend that ACOG consider how they will include the aircraft performance expertise in the structure, relevant to each phase, to ensure a successful outcome.

51. Risks (Masterplan chapter 14) – A number of are risks are evident in the masterplan, in particular the reliance on technology enablers, including aircraft Flight Management Systems, and operational enablers, such as securing agreements with neighbouring States on flow and speed procedures. These may not fit naturally into the risk categories suggested. We look forward to the key risks being considered and reported in the next

[14] DfT, Air Navigation Guidance 2017: Guidance to the CAA on its environmental objectives when carrying out its air navigation functions, and to the CAA and wider industry on airspace and noise management.

iteration. We recommend that as well as mitigations, the impact of the risk materialising and potential contingency position should be identified.

Chapter 6

Next Steps

52. Having now been established, ACOG is leading the preparation of the masterplan and co-ordination between the sponsors of all airspace changes, including NERL's upper airspace proposals with individual airports. ACOG is also identifying opportunities for additional benefits covering areas such as reducing noise or controlled airspace. Future masterplan iterations will therefore be led and developed by the ACOG staff team within NERL.

53. We expect ACOG to take the co-sponsors assessment feedback into account. In particular, ACOG will need to address as a priority how to achieve adequate co-ordination between different airspace change proposals, whilst also reducing the risk of delaying the whole modernisation programme. We believe alternative approaches should be considered, including developing the masterplan as a series batches or modules of interdependent airspace changes, concentrating on the government policies outlined in the AMS. The next iteration will also need to cover the expectations set out in paragraphs 12-15 of our letter of 30th July 2019 included in Appendix B.

54. The co-sponsors are preparing more detailed guidance on how we will 'accept' a future iteration of the masterplan into the CAA's strategy. This 'acceptance' is necessary because:

- The CAA is the regulatory decision-maker for airspace changes. Airspace changes must be developed and proposed by a change sponsor in accordance with the CAA's airspace change process, as set out in CAP 1616. The Air Navigation Directions state that the CAA must make airspace design change decisions in accordance with its statutory strategy and plan for airspace modernisation.
- The Government has now introduced the Air Traffic Management and Unmanned Aircraft Bill[15] into Parliament. It will create new powers for the Secretary of State[16] to decide to compel development of an airspace change. When determining whether to use the power, the Secretary of State would consider advice from the CAA regarding how it will assist in delivering the CAA's strategy, and any plan within it. This advice would therefore need to take account of the masterplan, and how critical an airspace change was to achieve airspace modernisation.
- Acceptance of the masterplan is a separate regulatory decision to airspace change decisions. However, individual airspace designs must still be regulated and decided upon in accordance with CAP1616 and the AMS (with an accepted masterplan becoming part of the AMS).[17]

[15] https://services.parliament.uk/Bills/2019-20/airtrafficmanagementandunmannedaircraft.html

[16] The Secretary of State may choose to delegate this power to the CAA.

[17] More information on airspace change decision making in the context of the AMS can be found at https://www.caa.co.uk/Commercial-industry/Airspace/Airspace-change/Airspace-change-proposals-in-the-FASI-S-

55. The CAA will develop this new regulatory process which will set out clear points of interaction with the CAP 1616 process, and clear indications as to which decisions would be made by different CAA teams. We expect to launch a short public engagement exercise in February 2020, and expect a final acceptance process to be published in summer 2020, ahead of our assessment of future iterations of the masterplan.

> **February 2021 update:** We launched a public consultation exercise on the criteria for assessing and accepting a masterplan in February 2020[18], and now expect to finalise the outcome in Spring 2021.

56. Tfhe co-sponsors may also need to develop policy to help guide decisions on how trade-offs should be struck between different airspace changes. For example, between the different objectives that a single airspace design could be focused on achieving (i.e. reducing controlled airspace, increasing commercial capacity, noise reduction etc).

57. This policy guidance may also be needed to help ACOG/ the co-sponsors determine how to make trade-offs and help guide decisions where the relationship between two or more airspace changes will reduce opportunities for, or create impacts on another sponsor's airspace design regarding the following, in no particular order, noting that safety is our overall priority:

- Noise distribution.
- Access for other users including General Aviation, military, UAS or others.
- Commercial growth
- Air quality or fuel efficiency.

58. The potential policy guidance and the acceptance of a masterplan would not override the need to consider all these factors when developing an airspace change, each of which must still follow the CAP 1616 process.

and-FASI-N-programmes/

[18] CAP1887: Proposed Criteria for Assessing and Accepting the Airspace Change Masterplan

APPENDIX A

Co-sponsor letter to NERL dated 2 November 2018

Department for Transport

Civil Aviation Authority

[redacted]
NATS (En Route) PLC
4000 Parkway
Whiteley
Fareham
Hants
PO15 7FL

02 November

UK Airspace Modernisation: commission to NERL lead a programme to create a coordinated implementation plan for airspace changes in Southern England.

1. As co-sponsor organisations of airspace modernisation in the UK, we are writing to NATS (En Route) PLC – NERL – to commission and set out our expectations of the work of the Airspace Modernisation Oversight Group (AMOG) in relation to FASI South.

Context:

2. The Government published in 2017 a Strategic Rationale for Upgrading UK airspace, setting out the rationale for a wholesale redesign of the UK's airspace to meet future demands on this finite piece of infrastructure. Delivering this outcome will be one of the key components of the CAA's Airspace Modernisation Strategy (AMS) for the UK. This strategy pulls together the relevant government policies that airspace modernisation must deliver, and how they should be delivered, including setting out the need for relevant industry bodies to have clear deployment plans in place.

3. As set out in CAA's letter to NERL of 25th September 2018, we think NERL is best placed to be responsible for drawing together a UK-wide coordinated implementation plan for airspace changes (or airspace change masterplan) between the start of RP3 and 2040. In developing this plan, NERL shall engage effectively with relevant organisations, such the airports using the airspace in question and will be the sponsors of airspace change. In addition to developing this masterplan, we expect NERL to sponsor a number of individual airspace design changes set out in the plan. The CAA proposes to enshrine this new strategic airspace role for NERL, in its economic licence.

Civil Aviation Authority
CAA House 45-59 Kingsway London WC2B 6TE www.caa.co.uk
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4. As part of this role, we expect NERL at the earliest possible opportunity to create an Airspace Modernisation Oversight Group (AMOG) that will, as a matter of urgency, lead the FASI South Programme to create a single coordinated implementation plan for airspace changes in Southern England (a south east airspace change masterplan, or masterplan for short).

5. The FASI-S masterplan is required for the following reasons:

   i. To create a single plan that aligns the airspace delivery aspirations of NERL and the 14 airports within the FASI-S programme and to give the DfT and CAA, as co-sponsors of airspace modernisation, confidence that a credible and implementable plan exists and that the sponsors understand what is required of them to deliver this change.
   ii. To enable CAA to understand how individual airspace change proposals relate to each other and therefore take better informed decisions
   iii. To inform the use of potential new legislative powers to compel airspace change to happen, where required. Our assumption is that being included in the masterplan would be one of the triggers for the use of these powers
   iv. To identify opportunities to improve airspace design that will deliver a wider set of benefits, not just to increase capacity.

Commission:

6. Within the context described above and noting that the programme will have a number of stages of development, we require that the AMOG, under NERL's leadership and programme management, prepares a south east masterplan that meets the following criteria:

   a) Identifies where airspace changes could be developed in Southern England in light of:

      - Forecast growth in demand for aviation across all sectors and the required airspace capacity to accommodate that growth;
      - airspace bottlenecks where delays to consumers could be alleviated by capacity;
      - areas where planned development on the ground such as new runways will require new airspace designs;
      - areas where more direct routes are possible that could, for example, reduce controlled airspace.

   b) Identifies other changes that may be required deliver one or more of the following benefits:

      i. where airspace changes are needed to deliver a safety benefit, for example, changes that ensure route separation

      ii. where airspace changes can reduce noise (more specifically, reduce the total adverse effects of noise, as set out in the Air Navigation Guidance 2017)

      iii. where airspace changes can deliver air quality or fuel efficiency benefits

Continued (2 of 2 pages)

iv. where airspace changes are needed to allow improved access to airspace for all users, for example where the existence of controlled airspace is no longer justified

v. where airspace changes are needed to enable the military to fulfil their training requirements and national security functions

vi. where airspace changes are needed to introduce new technology, for example the introduction of performance-based navigation

c) Identifies:

- the operational concepts required to deliver these changes and their level of maturity
- the set of assumptions on which the proposed changes are based and are dependent
- the key risks associated with delivering the plan and how they could be mitigated
- the recommended coherent sequence of individual or modules of changes against the evaluated alternatives
- the preferred timescale for their adherence against each step of the CAA's CAP1616 process and subsequent implementation
- the party responsible for taking each individual airspace change forward
- the interdependencies between individual changes
- the degree of commitment offered by each individual party

7. We would also like to know the minimum number of changes that are necessary to ensure that major airspace projects (e.g. to accommodate new runway capacity) are viable.

8. We recognise that some of the work to create the FASI-S masterplan is already underway, for example through the NERL Feasibility Assessment, the LTMA Working Group and work by individual airports on potential airspace changes. We would expect the further work on each of these projects to be reflected in the output of this commission.

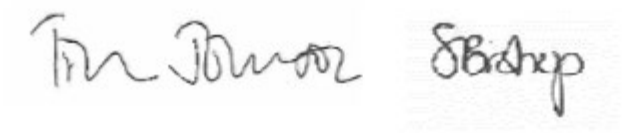
9. In establishing the AMOG, we require to NERL to provide to the DfT and the CAA by end November its formal proposals that address the following:
   a. how they will ensure that the AMOG working group contains the necessary skills and capabilities drawn from a blend of its own, qualified third party and airport resources;
   b. the governance arrangements that will give all stakeholders confidence of equal access to this process;
   c. how they will assure the independence of their role in this process (e.g. via non-executive membership on the governance group), and how NSL's commercial relationship with some stakeholders would not confer any additional status or influence to any particular stakeholder in the process.

10. We expect NERL to deliver a fully developed FASI-S masterplan by end June 2019. We expect NERL to report monthly to the AMS Delivery Monitoring and Oversight (DMO) team (currently being set up in the CAA) on the progress with the development of the masterplan and its subsequent implementation. The format of this reporting will be agreed separately.

Continued (3 of 2 pages)

11. Recognising the need to build and maintain momentum on this essential programme, we expect NERL to work with airspace users – as the key beneficiaries of airspace modernisation – to put in place the necessary arrangements to begin this work now. We understand NERL is already engaging with airspace users to agree financial support through the FAS Facilitation Fund and would urge NERL and airspace users to conclude this discussion as a matter of priority. We have also written to the FAS Investment Board to set out our support for the use of the FAS Facilitation Fund for this purpose, subject to the conditions set out in paragraph 9. Continuing the principle that the key beneficiaries pay, we understand NERL intends to include provision for efficiently incurred costs of the AMOG programme management function over 2020 to 2024, in its RP3 Business Plan.

12. As noted at the start of this letter, the Airspace Modernisation Strategy requires a concerted industry effort to deliver airspace modernisation. This letter commissions work necessary to deliver one of the initiatives in the Airspace Modernisation Strategy. Further commissions will be prepared in due course, including a commission for further work from NERL to build on their Feasibility Assessment and the new airspace design concept they set out in that report, which will inform the airspace changes in the FASI-S programme.



Tim Johnson
CAA Director of Policy

Sarah Bishop
DfT Deputy Director

Continued (4 of 2 pages)

APPENDIX B

Co-sponsor letter to NERL dated 30 July 2019

Department for Transport

Civil Aviation Authority

[redacted]
NATS (En Route) PLC
4000 Parkway
Whiteley
Fareham
Hants
PO15 7FL

30 July 2019

Southern Airspace Masterplan – first iteration and assessment

1. On 2 November 2018, as co-sponsor organisations of airspace modernisation in the UK, we wrote to NATS (En Route) PLC – NERL – to commission and set out our expectations of the work of the Airspace Change Organising Group (then called the Airspace Modernisation Oversight Group). We asked NERL to set up the group to, as a matter of urgency, lead the FASI South Programme of airspace modernisation to create a single coordinated implementation plan for airspace changes in Southern England (a south east airspace change masterplan, or masterplan for short).

2. The expectations for the masterplan (paragraphs 5, 6 and 7 of the letter) were replicated in Chapter 6 of the CAA's Airspace Modernisation Strategy, which was published on 18 December 2018.

3. NERL is due to share the first iteration of the masterplan with the co-sponsors in July 2019. The documentation we will see is well described as iteration 1 of phase 1 (the southern UK phase) of a national airspace masterplan. It is not the full solution.

4. We are now writing to confirm the contents of this iteration of the masterplan; plans for future iterations; and how we will assess the first iteration.

Content of first iteration:

5. The first iteration of southern masterplan is a high level airspace change plan with preliminary milestones of the 17 airspace change proposals (ACPs) required for the programme referred to as FASI-S, and supporting analysis including operational concepts. (Some of this analysis will be developed in future iterations by ACOG; some will continue to be owned by NERL. This distinction will be clearer in future documents, once ACOG is fully up and running.)

6. We understand that the iteration we receive in 2019 will include the following:
   - forecast growth and bottlenecks in airspace (bottleneck meaning features of the airspace design or operation that have the potential to restrict the flow of aircraft and thereby reduce the capacity of the airspace system as a whole);
   - operational and technical concepts to deliver the southern masterplan ACPs (also referred to as FASI-S ACPs);
   - a preliminary ACP plan based on this analysis that has been derived from submissions from all of the ACP sponsors involved. The plan will include preliminary milestones for individual ACPs and their progress through the CAP 1616 airspace change process, and the critical path. It will not at this stage include the interdependencies between those ACPs.

7. The first iteration may not include detail on conflicts and interdependencies covered in the 2 November 2018 letter, but a more mature version of the masterplan will need to. The more mature version will also need to include the co-ordinated sequencing of airspace change proposals, their progression through the CAP 1616 processes (including timing of CAA decisions) and implementation of any approved changes.

8. This iteration may not include potential ACPs identified by NERL that are driven primarily by the potential to reduce noise or reduce controlled airspace (or the other factors listed in the commission letter), but will help to inform ACP sponsors on opportunities that may be included in their designs aimed at accommodating additional runway capacity and/or making best use of existing runway capacity. Once published, it may also give wider stakeholders an opportunity to engage on whether and where such opportunities may exist.

9. The 17 FASI-S ACPs were identified through NERL's assessment of airport growth plans, analysis of forecasts and bottlenecks. Through the ACP design process, the need to consider good outcomes for noise, general aviation, military requirements, and other factors will be built into the design.[1] If there are volumes of airspace not covered by those 17 ACPs, further analysis before the next iteration of the masterplan will identify opportunities for new ACPs in those areas (driven, for example, by an opportunity to reduce the health impacts of noise or reduce the volume of controlled airspace).

10. In anticipation of this work, this iteration of the masterplan will include some initial, top down analysis that could help to identify those additional ACPs:
    - all controlled airspace in the south east of the UK below 10,000 ft will be reviewed and visualisations of the airspace created, indicating areas where controlled airspace is being used less intensively. This will highlight any geographical areas within the current operation where controlled airspace could be reduced through an ACP, though any decision to do so would require a full ACP process including a safety analysis. This analysis will be updated when ACP designs below 10,000 ft are at a mature stage.
    - heat maps of aircraft noise below 7,000 ft for the airports involved in the masterplan will be provided. This will highlight areas subject to two or more traffic routes that could potentially be alleviated through ACPs identified in the masterplan.

[1] These factors were covered in paragraph 6 of the commission letter and broadly reflect the factors identified in Section 70 of the Transport Act 2000.

Continued (2 of 2 pages)

11. We confirm support for this content as reflected in paragraphs 5-10 above as a first step towards producing a comprehensive airspace masterplan set out in full in our 2 November 2018 letter.

Content of future iterations

12. Based on the current FASI-S preliminary airspace change programme plan of the Southern UK in the first iteration of the masterplan, we understand it is NERL's view that all ACPs are due to progress through the CAP 1616 airspace change process to stage 2B and the 'develop and assess' gateway by July 2020. NERL suggests that at this time there will be more clarity as to the design options for those ACPs and NERL will then be in a position to[2]:
    - identify the requirements for expanding capacity in the SE of England (including to enable the operation of the proposed NW Runway at Heathrow and enable more intensive use of the existing runways, whilst maintaining the UK's hub status) – meaning the masterplan should identify the minimum number of changes that are necessary to ensure that major airspace projects (e.g. to accommodate new runway capacity) are viable;
    - identify the best sequence for proceeding with the ACPs;
    - have a clear view of all interdependencies and the trade-offs that will be required to ensure a safe design is submitted to the CAA for all FASI-S sponsors;
    - map out volumes of airspace not covered by those existing ACPs and their options;
    - use their analysis of i) volumes of controlled airspace and ii) noise to consider additional ACPs that may be undertaken in those remaining volumes of airspace to deliver GA and noise benefits;
    - engage relevant stakeholders listed in the airspace modernisation governance structure (including representative groups but not individual communities or organisations) to identify further potential ACPs.

13. NERL has suggested that at this stage it is not possible for the airports in the FASI-S programme to provide clarity as to whether they will consider all arrival and departure procedures as part of the design process. Once this information is clear we would also, at an appropriate stage, expect to see further detail on how noise is being considered. It would be useful for ACOG to establish a mechanism for stakeholders and airports to look at how potential opportunities for environmental improvements, including noise improvements, can be considered. This may result in additional airspace changes. Stakeholders engaged may include:
    - the airport/ANSP in question,
    - neighbouring airports/ANSPs who use adjacent volumes of airspace,
    - community representatives impacted by the current airspace arrangements,
    - the Independent Commission on Civil Aviation Noise (ICCAN).

14. We therefore expect to see those details in the future iteration of the masterplan. We expect this future iteration to offer an ACP programme plan based on analysis of forecasts, bottlenecks, use of controlled airspace, noise, and other analysis as required by the factors listed in paragraphs 6 and 7 of our

[2] The CAA is developing guidance as to how this stage of the CAP 1616 process should be enhanced to consider masterplan (i.e. interrelated) ACPs.

Continued (3 of 2 pages)

commission letter. The programme plan is expected to include milestones for individual ACPs and their progress through the ACP process, and the critical path. It will also include the trade-offs that will be required through the design processes and consultation interdependencies between those ACPs, with suggested modules of those ACPs that are necessarily interlinked.

15. We expect ACOG to work with all ACP sponsors to try to solve these trade-offs, and to publish their approach for doing so, including through developing a mediation mechanism. We expect to agree this mediation mechanism with NERL and ACOG. The trade-offs must be solved in accordance with UK government policy and the CAA policy and strategy; the co-sponsors are developing additional process requirements and guidance on how the masterplan must address policy and strategy and we will engage with NERL and other stakeholders in due course.

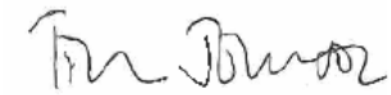
Assessing the masterplan

16. When the co-sponsors receive the first iteration of the masterplan, we will read the document in detail and offer feedback on it. Once we have assessed it, this iteration and a summary of our feedback will be published.

17. The co-sponsors are preparing more detailed guidance on how we will assess and the basis for accepting future iterations of the masterplan. This will include requirements on the co-ordination process necessary for the masterplan work. Iteration one will not be considered for acceptance. Our guidance will be published ahead of our assessment and acceptance of future iterations of the masterplan.

18. The DfT is currently considering bringing forward legislation that would enable the SofS to be able to direct that an Airspace Change is prepared and submitted to the CAA. The government's intention is to use the proposed powers for ACPs that will deliver the CAA's strategy and plan under Air Navigation Direction 3(e) (i.e. the Airspace Modernisation Strategy as updated from time to time). Initially, the way that the government plans to do this, is through only using the prospective powers, if required, in respect of ACPs that have been identified as part of the airspace change masterplan. The potential legislation would only be used in relation to an accepted masterplan.

19. As noted in our commission letter, the Airspace Modernisation Strategy requires a concerted industry effort to deliver airspace modernisation. This letter commissions work necessary to deliver one of the initiatives in the Airspace Modernisation Strategy. Further commissions will be prepared in due course.



Tim Johnson
CAA Director of Policy

Sarah Bishop
DfT Deputy Director

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APPENDIX C

Masterplan Iteration One


NATS
Quicker, quieter and cleaner
Southern UK Airspace Masterplan
Iteration 1, July 2019

Contents

1. Preface

In November 2018, the Department for Transport (DfT) and the Civil Aviation Authority (CAA) commissioned NATS to produce a Future Airspace Strategy Implementation (FASI) South Masterplan (or "Masterplan" for short). The Masterplan will create a coordinated implementation plan and timeline for airspace changes that identify where changes could be developed in the South of the UK. The Masterplan will identify where airspace changes are needed to deliver improvements to: safety; capacity; noise; air quality; fuel efficiency; access to airspace for users (including where controlled airspace is no longer justified or should be a different classification); military access; or to introduce new technology. This Masterplan represents a first iteration of our proposals as they stand in July 2019, with some initial assumptions and data.

NATS intends that this Masterplan will be used by key stakeholders including the Airspace Change Organising Group (ACOG), airports, the military and the London Airspace Modernisation Project (LAMP) team as the concepts and designs of airspace change are progressed over the coming years. A copy of the commissioning letter is included in the appendices.

As a critical part of the UK's national infrastructure, the strategic rationale for modernising airspace is set out in the CAA's Airspace Modernisation Strategy (CAP 1711):

"...to provide more choice and value for consumers, through the capacity for airlines to add new flights, reduced flight delays and enhanced global connections that can help boost the UK economy, while continuing to improve safety standards. Unlocking the benefits of modernisation will make journeys faster and more environmentally friendly. Better airspace design can help with the management of noise impacts and improve access for other airspace users..."

This Masterplan is set against the context of the FASI South programme of cooperative airspace development, which is the umbrella term for the concept of modernising air traffic services (ATS) in the South of the UK. NATS and 18 airports in the South (see Figure 1) have been working collaboratively for just over two years on the development of the programme.

This first iteration is based on the FASI South Programme Plan, which is run in accordance with the CAA's statutory airspace change process (known as CAP1616). However, it also takes a broader, strategic view of future airspace requirements. The initial focus of the Masterplan is on the South of the United Kingdom, recognizing the complexities and interdependencies in the region.

To support this, this first iteration provides an overview of the FASI South programme plan and Concept of Operations; forecasted growth; bottlenecks; underused controlled airspace analysis and future military airspace requirements.

Further information relating to: noise distribution; design principles; environmental best practice; evidence of engagement; a mediation and legislative process and risks are outlined.

The Masterplan also provides an update on the setup and governance arrangements of ACOG, an independent body within NATS which will provide co-ordination between stakeholders by coordinating the delivery of some of the initiatives in the Airspace Modernisation Strategy.

The FASI South Concept of Operations describes the operational and technical concepts required to facilitate airspace change and the level of maturity and risk associated with the proposed enhancements. In this respect, this document expands on the information provided in the May 2018 NATS Feasibility Report to the Secretary of State for Transport.[1] That report considered whether there is sufficient capacity in the South of the UK to accommodate airports' potential future demands; the interdependencies between different airports' potential future demands; and an initial plan for the delivery of airspace change.

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/763085/nats-caa-feasibil ty-airspace-modernisation.pdf

This Masterplan also explores the expected forecasted growth in the aviation industry and the 'en-route' network design that could minimise growth constraints and maximise demand from existing and planned runways. In support of forecasted demand, Chapter 5 examines airspace bottlenecks in the absence of FASI South deployment and the required growth in capacity for 2040.

To identify currently under-used airspace, Chapter 6 includes a preliminary analysis of controlled airspace below FL100 and identifies under-utilised airspace. Future iterations will include suggestions from airspace users for the release of airspace and a comparison between both requirements. This information can subsequently be used by Airspace Change Proposal (ACP) sponsors to identify opportunities to release airspace for other users such as the Ministry of Defence (MoD) and 'General Aviation' (GA) and by stakeholders engaging in the master planning process to suggest ideas for other ACPs.

Chapter 7 provides details of MoD airspace demands and further information will be included in future versions of this Masterplan. Chapter 8 examines areas of noise concentration within controlled airspace, and where noise could be better distributed if Airspace Change Proposal (ACP) sponsors and communities favour distribution over concentration. Chapter 10 describes environmental best practices that ACP sponsors should consider deploying principally in terms of noise and emissions benefits.

Subsequent iterations of the Masterplan will include additional industry and stakeholder engagement. The engagement plan for the Masterplan will also be summarised as it reaches greater levels of maturity and will describe the options for change within the 2040 timeframe.

The authors would like to acknowledge the support, engagement and contribution to this first iteration of the FASI South Airspace Masterplan from stakeholders and look forward to continued strong engagement as the plan matures, shaping airspace as critical national infrastructure.

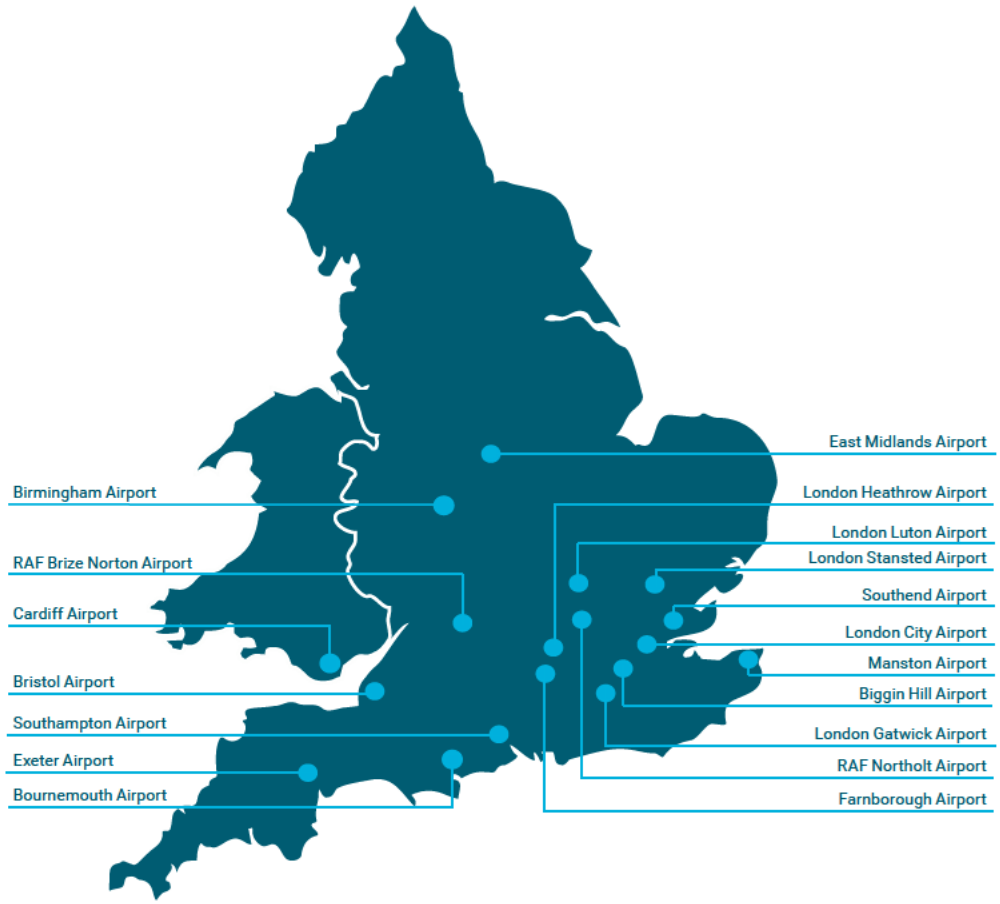

Figure 1: Geographical Scope of this Masterplan.

2. FASI South Programme Plan

Chapter Summary:

This chapter outlines how the FASI South programme plan has been developed in collaboration with airspace change sponsors and ACOG's role in managing identified risks and opportunities.

The FASI South programme goal plan has been developed in collaboration with 18 airports in the South of the United Kingdom and NATS. The programme plan articulates the key milestones within the CAA regulatory airspace change process for each sponsor as well as indicative timeframes.

ACOG will play a critical role in coordinating this process and will be responsible for considering the risks, opportunities and associated interdependencies of each of the proposed plans.

The programme goal template (Figure 2) has been designed as an available resource tracked by the FASI South sub-group and FASI South programme board. It has yet to be fully coordinated by ACOG. The Programme so far has provided the opportunity for all stakeholders to submit ACP milestones beyond July 2020 and to suggest provisional implementation timelines.

The information provided by the ACP Sponsors is outlined in the goal plan. ACOG and NATS will be further reviewing the FASI South programme plan given the predicted interdependencies between some ACP sponsors. For instance, some of the current consultation timelines are not aligned sequentially or geographically. There may be a need for further alignment and mediation given the interactions between so many airports, particularly in London and the South East. It is expected that a more detailed plan will become available at Gateway 2B.

Crucially, this first iteration will not identify interdependencies between ACPs. NATS intends that this analysis will have been completed when all sponsors reach Gateway 2B of the CAP1616 process. Overlaps in airspace designs will be identified during the design processes and ACP sponsors will seek to resolve these compromises with other ACP sponsors in conjunction with their stakeholders.

This iteration of the Masterplan does not identify the minimum number of changes that are necessary to ensure that major airspace projects (e.g. to accommodate new runway demand) are viable. For example, it is not yet known what airports would also be required to modernise their airspace in order to permit Heathrow growth. This work will be facilitated in a transparent, independent manner by ACOG with ACP sponsors and will subsequently be included in any consultation material. In addition this Masterplan does not include analysis or identification of additional specific airspace changes to address military, GA or noise imperatives in isolation.

Overleaf the goal plan is shown for the FASI South programme. The programme coordinates the development and deployment of the co-dependent ACPs led by NATS and the airports that operate in Southern UK. The goals in the plan are structured around the stages, gateways and key deliverables in the CAA's regulatory airspace change process. The FASI South airports and NATS are committed as far as is practicable to align their individual airspace developments with a common timetable.

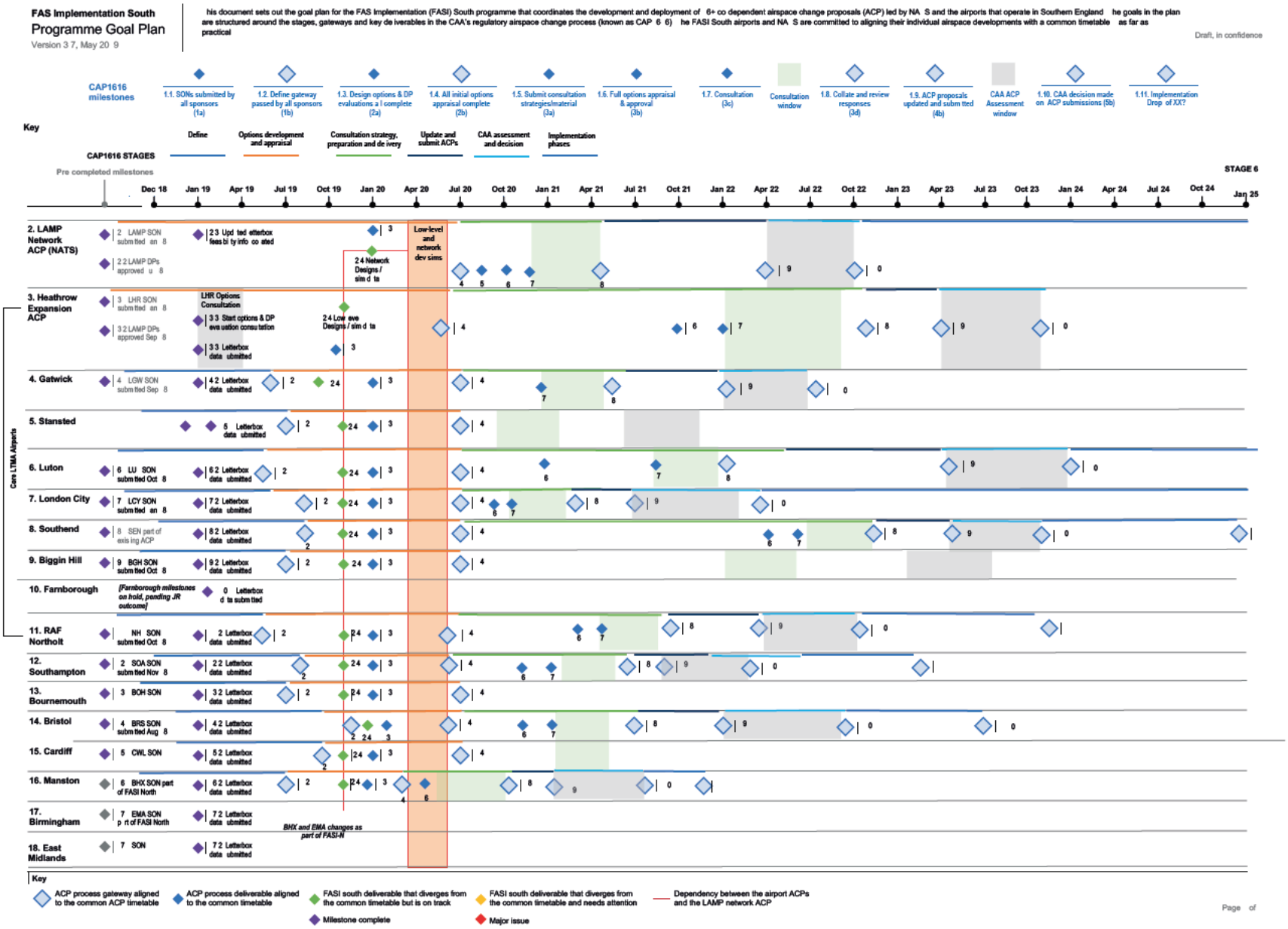

Figure 2: Current FASI South Programme prior to ACOG Coordination.

3. FASI South Concept of Operations

Chapter Summary:

This chapter provides a summary of the technical and technological changes that would enable the proposed airspace modernisation programme in LAMP and FASI South, and the potential benefits in terms of capacity, efficiency and the environment.

3.1. London Airspace Modernisation Project (LAMP) Concept

3.1.1. Airspace

The objective of the London Airspace Modernisation Project (LAMP) is to deliver long-term changes to the airspace above the Southern United Kingdom by seeking to redesign the routes that aircraft follow from take-off to exiting UK airspace, and from entering into UK airspace to aircraft touchdown. The proposed enhancements will enable all airfields to release aircraft into the network independently, without reference to one another.

The airspace used at present has evolved since the 1950s in a fragmentary fashion. It still relies broadly on ground-based radio-navigation beacons and therefore restricts the routes to point-to-point designs, which several airfields utilise. This leads to inefficiencies in the theoretical network as airfields may be dependent on the traffic flow from another and not operate independently, thereby restricting capacity.

Recent airspace changes above 7,000 feet, such as that introduced by NATS through the LAMP1A project in 2016, began the move to a more systemised environment utilising existing and future aircraft equipage driven by satellite based navigation technology. This enables systemisation where airspace designers create routes which aircraft repeatedly follow with high degrees of accuracy. This improves safety, reduces controller workload and complexity, enables environmental efficiency through reductions in emissions and enhances capacity.

The LAMP1A project delivered the first stage of systemisation within the UK, changing the inbound procedures for London City airport through the deployment of PBN routes. Such improvements demonstrated the feasibility of the systemisation concept in the horizontal plane. NATS, through the LAMP project, has subsequently confirmed that they will develop and deploy a new concept, which will take advantage of better horizontal spacing to constrain paths and appropriate vertical constraints to optimize airspace used by each flight.

To facilitate this, 3D 'routes' will be created in the airspace (see Figure 3) to ensure departures and arrivals from all airports are separated. This will bring many benefits including improving overall safety through reduced controller workload. Additionally, the proposed changes will provide environmental benefits to communities under the airspace through a reduction in emissions above 7,000 feet and potential respite from aircraft noise below 7,000 feet depending on specific designs created by airport ACP sponsors. Increased levels of efficiency in terms of fuel burn will benefit airspace users, along with an increase in the overall network capacity.

Developments in aircraft capability, through Flight Management Systems (FMS) technology, will continue to refine these routes and provide further safety, environmental and capacity benefits.

Systemisation utilising Performance Based Navigation (PBN)

PBN is a concept developed by the ICAO (International Civil Aviation Organization) and an EU requirement that moves aviation away from the traditional use of aircraft navigating by ground-based radio beacons to a 'satnav' system more reliant on airborne technologies, utilising area navigation and global navigation satellite systems (Air Navigation Guidance 2017). More specifically, area navigation based on performance requirements for aircraft operating along an ATS route, or an instrument approach procedure or in a designated airspace (ICAO Doc 9613). PBN deployment specifies the routes flights will follow more accurately and predictably.

3.1.2. Outbound Procedures

Aircraft will leave the runway and follow the new departure routes (designed and implemented by each specific airfield in cooperation with the NATS project LAMP, and other airfields/airspace users) to an entry point within the new network. From this point, the aircraft will follow a highly accurate 2D PBN route, designed to utilise the latest separation standards that the CAA CAP1385 allows, towards its UK exit point.

The aircraft will then follow these routes, which will reduce the requirement for controller intervention, subsequently reducing workload for controllers and improving overall network efficiency. By introducing vertical restrictions into these routes, it will be possible to create '3D routes' that aircraft will be able to utilise and fly through with minimal input from air traffic control. Initially, the routes will require relatively broad vertical tolerances to allow for the differing performance characteristics of the aircraft utilising the space.

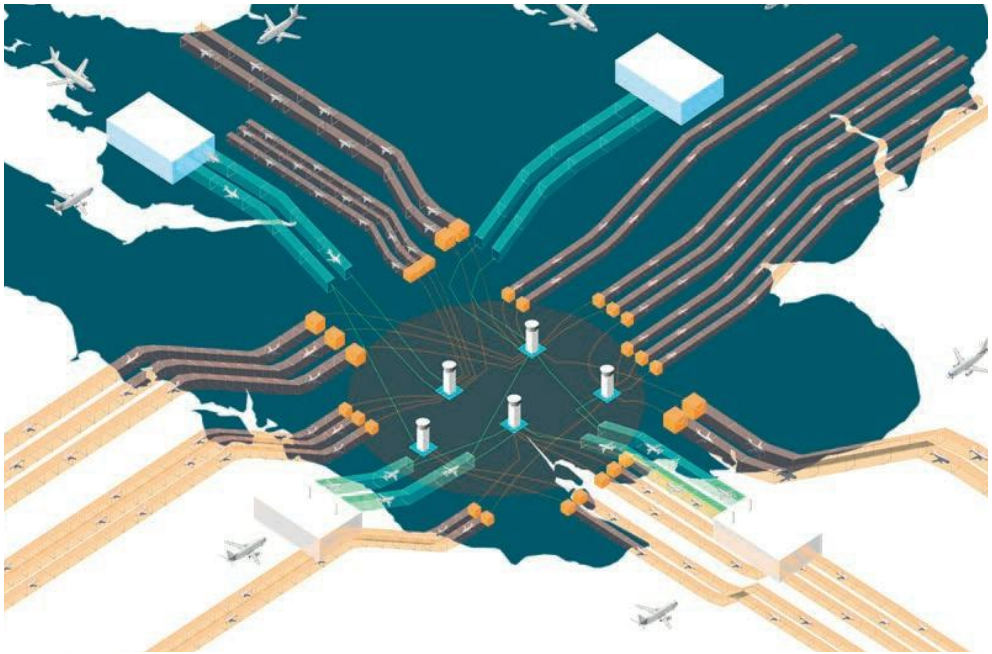

Figure 3: Schematic view of the future airspace.

[2] https://publicapps.caa.co.uk/docs/33/CAP%201385%20APR16.pdf

3D Routes

As part of NATS' feasibility assessment into airspace modernisation, a '3D route' concept has been created which utilises both lateral and vertical constraints to higher levels than existing procedures. Aircraft would be able to follow a number of set routes, defined by the local airport in consultation with their local communities, airspace users and other stakeholders, from take-off up to Flight Level 70 (approximately 7,000 ft.) at which point they would join one of a series of PBN routes in the sky. From here, thanks to the lateral separation provided, they could use continuous climb and descent between FL70 and FL305, after which they would be able to transition to free-routing. For the purpose of modelling only, airports were asked to indicate in the broadest terms potential routes to FL90. [2]

Currently, the performance of aircraft on departure varies due to the operation of the Flight Management System on board, meaning that a degree of controller input in the vertical plane will still be required. By utilising an advanced toolset, the vertical constraints could also be managed by a controller. As further understanding is obtained and adjustments to FMS develop, it will be possible to utilise vertical constraints throughout these routes without the need for controller intervention. Ultimately, it should be possible to have low and high performance routes to cater for aircraft with an array of performance capabilities. Use of the same route for both heavy transatlantic aircraft and lighter domestic aircraft, for example, would not be an efficient use of airspace given the performance envelopes of such aircraft are significantly different.

This subsequently enables the majority of aircraft to fly an increasingly efficient flight profile route; some will get continuous climb departures from ground to Free Route Airspace through better flight profile management and with minimal controller intervention. Through the ACP consultation process, it will be possible to provide local communities and flight planners with a range of options. For airport communities, greater definition of the vertical profile will make the low-level airspace more efficient and could provide the opportunity for greater levels of respite in their designs providing defined breaks from aircraft overflying communities.

As technology continues to develop and next generation aircraft come into the system, it will be possible to introduce tighter level restrictions into these routes, or perhaps gradients to fly, allowing the separation between routes to be safely reduced. This will further reduce delays, increase the environmental efficiency of the airspace and increase capacity. It will also be necessary to have a degree of tool-based conformance monitoring to ensure aircraft sustain the appropriate tolerances necessary to fly the PBN routes and to alert controllers when deviations occur. This will be enhanced by on-board conformance monitoring on the aircraft where they are so equipped, utilising Required Navigation Performance (RNP) specification, for example.

Figure 4: Traditional vertical holding stacking (white) with London City PBN routes (gold) within Southern UK airspace.

'Letterboxes' in the Sky

NATS developed a feasibility assessment for airspace at the request of the Secretary of State. This outlines the concept of 'letterboxes' in the sky at 7,000ft, i.e. entry points to the network airspace. NATS will develop this concept further and propose an airspace change to the CAA for the network, interfacing with an airport at the letterbox. Airports, in co-operation with NATS and each other, will design flightpaths into and out of these letterboxes, proposing these airspace changes to the CAA. Both NATS and the individual airports will have to follow the CAA's airspace change process, including engagement and consultation requirements, when they design the changes deemed necessary.

3.1.3. Inbound Procedures

Inbound aircraft will follow 2D PBN routes with vertical profiles created by level restrictions at various waypoints. This method of operation is already in use by other Air Navigation Service Providers (ANSPs), such as Deutsche Flugsicherung (DFS) in Germany, where some inbounds to Frankfurt follow a fully defined arrival route from 35,000ft. The Federal Aviation Authority (FAA) in the United States is also deploying this type of route throughout their Metroplex airspace update, and it is currently in operation for inbounds to major airfields such as Washington Dulles and Baltimore.

Speed profiles will also be a part of the inbound procedures. This will improve predictability in the overall network, reducing terminal holding and emissions. This will be achieved by maintaining longitudinal spacing between aircraft, created before entering the systemised network, and allowing on-time arrivals. Once on the inbound route, the aircraft should need few instructions until entering the approach phase of flight, meaning that almost continual descent approaches could be possible from cruising altitudes.

Neighbouring ANSPs and adjacent sectors within the UK will need to stream arrivals before entering the system in order to provide a steady supply of aircraft to the approach units responsible for the final phase of the flight. These units provide the air traffic service which delivers accurate and optimal spacing on final approach in order to maximise the runway utilisation.

This will enable a significant reduction of low-level orbital holding in the London area. Aircraft will reduce speed earlier in the en-route phase and at higher levels. This is more efficient in terms of reducing emissions and fuel burn and also reduces the noise impact of lower-level holds on local communities.

3.1.4. Network Management

3.1.4.1. Inbound Procedures

Inbound aircraft will be streamed prior to entering systemised airspace. This may require aircraft to slightly adjust their speed in the latter phase of cruise flight in order to provide suitable spacing prior to entry into descent-phase systemised airspace. This speed adjustment provides environmental and fuel-saving benefits when compared with the current practice of flying orbital stack holding at lower altitudes close to the airport.

Suitably spaced inbound aircraft will then follow 2D PBN routes, with a limited number of vertical constraints applied where necessary. This method of operation is already in use by other Air Navigation Service Providers (ANSPs). As the ability of aircraft to follow vertical profiles (defined in terms of a climb or descent gradient), evolves, the airspace design will also evolve to make use of this capability to increasingly separate routes vertically.

Aircraft descending on systemised routes may be required to follow standard speed profiles in order to maintain suitable spacing. However, this will enable greater use of continuous descent approaches from a much higher altitude as well as maintaining capacity on routes.

3.1.4.2. Outbound Procedures

Systemised airspace greatly reduces the interaction between aircraft departing from adjacent airports but potential complexity will still exist as aircraft depart systemised airspace.

Airports already provide information about departing aircraft timings into network management systems, and the accuracy of such information is continuously improving as the larger airports improve their systems and procedures. Deployment of improved network management tools, updated by improved airport departure systems, will enable periods of potential high traffic complexity to be detected earlier, enabling a solution to be put in place earlier. Such solutions may include slightly adjusting the departure flow rate from affected airports before aircraft taxi and are committed to a taxiway order, or making use of alternative departure routes where suitable alternatives exist.

Free Route Airspace (FRA)

The aim of FRA is to provide airspace users with the ability to flight plan and fly the most efficient route of their choice through high-level airspace without being constrained by a network route structure. This concept of operations has already been deployed in parts of Europe, such as Ireland and Scandinavia, and is a mandated European requirement. Amongst many benefits this will reduce CO2 emissions per flight, reduce overall cost per flight, reduce total fuel burn and provide improved predictability in flight time, optimising airline and airport operations.

3.1.5. Airspace Interfaces

It is yet to be decided at what flight level systemised airspace will operate. It is suggested by NATS that the routes could terminate at the interface with Free Route Airspace (generally above 30,000 feet).

This network airspace change would maximise the environmental benefits both in the air and on the ground, whilst also improving intervention and would enable increasingly accurate flight planning for airlines. By creating repeatable and consistent routes, the network will be easier to understand and manage.

However, this would mean large-scale change not only in the London Terminal Manoeuvring Area but also in en-route airspace. The scale of such an airspace change would be unprecedented and could take many years to deliver, due to constraints in the wider airspace change industry. The current AIRAC (Aeronautical Information Regulation And Control) cycle, for instance, defines the dates at which airspace changes can be delivered around the world and has a finite capacity.

An interim 'transition' airspace may therefore be needed, where aircraft exit and enter the systemised network at known points but pass into a more 'traditional' type of airspace where controllers handle the traffic giving tool-supported tactical clearances. This airspace would sit between the systemised network from approx. 24,500ft to Free Route Airspace above 30,000ft.

Interface will also exist with surrounding ANSPs where the route profile means that the aircraft will never reach FRA in UK airspace. It will be necessary to define, through negotiation, the exit and entry points to and from the network at the airspace boundaries at discrete points through which all aircraft must pass in order to maintain separation within the network. This will be beneficial to our neighbours, as they will have a predictable flow of traffic out of the UK always at the same point and at the same level.

3.1.6. Other Airspace Users

While the vast majority of airspace users within the new systemised network will be from the commercial air transport industry, the airspace needs to be open and usable by other stakeholders. The General Aviation community is currently, dependent on qualification and airspace classification, able to file and fly within controlled airspace, which will continue. Where the equipment on these aircraft meets the minimum specification necessary they will be able to use the network as any other user would.

It may be necessary to create discrete routes for aircraft departing from or arriving to smaller airfields that sit outside of controlled airspace in order to reduce any disruption to larger airfields.

For the military, there will be increased predictability in terms of being able to avoid civil air traffic routes in the network, and intentions of civil aircraft will be better understood by military controllers. Routes or corridors will be provided where aircraft can cross controlled airspace in a safe and predictable manner, should this be required.

If an airspace user does not meet the equipage requirements to fly in the network, such as small private general aviation aircraft or older commercial aircraft, they will have to route around the area. It may be possible to provide specific corridors for this purpose, which would be safely separated from the wider network routes. These corridors may provide less efficient routings than the systemised network.

3.2. Description of the Projected Benefits

3.2.1. Maintaining and Enhancing Safety Standards

The UK's airspace has an excellent current safety record. However, as air traffic continues to grow, it is important that the airspace evolves in order to safely handle increased traffic demand.

The concept of routes which are separated by design, in addition to a number of planned enhancements to the air traffic control toolset, will ensure that UK airspace continues to operate in a safe manner. Furthermore, it is projected that the airspace enhancements highlighted in this document will provide a safety improvement within Southern UK airspace.

3.2.2. Reduction in Delays

In 2018, there was a total of 268,000 minutes of delay due to airspace capacity in the UK. It is currently estimated that if no changes are made to the airspace and traffic increases in order to maximise the ground infrastructure available, there will be more than 30 times this level of delay by 2030. Such levels of delay are far greater than airports and airlines could tolerate commercially which would jeopardise UK ambitions for growth.

The concept described here will deliver a 30% increase in capacity within Southern UK airspace. This should more than meet the increase in demand expected in 2030 and reduce delays below current levels.

3.2.3. Environmental Improvement

A central objective of the concept is that wherever possible, aircraft are able to climb and descend continuously given improvements in aircraft technology. In addition, the Concept of Operations does not rely on vertical holding at low levels close to airports.

These improvements could reduce CO2 emissions in UK airspace by up to 20% per flight. In addition, the introduction of continuous climbs and descents for aircraft will reduce noise for local communities.

3.2.4. Foundation for Future Technologies

A systemised airspace without the need for tactical intervention means that the airport, airline and airspace can 'operate to plan'. Systemisation allows better punctuality, which enables the arrival time of an aircraft to be planned and resources fine-tuned to efficiently manage operations. For example, the arrival gate is ready just in time, the tug arrives just in time, and the capacity of baggage, customs etc. can be better matched to the known schedule and plan.

NATS is investing in Air Traffic Management Planning tools to optimise and stream traffic inbound to airports through airspace that is designed to facilitate streaming and spacing. This will maximise environmental benefits and fuel savings whilst delivering stable, high-capacity flows.

Figure 5: Potential Environmental and Economic Benefits.

10-20%
Reduction in fuel burn and CO2 based on enabled fuel savings of between 90kT and 180kT of aviation fuel per annum.

Significant noise improvements through airports modifying their routes below 7,000ft, with the use of PBN and climb profiles.

30% **Increase in capacity** to deal with expected levels of growth across Southern UK airspace.

4. Forecasted Growth

Chapter Summary:

This chapter outlines the significant predicted growth in air movements between 2018 and 2030, based on two scenarios - NATS' and airports' forecasts.

In 2018, NATS facilitated approximately 2.5 million movements[3]. Intelligence from NATS' internal forecasts suggests that air traffic is predicted to grow to approximately 3.1 million movements (a 21% increase) by 2030. When airport forecasts provided by the 18 major airfields in the South of the UK are also considered, this figure rises to approximately 3.5 million movements[4] (a 40% increase).

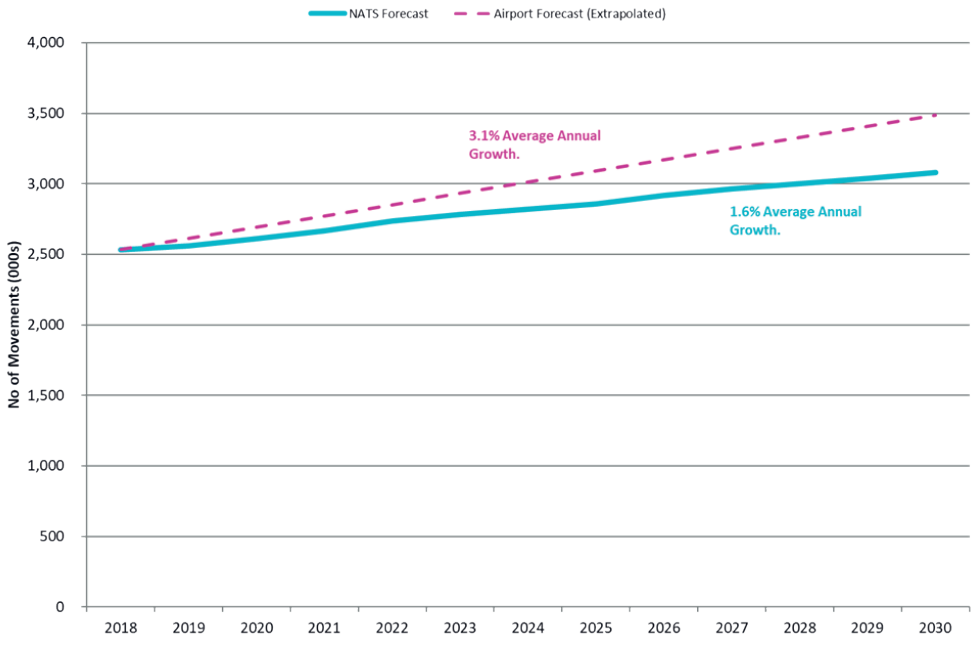

Figure 6: Network growth areas in 2030 based on the NATS' December base case forecast (left) and airports' forecast provided as part of the FASI South RFI (right).

Figure 6 provides an overview of the predicted aviation growth by the number of movements in the UK skies from 2018 – 2030. Overall, the average annual growth based on the NATS' forecast is 1.6%. For comparative purposes, the latest DfT forecast predicts an average annual growth of 1%, however these two sources are not directly comparable as the DfT forecast focuses on movements from UK airports only, whilst the NATS' forecast considers all commercial traffic within UK airspace.

The figure also shows the airports' forecast. The only data point here is 2030, but the line is extrapolated for illustration purposes. The average growth forecast of 3.1% per year is higher than the NATS' forecast as the airports' forecast reflects individual airport growth aspirations.

Figure 7 illustrates the likely areas of network growth in the South of the UK. Both scenarios highlight significant levels of network growth due to planned airport expansion with many congested routes projecting increases of more than 50%.

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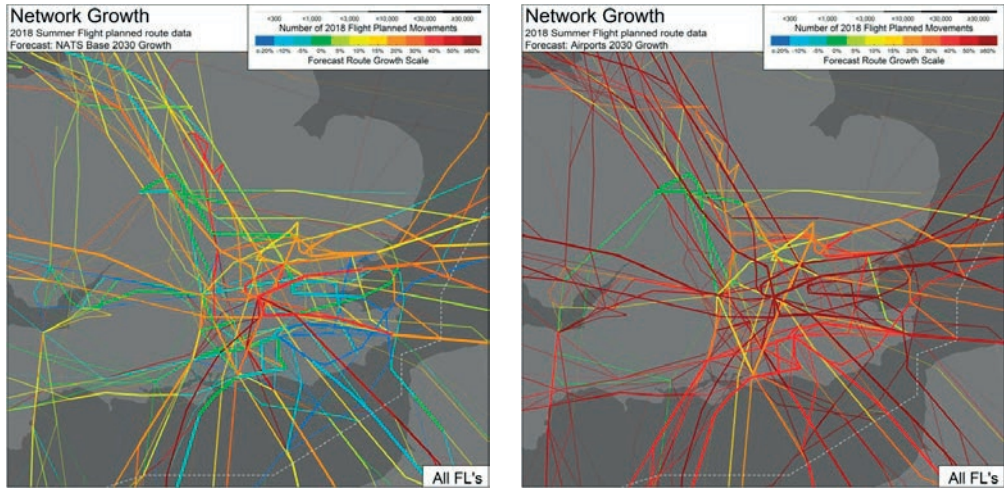


Figure 7: Projected UK aviation growth.

[3] Movements refer to growth that includes all NATS flights w thin the UKFIR according to NATS Network Manager data and the NATS 2018 Base Case UKFIR Forecast.
[4] Airport forecasts are based on the projected growth from each airport as per their submission to the RFI for the FASI-S Secretary of State Report in May 2018.

5. Bottlenecks

Chapter Summary:

This chapter outlines the significant capacity challenges that the Southern UK airspace will face based on both NATS' and airports' forecasts by 2030, and identifies specific bottlenecks around London and the South East.

For the purpose of this Masterplan, a bottleneck is defined as a situation where sustained air traffic sector demand is in excess of capacity. The projected growth in Southern UK air travel clearly highlights the increasing demand on finite airspace capacity. Despite the opportunities associated with such growth, there is also a likelihood that increased demand may increase delays for consumers and businesses.

The images in Figure 8 highlight the evolution of traffic demand vs. capacity in the Southern UK terminal airspace from c.25,000 feet to c.7,000 feet. The analysis assumes no changes in airspace capacity. These images show the peak hour for each sector against capacity to highlight the times where the airspace is at its most constrained.

The first image illustrates the current capacity constraints within the London TMA. The airspace is particularly congested to the west of the London TMA around 0500-0600. This is due to the morning rush of departures. Delays due to capacity constraints during this part of the day are particularly penalising for airline stakeholders and the public, as it has a knock-on effect on airline schedules for the rest of the day.

The other two images build on the current picture to present likely scenarios in 2030. The first scenario is based upon NATS' forecasts of likely growth in UK airspace. The second presents a picture based on airport forecasts of aviation growth.

Both images highlight the significant constraint of airspace capacity likely by 2030. It is apparent that demand will exceed capacity in the vast majority of sectors in the London TMA airspace by 2030 without the improvements expected from the implementation of FASI South. Based on NATS' forecasts, capacity increases of more than 20% will be required in a number of sectors in order to accommodate demand. This increases to 30% when airport forecasts are considered, which is clearly unsustainable. The current RP2 target for NATS attributable delay in the UK is

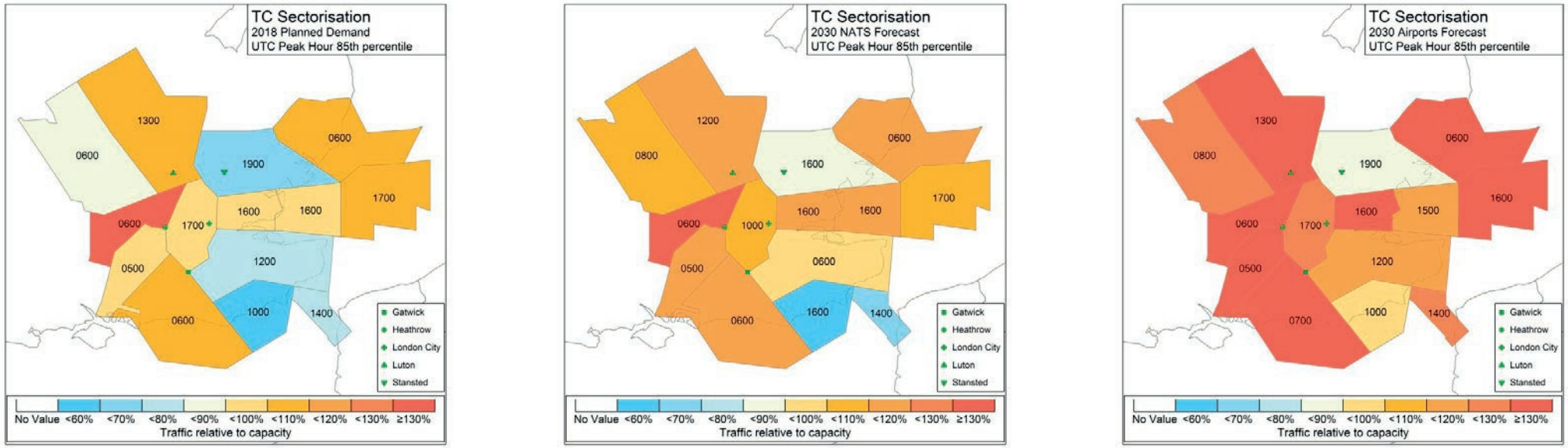


Figure 8: Evolution of Peak Hour Demand vs. Capacity in the London TMA.

10.8 seconds per flight. In 2018, this figure was slightly above target at 12.5 seconds per flight (predominantly due to the transition to EXCDS, the new electronic flight strip system).

Delay predictions show that, due to the capacity constraints highlighted above, the NATS attributable delay on UK flights could rise to as much as 33.6 seconds per flight. If airport aspirations are also considered, NATS attributable delay could increase by as much as 15 times, with an average delay of 154.3 seconds per flight, an increase of 1,134% on current levels.

Figure 9 provides a visual representation of the projected 2030 delay scenarios.

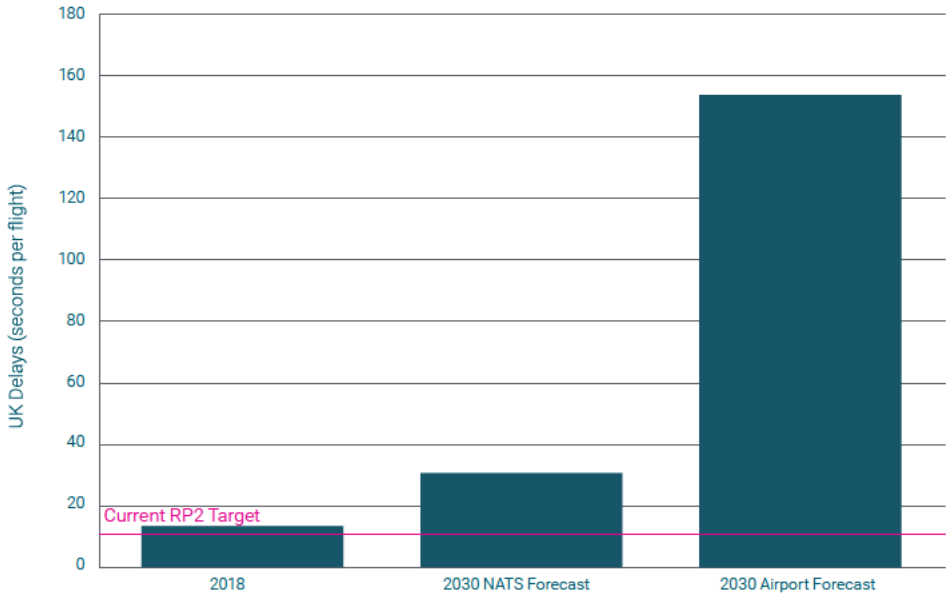
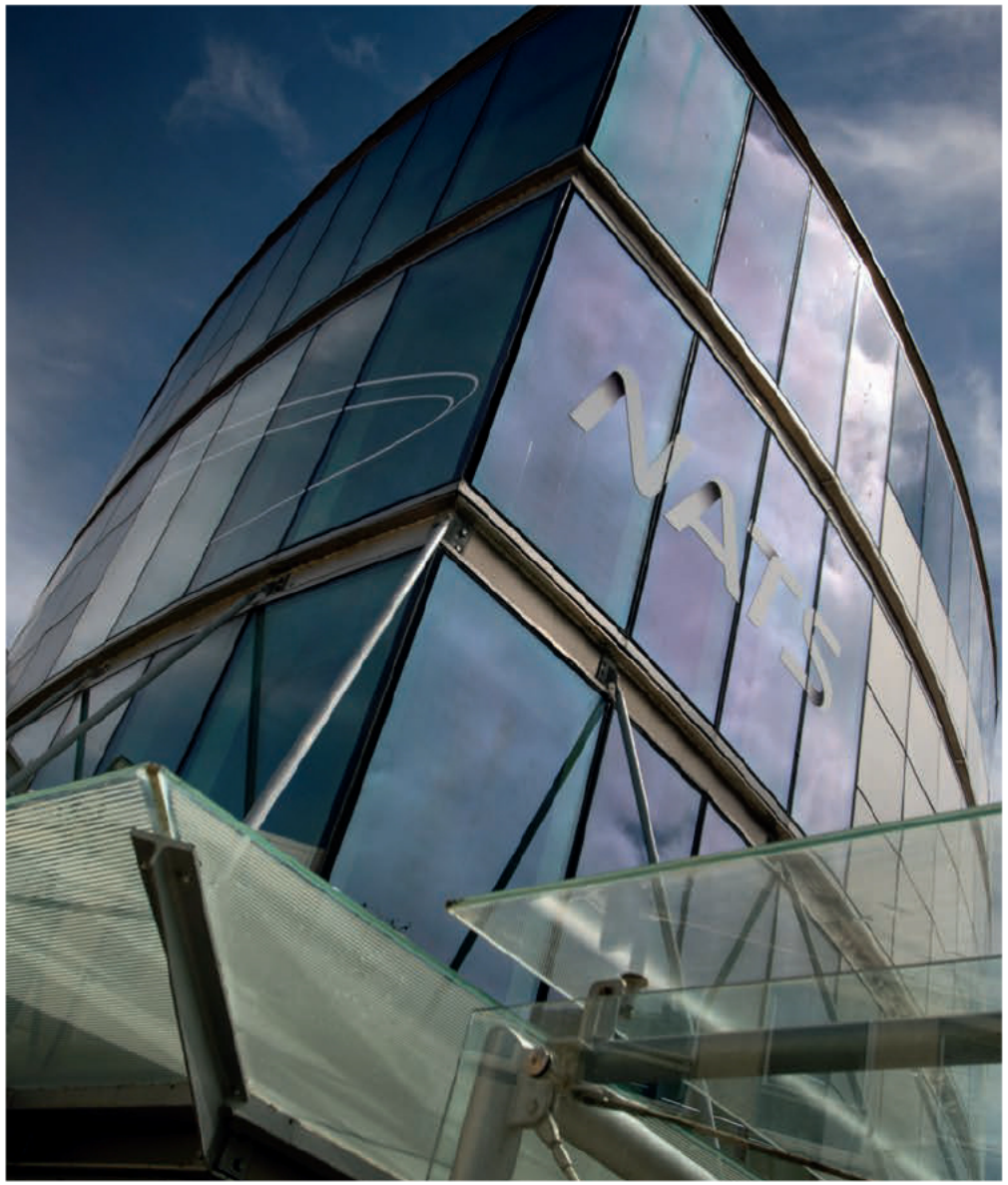


Figure 9: Projected delay scenarios based on future growth predictions.



6. Controlled Airspace Analysis

Chapter Summary:

This chapter outlines how airspace is currently used at levels up to FL100. Once an airspace design is complete, there may be further indications as to how airspace may be released to other users.

Performance Based Navigation (PBN), when used alongside systemisation, will provide the opportunity to reduce air traffic congestion within controlled airspace. There is scope to achieve this by increasing the predictability of the network though the use of PBN, as outlined in the FASI South Concept of Operations in Chapter 3.

The significant majority of controlled airspace is currently utilised at all levels up to FL100. Figure 10 illustrates how controlled airspace is currently used in the South of the UK and that in general terms, airspace under FL100 is used less frequently at the geographical peripheries.

Future iterations of this Masterplan will seek to identify areas where controlled airspace could be modified as the overall FASI South airspace design continues to evolve and airspace which is no longer required is identified. This airspace could be identified for a potential ACP that could deliver benefits, and a sponsor sought. It is possible that the release of controlled airspace may generate new low-level GA noise as airspace may not have been previously used by these operators.

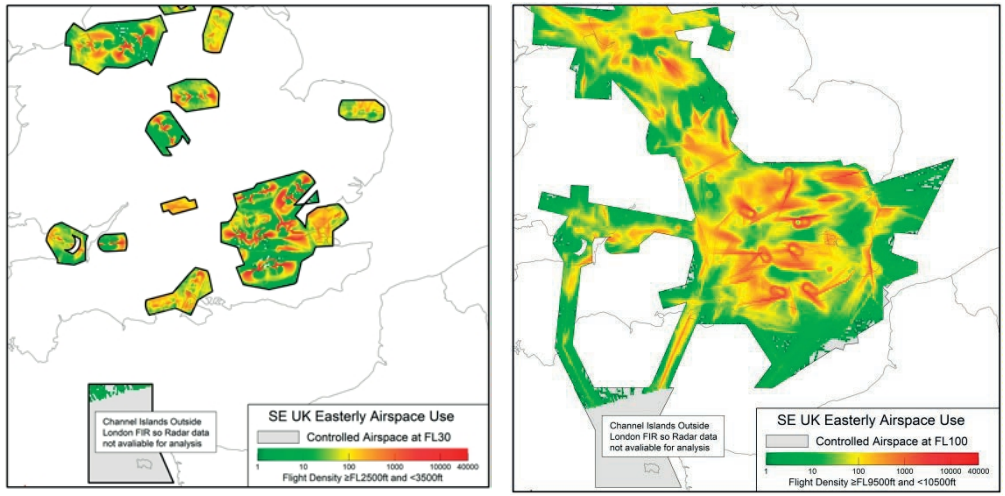


Figure 10: Current utilisation of airspace in the South of the UK at FL30 and FL100.

7. Future Military Airspace Requirements

Chapter Summary:

This chapter outlines the broad principles behind the future airspace requirements of the military, including how to make the most efficient use of airspace and meet the needs of new technologies such as 5th generation aircraft.

7.1. Ministry of Defence (MoD) Future Airspace Requirements

To support MoD Force Development, the MoD will continue to require flexible and timely access to UK airspace. In some cases, modern military aircraft will require access to larger portions of airspace in which to operate. In addition, airspace access will need to be coordinated with Electronic Warfare (EW) training requirements and weapons ranges. The next six years will see a gradual increase in fast jet numbers, predominantly based on the East coast of England.

Training airspace should provide aircrew with the ability to simulate realistic ingress/egress distances and weapons employment for all mission sets whilst defending against enemy tactics in a contested environment. Unfortunately, much of the current Special Use Airspace (SUA) was developed to support the training needs of retired aircraft and is not optimal for current missions or emerging requirements. With the transition to modern military aircraft and operating techniques, the need for specialised training airspace will continue to evolve.

Any developments should be mindful of the MoD's intention to routinely operate RPAS (Remotely Piloted Air Systems – 'drones') in the UK. The long-term intention is that RPAS will be integrated into UK airspace and will not require segregation. Ideally, the MoD would like to see the development of a series of airspace options/configurations that would maximise training opportunities for all military users, and provide flexibility for different weather conditions. It is recognised that NATS will need to have an input to future airspace designs for military training areas in order to minimise the impact upon airline commercial operations.

At this stage, the MoD is refining its requirements for airspace and airspace management to enable the production of more detailed solutions. However, there are some broad principles that need to be considered and aligned with other airspace users' needs:

- Airspace dimensions of sufficient size both laterally and vertically.
- Access to airspace overland in order to interact with EW sites and Air Weapons ranges.
- Airspace designed to permit aircraft to flow through the stages of a sortie.
- Airspace to be within range of East coast Main Operating Bases, but with options for poor weather alternatives.

It is envisaged that requirements will require additional airspace structures enabled through Flexible Use of Airspace principles and supported by appropriate airspace management.

7.2. Airspace Management

Effective airspace management in both the planning phase and on the day of operation will be essential to the delivery and effectiveness of any airspace solution. This will be required to ensure that military use is efficiently planned and that the resultant airspace plan and military usage minimises impact upon the commercial network.

Collaborative Decision Making (CDM) between military and civil airspace capacity and management functions will be required during the planning phase to ensure that the optimum airspace configuration for the UK is developed and notified to airspace users.

On the day of operation, tactical airspace management is essential for ensuring that late changes to airspace usage are dealt with quickly with airspace being reallocated to other users (military and civil) at the earliest possible juncture. Current airspace management arrangements may need enhancing to develop alongside and in support of airspace design.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8. Noise Distribution across the Southern UK and Noise Concentration Identification

Chapter Summary:

This chapter provides an overview of low-level (below 7,000 feet) air traffic in the Southern UK and noise distribution around London and the South East.

Previous airspace designs were to a great extent constrained by the ground-based navigation network and the capability of aircraft to follow these radio signals to navigate. This has resulted in areas of concentration of traffic. PBN navigation gives far more route options for ACP sponsors and the possibility to design the track of aircraft over the ground as part of the ACP engagement process. PBN enables a degree of choice of route, options for respite and greater capacity as more routes can be deployed.

Analysis will help stakeholders identify opportunities for new ACPs that could be beneficial. NATS intends to ensure that further work and engagement on this analysis will be undertaken in collaboration with ICCAN (the Independent Commission on Civil Aviation Noise).

Figure 11 provides an overview of traffic patterns below 4,000 feet in the Southern UK. The maps clearly depict high concentrations of traffic around major UK airfields. The distribution of air traffic portrayed in the map is indicative of the current methods of operation within the UK airspace. Systemising the airspace should act as an enabler for traffic to be handled in an increasingly predictable manner, with the opportunity for defined periods of respite for local communities.

Figure 12 illustrates the distribution of airspace traffic between 4,000 feet and 7,000 feet. Traffic between these parameters is more evenly distributed across the South East of the UK. Despite this, however, there are still a large proportion of communities affected.

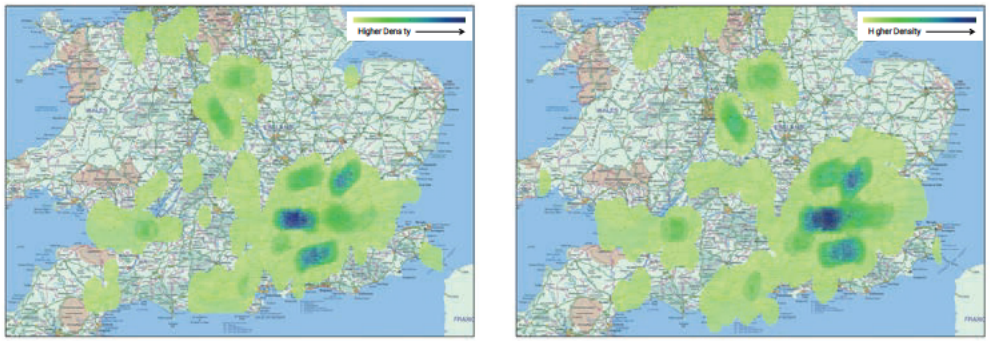


Figure 11: Traffic heat map for aircraft below 4,000 feet. (Left Image: Easterly Operations. Right Image: Westerly Operations).

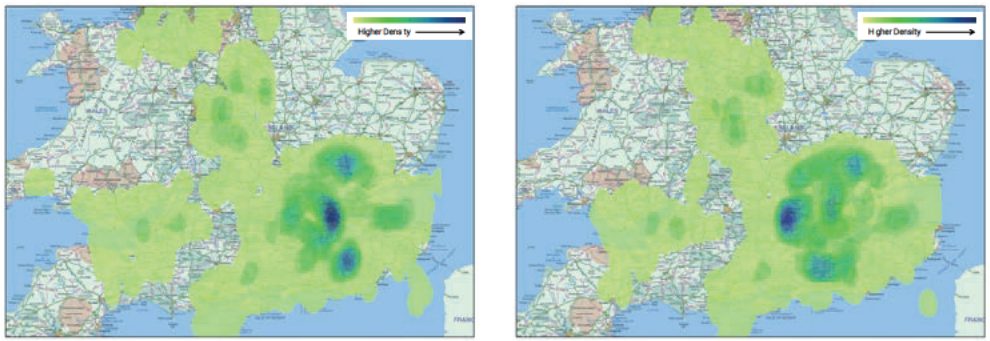


Figure 12: Traffic heat map for aircraft between 4,000 feet and 7,000 feet. (Left Image: Easterly Operations. Right Image: Westerly Operations).

9. Headline Airport and NATS En Route plc (NERL) Design Principles

Chapter Summary:

This chapter outlines for information and example the design principles that airspace change sponsors (airports and NERL) are working on within the FASI South programme, with safety being the highest priority.

All change sponsors in the FASI South Programme are currently in the process of engaging with their own stakeholders to determine specific design principles and for a qualitative structure against which design options can be evaluated. Early engagement with stakeholders, optionally facilitated by a third party, may help to avoid disagreement later in the process. Whilst all of the participants in the programme must deliver individual design principles following engagement with their own local stakeholders, they fall into eight broad areas of consideration:

1. Safety is always the highest priority	
2. Technical	– Who are the airspace users that need to be considered in the designs? – What are the technical aspects of the design that will be studied/utilised? For example, aircraft equipage considerations and ground-based equipment changes.
3. Regulatory	– Does the design need to take any CAA or other regulations into account?
4. Environmental	– This topic could include noise, CO2, NOx or other considerations. – It could also include other considerations for areas to be avoided in the design phase, minimising people overflown and avoiding areas such as parks, places of worship etc.
5. Operational	– What are the operational impacts/benefits that will be assessed in the design options? – Capac ty optimisation, operational resilience etc. should all be considered.
6. Economic	– The economic impact of the change for all users is an important topic for consideration. – How will the design impact both the sponsor and the user in terms of economics – increased capacity, reduced fuel etc.?
7. Policy	– What are the strategic policy objectives of the airspace change?
8. Implementation	– What will be considered in the designs that affect the implementation and deployment of the change?

Stage 1B of CAP1616 calls on each ACP sponsor to develop design principles that will be used in the assessment of each design option put forward at Stage 2B. Specifically, CAP1616 states:

"110. The aim is for there to be a good level of understanding by change sponsors as to what design considerations are important to stakeholders, such as predictable respite from noise for communities and access for General Aviation. This is a key stage in preventing misunderstanding or later disagreements by facilitating conversations, particularly concerning changes with more significant potential impacts. This should avoid significant iteration and re-work of the airspace change design stage, and should make the later consultation phase (Stage 3) more constructive.

111. The design principles will naturally be based around some fundamentals such as safety, throughput of traffic, and environmental impacts. But they must also be developed in a local context, in accordance with national policy. They must address any local trade-offs that need to be made, for example by addressing whether aircraft should, as a priority, avoid flying over specific local areas or populations.

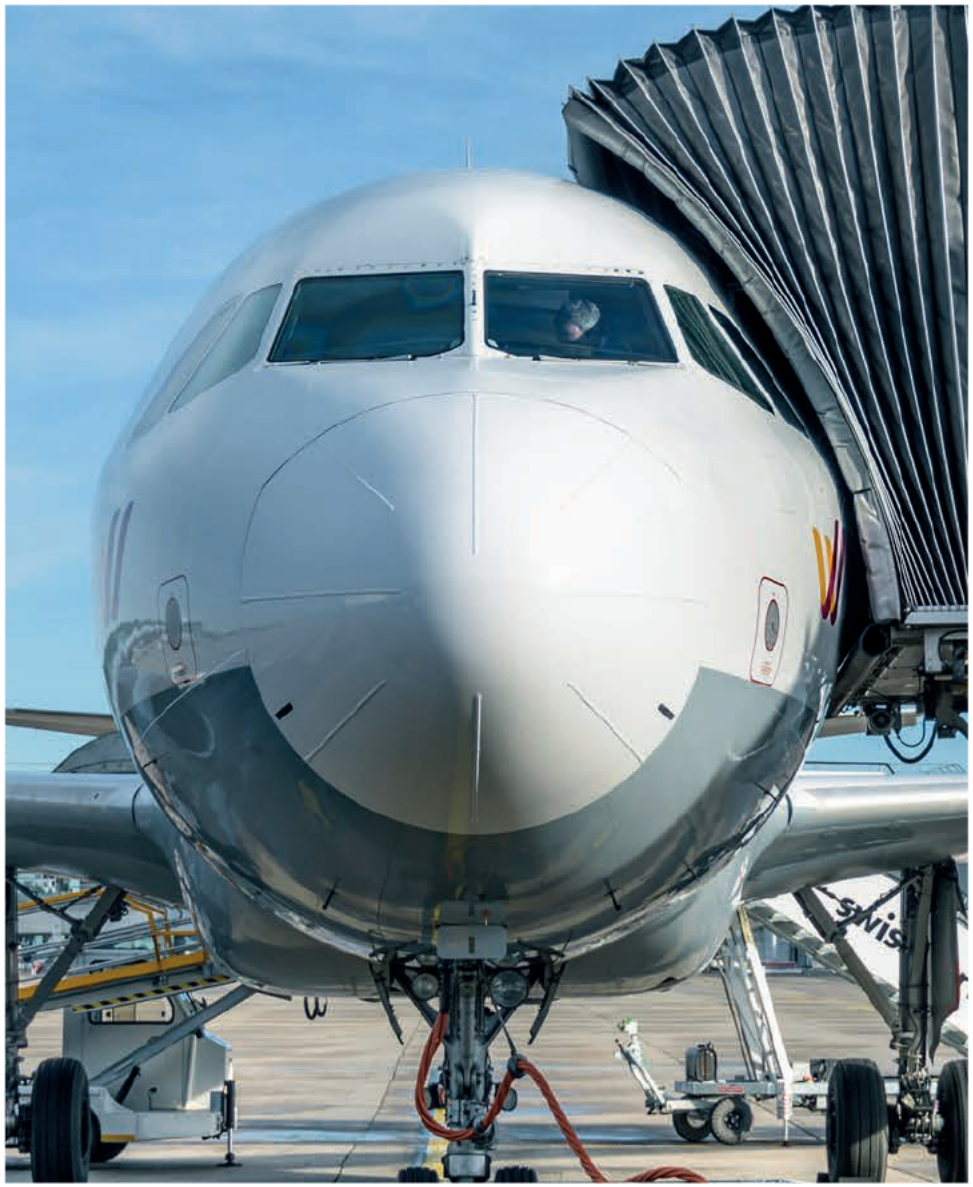
Where possible these discussions must identify whether stakeholders can identify common priorities, although the CAA acknowledges that unanimous agreement on the principles may be unlikely. Some of the principles may contradict one another and some may be prioritised over others."

An important part of Step 1B is for the design principles to be drawn up through discussion between the change sponsor and affected stakeholders at this early stage in the process. Local stakeholders will normally include elected community representatives, local community groups, the airport consultative committee and representatives of local General Aviation organisations or clubs.

The change sponsor may also consider convening a focus group with a mix of representatives. In the case of changes with higher potential impacts, the CAA may recommend the use by the change sponsor of an independent third-party facilitator to make early engagement with stakeholders on design principles more effective. A facilitator may also be used in later formal consultation.

For reference the NERL LAMP Design Principle titles are:

	Safety is always the highest priority (Category A)			
	Technical	Environmental	Operational	Economic
Category B	The main route network linking Airport procedures with the en-route phase of flight will be spaced to yield maximum safety and efficiency benefits by using an appropriate standard of PBN.		The airspace will enable increased operational resilience.	
			Systemisation will deliver the optimal capacity and efficiency benefits.	
Category C	The volume of controlled airspace required for LAMP should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users.	Optimise CO2 emissions per flight.		Optimise network fuel performance.
	The impacts on GA and other civilian airspace users due to LAMP will be minimised.	Minimising of noise impacts due to LAMP influence will take place in accordance with local needs.		



10. NATS Environmental Best Practices – Noise, Emissions and Air Quality

Chapter Summary:

This chapter outlines some first principles that airspace change sponsors may want to consider in relation to noise, emissions and air quality as they develop their designs and hold public consultations.

Airspace modernisation provides a once-in-a-generation opportunity for the aviation industry to address the environmental inefficiencies of airspace design, making journeys cleaner, quieter and quicker. Underpinned by the implementation of PBN, it allows today's modern aircraft fleet to fly to their full capabilities: letting aircraft climb quicker; stay higher for longer; and follow accurate routes designed to avoid densely populated areas.

This technology, alongside new airspace infrastructure design, airspace management tools and Concept of Operations, combine to either support reductions in overall noise and emissions impacts, or support the management of where and when impacts happen, potentially tailored to local preferences. For example, in the case of aircraft noise, modernisation allows opportunities to deploy multiple routes alternated by day or time to provide predictable respite or different distributions of noise. Such noise management techniques may increase the total number of people impacted by noise but crucially still deliver against Government policy guidance to reduce the total adverse impacts' of noise (e.g. health and quality of life). Separately, utilising the opportunity to concentrate flights on accurately flown routes can help minimise the overall number of people impacted but may lead to increases in noise for those still overflown.

The specific options available for change sponsors to deliver improved environmental performance depends on local circumstances; informed by extensive stakeholder consultation and accounting for any local constraints to airspace development.

The interrelationships between noise, emissions and other operational factors, such as delay and capacity, are often complex and at times contradictory. The delivery of positive outcomes in all these areas is not always possible. It is clear, however, that fuel burn, emissions and managing the impact of noise on local communities are high on the agenda for all stakeholders and crucial to the sustainable development of aviation.

The CAA's guidance on the airspace change process (CAP 1616) sets out the protocols that proposers of airspace change should follow, including detailed guidance on environmental assessments and consultation methodologies. We detail here some of the environmental best practice options that ACP sponsors may wish to deploy when developing their airspace proposals.

Sponsors should consider the detailed feedback from stakeholders in choosing which options to pursue and understand that preferences may vary between different communities and stakeholders. As such, a range of options may need to be tailored to meet different expectations by airport and by specific geographic region.

The options listed on the following pages are not exhaustive but are provided for example as being ones that could be explored locally through consultation on design principles.

Reducing noise impacts

- Using PBN and new airspace design to support improved vertical profiles of flight by embedding continuous climb and continuous descent operations into the design of airspace and considering the optimum climb/descent gradients for aircraft to minimise noise. New air routes can be designed to provide quicker climbs, later descents and to avoid level flight at increased thrust levels in low altitude airspace. De-conflicting routes from one another can support the predictable delivery of flight profiles with noise abatement principles built into their design.

- The implementation of slightly steeper approaches. In recent years the term 'slightly steeper approach' has come into common use for descent gradients above the standard 3° (ICAO PANS-OPS) approach but typically below 4°. At busy airports operational trials and implementations have focused on proving that approach angles up to 3.2° are acceptable without impacting airport, airline and ATC operations, while still reducing noise. Angles above this start to impact on airport resilience (due to aircraft not meeting certification limits for Autoland in poor visibility) and are often therefore discounted. While noise reductions may not be perceptible to individuals on an aircraft-by-aircraft basis, slightly steeper approaches have been shown to reduce noise levels and therefore contribute to reducing total adverse impacts.

- Using single routes to minimise the number of people newly overflown. This represents a minimal change scenario and supports the objective to provide stability and certainty of the airspace design over time. It involves designing routes that fall within the current swathe of flight paths or replicating current flight paths with PBN routes to ensure that noise is not experienced in new areas previously not overflown. Care needs to be taken to consider how the concentration aspect of PBN may impact communities previously under highly dispersed flight paths.

- Using single routes to minimise the total number of people overflown. Utilising the enhanced accuracy of PBN to concentrate aircraft on routes that have been designed to fly around population centres or elect to overfly the fewest number of people possible. For example, PBN can be used to prioritise the accurate routing of aircraft over rural/non-residential areas such as commercial and industrial areas where fewer people live or using 'curved routes' to find the least populous areas between two points. PBN can also be used in this way to ensure noise sensitive buildings are protected from overflight. The use of the CAA 'overflight metric' (CAP1498)[5] could be a useful assessment tool, particularly for communities lying further away from airports and outside of traditional average noise exposure contours (e.g. L_{eq} and L_{DEN}).

- Prioritising routing over noisy urban areas. Some urban areas can have higher ambient background noise levels during the day compared to rural areas, which may affect how 'noticeable' aircraft noise events are. Airspace design can take into account local preferences with regards to urban vs. rural choices and differences in preference at different times of the day. Similarly, when designing routes that cannot avoid overflying urban areas, PBN could also be used to avoid parks, quiet spaces and other areas with a high amenity value.

- Using multiple PBN routes to alternate flights over different areas, possibly on a planned basis to give communities predictable periods of respite or temporary relief from aircraft noise. This concept provides the ability to switch routes 'on or off' based on a period of hours, days or weeks. The ability to provide meaningful respite depends on both the availability of airspace and the height at which aircraft are; as aircraft attain height, greater lateral distances are required between routes for there to be noticeable reductions in noise.

- Equitable sharing of impacts over a wider area with multiple PBN routes. As above this concept considers multiple routes but without an alternation pattern. Multiple routes also potentially allows the dispersion of existing flight paths to be better replicated (depending on how dispersed current flights are).

- Use of a hybrid procedure. This provides the opportunity to retain track dispersion for departures close to an airport by using ATC vectors initially, after which aircraft transition on to PBN navigation away from densely populated areas or when noise no longer becomes a priority (for example above 7,000ft).

- Reviewing potential for increased noise sharing at night through the implementation of different night-time routes alongside runway alternation when conditions allow.

- Consideration of the compound noise impact from multiple routes. For an individual change sponsor this requires consideration of the compound impact from overlaying various modes of operation and routes together. The use of supplementary noise metrics, particularly for further- out communities can support the identification of these noise impacts (e.g. CAP1498, track density or N60 contours). For multiple sponsors this could be managed with oversight from the Masterplan.

- Combining changes to airspace with changes to planning/ground infrastructure, for example to implement displaced thresholds. A displaced threshold moves the earliest point at which aircraft can touchdown further along the runway. While this does not change the arrival glide-slope gradient it has the effect of increasing the height of aircraft over communities all the way under the approach, thereby increasing the height of aircraft over ground and reducing noise. This is only possible at airports with long runways where their full length is not required by landing aircraft (but is for departing aircraft). It also requires development to exit taxiways.

[5] https://publicapps.caa.co.uk/docs/33/CAP_1498_V2_APR17.pdf

Reducing fuel burn and improving carbon efficiency

– Optimal Trajectories. Fuel efficiency can be measured in numerous ways to account for different purposes and stakeholder requirements. Airlines are interested in both the network design, as it affects the flight plans they can file (and fuel uplifted) and the tactical service they receive from Air Navigation Service Providers. Both elements can determine the overall amount of fuel required to fly a route. To achieve the optimal results for fuel burn and emissions purposes, airspace change should focus on making the trajectories expected to be flown day-to-day as close to optimal as possible and the structure of airspace to best reflect the expected trajectories.

– Optimising Fuel Uplift. There are several ways efficiency can be improved – by helping aircraft stay higher, and fly more direct, lighter and slower routes. Airspace change could support aircraft to fly higher and on routes that are more direct. Improving the efficiency of the network design also allows airlines to optimise fuel uplift, thereby reducing the weight of the aircraft (and avoid extra fuel being burnt to carry extra fuel). Separately, airspace management tools can support reduced fuel outcomes by helping slow aircraft down to avoid unnecessary arrival holding in low-level airspace – which is particularly penal for fuel burn. Airlines' own initiatives also contribute to aircraft flying higher, more direct, lighter and slower. Fuel uplift considerations can also be important when making decisions on trade-offs between departure and arrival routes. An airport with a high proportion of international flights may wish to consider that the impact of adding an extra mile of flight for arrival traffic may count more than for departure traffic, given the distances flown.

– The operational efficiency of air traffic management through UK domestic airspace is regulated by the CAA and monitored by the EUROCONTROL network manager. The CAA and NATS use a metric known as 3Di, which measures the difference between the actual flight profile (vertical and horizontal) a flight achieves with an optimised great-circle profile. A second similar metric, known as KEA (horizontal only), also exists and is monitored by EUROCONTROL. These metrics enable areas for improvement to be identified and for ANSPs to benchmark their relative performance. The metrics are also useful to help measure the environmental benefits of implementing various Aviation System Block Upgrade (ASBU) modules, as part of the ICAO Global Air Navigation Plan. Airspace modernisation creates an opportunity to improve efficiency of both horizontal and vertical flight profiles through airspace design.

– Specific measures to consider for the structural design of airspace include direct routeing and continuous climb/descent from ground to higher levels in en-route airspace. Tactical performance and achieving continuous climb/descents is today dependent on several factors, including airline operating practices, air traffic control, weather etc. The use of PBN can support embedding improvement into the inherent design of airspace. Consideration should be made to provide certainty to airlines of the route they file and fly to avoid tankering fuel (and fuel uplift) unnecessarily.

– Intelligent approach using arrivals management tools and time-based spacing could reduce airborne holding, fuel burn and CO2 emissions. A suite of ATC tools is already available to manage the flow and arrival of inbound traffic. However, managing the upstream implications of this intervention requires flexibility by both ATC and the sector design.

– Consideration to all users. Access to airspace, including military training and danger areas e.g. Special Use Airspace should be ensured. Airspace is a finite resource and is not just for commercial aviation and the military. A range of other stakeholders are entitled to and require access to airspace, including General Aviation, hot air balloonists, and other aviation enthusiasts, remote sensing firms and well as civil & emergency service providers.

– Consideration at the design phase of the resilience of airspace in responding to disruption due to future climate effects or managing increased levels of capacity. Because of climate change, i.e. more frequent and disruptive extreme weather events or more variable jet stream, it is likely that traffic flows may be disrupted at short notice. Traditional sectors could become overloaded due to tactical re-routing and/or diversions, placing strain on rigidly defined airspace sectors. Airspace sectors in future should be dynamic and actively respond to traffic flow optimisation, dealing with disruption caused elsewhere in a stable and systemised way.

– A particular challenge in a complex TMA environment is the compound inefficiency impact (and extra fuel burn/CO2) from the convergence of multiple routes from multiple airports. For example, the four holds for Heathrow airport are asymmetric relative to the airports. As a result, different efficiencies are delivered depending on wind direction. Consideration in the design stage should take account of the efficiencies delivered in all modes.

– Unintended upstream/downstream impacts can arise from airlines accessing Free Route Airspace, shared airspace and neighbouring ANSP airspace i.e. in terms of aircraft trying to achieve a level or air traffic controllers seeking to meet a standing agreement.

– Departure management is generally prioritised across Europe, with the effect that arrivals are either held in a standard hold or vectored at relatively low level – which can be more penal for fuel and noise. Airspace design should initially consider the impact of arrivals management techniques on the future structural design needs for delay absorption.

– Changes to ground/space-based surveillance will create an opportunity to reduce separation standards, which can improve airspace network efficiency through the creation of new multiple routes, or by reducing inefficiency previously required to de-conflict flows/separation standards.

– Airspace design should consider how best to de-conflict and optimise known regular airport pair repositioning flights.

– There may be scope for airspace and on-board optimisation tools to be more aligned and interconnected across industry stakeholders, including FMS and/or tools from other on-board equipment manufacturers, airlines and ANSPs, to maximise the potential for better in-flight decisions on flight planning and arrivals management.

Maintaining local air quality (LAQ)

The Government's Air Navigation Guidance 2017[6] states:

"Studies have shown that NOx emissions from aviation related operations reduce rapidly beyond the immediate area around the runway. Due to the effects of mixing and dispersion, emissions from aircraft above 1,000 feet are unlikely to have a significant impact on local air quality. Therefore the impact of airspace design on local air quality is generally negligible compared to changes in the volume of air traffic and that of the local transport infrastructures feeding the airport."

This is due to airspace design rules requiring straight out/in routes in the critical early phase of departure and final approach. However, consideration needs to be given as to whether airspace design facilitates increased capacity at an airport level; increasing the absolute numbers of flights and emissions from increased aircraft movements, ground vehicles, and increased surface access.

The impact of increased movements on the efficiency of aircraft ground-based operations needs also to be considered in terms of impacts to average taxi time and the ability to deploy reduced engine taxi etc. Opportunities to improve efficiencies here include: improved connectivity between ATM tools such as arrivals manager and ACDM (Advanced Collaborative Decision Making); the design of airport infrastructure (e.g. taxiways and stands); and the effect of airport choices to prioritise arrival/departure flows.

[6] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/653978/air-navigation-guidance-2017.pdf

11. Evidence of Stakeholder Engagement

Chapter Summary:

This chapter outlines different forms of engagement that NATS and ACOG have conducted to date with key airspace stakeholders and lists organisations that will be consulted in future iterations of this Masterplan.

Continued engagement with a wide array of stakeholders in the FASI South programme has taken place through public meetings highlighting the importance and relative need for airspace modernisation, the provision of feedback regarding the CAP1616 Design Principles and bilateral meetings with additional industry-wide stakeholders.

This has included meetings with, briefings to and requests for requirements and/or information from:

- Airports (bilaterals, trilaterals, FASI South meetings etc.)
- Airlines (AFEP, ICAMS etc.)
- Ministry of Defence (through DAATM, UK FMARS)
- General Aviation Alliance Members
- Neighbouring ANSPs (bilaterals, APDSG, RNDSG etc.)

Engagement is a key part of the CAP1616 process and stakeholder interaction will continue to be a fundamental element of the programme. Individual ACP sponsors will be required to conduct and evidence their own stakeholder engagement. It is suggested that a core record of such meetings is kept and maintained by the individual sponsors and ACOG. Consistent good practice should also be established and followed in relation to stakeholder engagement. ACOG has begun a process of both mapping its key stakeholders and conducting initial engagement, as well as considering what support might be provided to airports as they conduct public consultations on airspace designs.

In addition to the above, the CAA's Airspace Modernisation Governance Annex 7 (CAP1711) lists the organisations that should also be included within the engagement process:

- Airspace4All: a group coordinating General Aviation roles and information (formerly FASVIG)
- ANEG: Airspace and Noise Engagement Group run and chaired by the Department for Transport (DfT)
- AEF: Aviation environment and community membership body
- Airlines UK: airline trade association
- Airport Consultative Committees
- AOA: Airports trade association
- ARPAS UK: drone industry trade association
- CDF: Community Discussion Forum run by the CAA
- Devolved Administrations
- General and Business Aviation Strategic Forum
- IATA: International Air Transport Association
- ICAMS: Industry Communications for the Airspace Modernisation Strategy (previously FASIIG)
- ICCAN: Independent Commission on Civil Aviation Noise
- Ministry of Defence
- NATMAC: National Air Traffic Management Advisory Committee, run by the CAA
- SASIG: Strategic Aviation Special Interest Group for local authorities
- Sustainable Aviation: industry coalition
- UK Space Agency

[7] http://publicapps.caa.co.uk/docs/33/CAP%201711b%20Governance%20Annex%20to%20CAP%201711.pdf

12. Mediation and Legislative Process

Chapter Summary:

This chapter outlines a process to resolve potential challenges and obstacles to the delivery of airspace modernisation through bilateral engagement and ACOG mediation; proposed legislation; and then the ultimate sanction of removing an airport from the FASI South programme.

There is a significant delivery challenge to coordinate multiple and overlapping low-level airspace changes across FASI South airports with overarching airspace changes delivered by NATS at medium and high altitudes. The following details the proposed methodology for delivering the programme when there are conflicting airspace designs to ensure the best solution possible. It should be noted that when ACPs are submitted there will need to be detail provided on the rationale for trade-offs and decisions made.

12.1. Airport bilateral meetings and ACOG mediation

It is expected that the vast majority of design issues and conflicts will be resolved on a sponsor-to-sponsor bilateral basis as the sponsors have the best understanding of their current airspace, constraints and local communities. ACOG will work with all sponsors and support bilateral meetings to ensure that designs can be accommodated where practicable. This includes ensuring designs can be accommodated within the wider UK network (NERL-led LAMP programme).

The small number of design conflicts which remain will be subject to an agreed mediation process. In conjunction with the FASI South Technical Group, ACOG will create a process which will provide decision criteria to be used when multiple airport designs conflict and ATC procedures will not allow designs to be flown safely.

The criteria is most likely to be based on CAA and Government policy (CAP1616 and the Air Navigation Guidance 2017[8]) and will link back to the design principles that the sponsors have identified as part of their ACPs.

It is essential that the process is simple, lean and transparent and takes a holistic view of the change programme with ACP sponsors voluntarily agreeing to be bound by it. ACOG will engage with the CAA and DfT to ensure they are brought in to the process.

ACOG may be responsible for providing specific benefits analysis in order to support the decision-making process. If an agreement cannot be reached between two or more stakeholders, the specific case can be escalated via the ACOG Steering Committee to the DMO (Delivery, Monitoring, Oversight) function within the DfT/CAA.

12.2. Development of legislation related to the enforcement of airspace change

DfT published a consultation in April 2019 outlining potential new primary legislation to provide DfT/CAA with the power to direct airports/ANSPs to prepare and submit Airspace Change Proposals if they are unwilling or unable to do so. It is possible that in some circumstances the legislation could be deployed to solve conflicts though this will depend on the nature of the conflict.

ACOG will determine how critical each airport is to the overall FASI South programme. Where an airspace change proposal is not deemed to be critical, then that airport could be excluded from the programme.

The introduction of legislative powers could provide a suitable 'Plan B' for the delivery of the FASI South programme where the Secretary of State could make directions. The consultation on the proposed legislation is ongoing.

[8] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/653978/air-navigation-guidance-2017.pdf

13. ACOG Setup, Terms of Reference and Governance

Chapter Summary:

This chapter outlines the current staffing model, terms of reference and governance of the Airspace Change Organising Group (ACOG) and progress along its mobilisation plans.

The Airspace Change Organising Group (ACOG) has been established as an independent body within NATS to provide co-ordination between stakeholders and facilitate the progress of airspace modernisation. The current staffing structure of ACOG is shown in Figure 13. Several individuals are in post full time and others will continue to transition into their roles in the coming period while interim support and leadership is being provided by NATS. The Head of ACOG has been identified and once in post will determine what other skills and capabilities are required to ensure the effective delivery of ACOG's objectives.

ACOG has taken over the running of the FASI South Project Managers and Technical working groups. ACOG will determine the future meeting structures to ensure that the FASI South Programme Board and ACOG Steering Committee meetings are aligned.

The ACOG Steering Committee has been formed and the terms of reference for this group were agreed at the first meeting, held on 9th April. The ACOG Steering Committee includes representatives from NATS, airlines, airports and also includes two independent members. They will provide constructive challenge, strategic guidance and specialist advice to ensure that ACOG objectives and deliverables are clear, understood and delivered on time and to the required standard.

External support will be provided to support the development of an ACOG Operating Strategy. This will be shared with the Head of ACOG and the ACOG Steering Committee as soon as practicable.

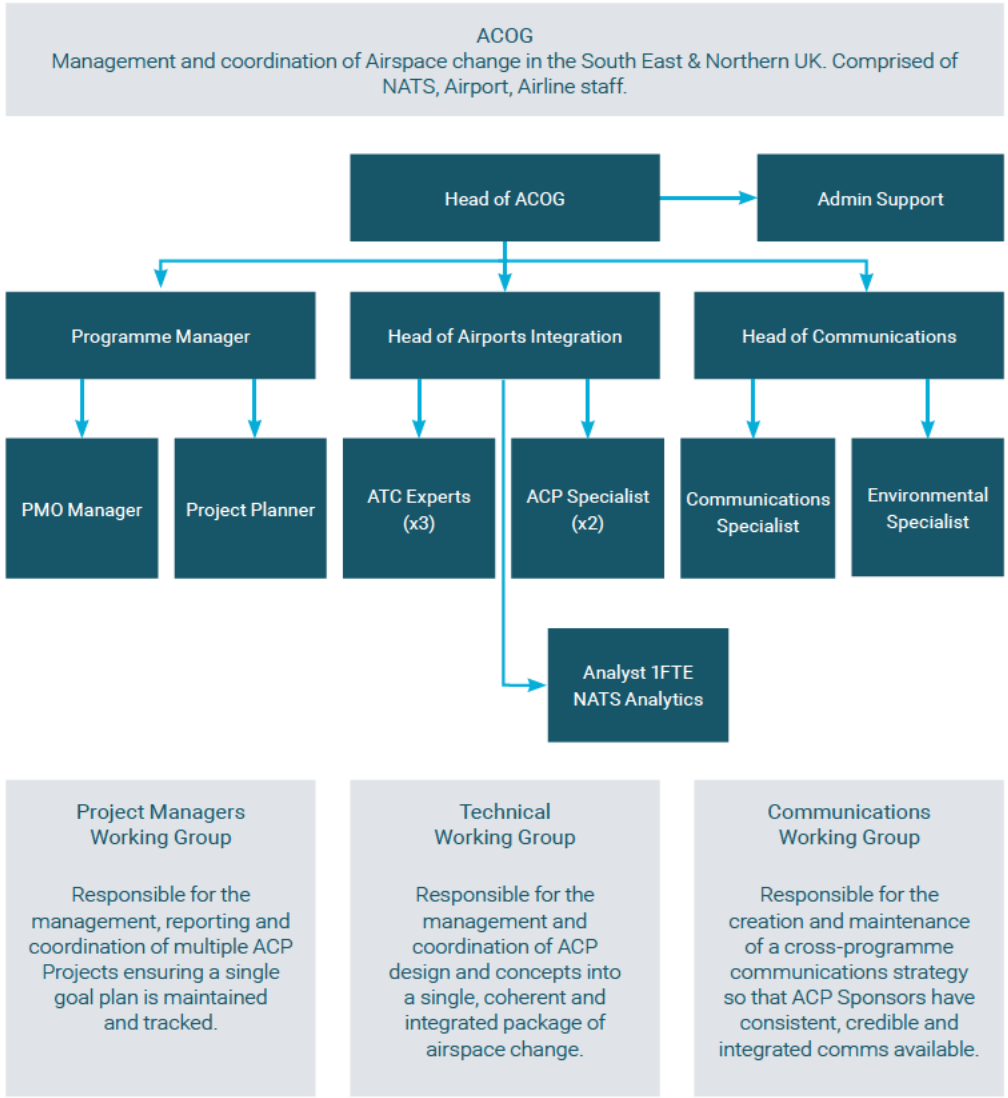


Figure 13: current ACOG organisational structure.


NATS

14. Risks

Chapter Summary:

This chapter outlines the broad risk categories that NATS and ACOG have identified and details the mitigation and escalation procedures that will be in place to ensure the delivery of the FASI South programme plan.

FASI South, LAMP and ACOG have or will have extensive risk registers. These will detail critical risks and mitigations as well as clearly identifying the likelihood and impact of these risks. Currently risks fall into these broad areas:

- Governance
- Coordination and synchronisation of change development across multiple ACPs
- Coordination and synchronisation of implementation of multiple ACPs
- Engaging stakeholders that do not normally engage or are aware they can engage
- Application of CAP1616 to an integrated, large programme of change
- Dependency on NATS' technical change

NATS and ACOG will use industry standard risk management techniques, with top risks being RAG rated and tracked by individual programme teams. An overview of the risks will subsequently be provided and reported at the ACOG Steering Committee and ultimately to the DMO.

ACOG will take primary responsibility for mitigating risks relating to the management and coordination of the programme.

Appendix A: Glossary of Terms

Term	Abbreviation	Description
Airspace Change Organising Group	ACOG	In accordance with the CAA/DfT Commissioning Letter to NATS of 25th September 2018, ACOG has been established to create and maintain a single delivery plan that includes programmes known as FASI South and North and then coordinate delivery as one programme. ACOG will manage two airspace change initiatives (FASI North and South) in the UK Airspace Modernisation Strategy.[9]
Airspace Change Proposal Sponsors	ACP sponsor	Changes to the design of UK airspace are proposed by an airspace change sponsor, usually an airport or a provider or air navigation services (including air traffic control). The CAA requires the change sponsor of any permanent change to the published airspace design to follow the CCA's airspace change process.[10]
Airspace Modernisation Strategy	AMS	The Civil Aviation Authority has been directed to prepare and maintain a coordinated strategy and plan for the use of UK airspace for air navigation up to 2040, including for the modernisation of the use of such airspace. The Airspace Modernisation Strategy addresses upper and lower airspace in the controlled and uncontrolled environments and forms part of the Governments' new arrangements to take forward the delivery of the airspace modernisation programme.[11]
Air Traffic Control	ATC	Air Traffic Control is a service provided by ground based air traffic controllers who direct aircraft on the ground and through controlled airspace, and can provide advisory services to aircraft in non-controlled airspace.[12]
Air Navigation Service Providers	ANSPs	An Air Navigation Service Provider is a public or private legal entity providing Air Navigation Services such as NATS in the UK. It manages air traffic on behalf of a company, region or country.[13]
Civil Aviation Authority	CAA	The Civil Aviation Authority is the statutory corporation which overseas and regulates all aspects of civil aviation in the UK. Key responsibilities include but are not limited to supervising the issuing of pilots' licences, managing the regulation of security standards and overseeing the national protection scheme for customers abroad in the event of a travel company failure.[14]

[9] ACOG Initial Mobilisation Plan 101218
[10] https://www.caa.co.uk/Commercial-industry/Airspace/Airspace-change/Airspace-Change/
[11] https://consu tations.caa.co.uk/policy-development/draft-airspace-modernisation-strategy/supporting_documents/CAP1690%20FINAL%20Draft%20Airspace%20Modernisation%201807182.pdf
[12] https://en.wikipedia.org/wiki/Air_traffic_control
[13] https://en.wikipedia.org/wiki/Air_navigation_service_provider
[14] https://en.wikipedia.org/wiki/Civil_Aviation_Authority_(United_Kingdom)

Extended Arrival Management	XMAN	The Extended Arrival Management concept allows air traffic controllers to meter traffic into a busy Terminal Manoeuvring Area (TMA) from far out in the en-route airspace. When Extended Arrival Management is implemented, en-route controllers can then inform aircraft pilots to adjust their speed before their Top of Descent, thus reducing the amount of time the aircraft spends in the TMA.[15]
EXCDS transition	EXCDS	EXCDS is a new electronic flight strip system which NATS has been introducing in their London Terminal Control Centre. The system manages flights entering and departing London and the South East of the United Kingdom, some of the busiest and most complex airspace in the world. It will replace the existing paper strips system.[16]
Future Airspace Strategy	FAS	The Future Airspace Strategy sets out a vision to modernise UK airspace and use technology to make it fit for the 21st century. It ensures the UK remains connected to Europe and the rest of the world by simplifying and harmonising the way airspace and air traffic control is used through the Single European Sky project.[17]
Future Airspace Strategy Implementation	FASI	Future Airspace Strategy Implementation is the term for the concept of modernising air traffic services (ATS) in the South of the UK. NATS and 18 airports in the South have been working collaboratively for just over two years on the development of the programme.[18]
Free Route Airspace	FRA	Free Route Airspace (FRA) is a specified airspace within which users can freely plan a route between a defined entry point and a defined exit point, with the possibility of routeing via intermediate (published or unpublished) waypoints, without reference to the air traffic services (ATS) route network, subject of course to availability. Within such airspace, flights remain subject to air traffic control.
General Aviation	GA	Essentially all civil flying other than commercial airline operations, which therefore encompasses a wide range of aviation activity from drones, powered parachutes, gliding and ballooning to corporate business jets, and includes all sport and recreational flying.
London Airspace Modernisation Project	LAMP	The objective of LAMP is to deliver long-term changes to the airspace above the Southern United Kingdom by seeking to redesign the routes that aircraft follow from departing the airfield to the exit from UK airspace, and from entry into UK airspace to aircraft touchdown. The proposed enhancements will enable all airfields to release aircraft into the network independently, without reference to another.

[15] https://www.harris-orthogon.com/solution/extended-arrival-management-e-aman/
[16] https://www.nats.aero/excds/
[17] https://futureairspace.aero/
[18] https://www.eurocontrol.int/articles/free-route-airspace

Ministry of Defence	MoD	The Ministry of Defence is the UK government department responsible for implementing the defence policy set by Her Majesty's Government and is the Headquarters of the British Armed Forces. The Ministry of Defence states that its principle objectives are to defend the UK and its interests, to strengthen international peace and stability.[19]
National Air Traffic Services	NATS	The biggest air navigation service provider in the UK, formerly National Air Traffic Services. Parent company of NERL (NATS En Route plc) and NSL (NATS Services Limited).[20]
NATS En Route Plc	NERL	NATS (En Route) plc provides air traffic control (ATC) services for aircraft flying in airspace over the United Kingdom and the eastern part of the North Atlantic. The company operates in Airspace and Other Service Lines segments. It also provides communication, navigation, and surveillance infrastructure and facility services; air traffic services for helicopters operating in the North Sea; approach services for London airports; and infrastructure services to the Ministry of Defence (MoD) for their en-route operations and European projects.[21]
Performance Based Navigation	PBN	Performance-based Navigation (PBN) flight procedures use global positioning systems and satellite technology for navigating aircraft to and from airports. PBN is a term that encompasses several types of precision navigation methods to optimise airspace navigation and improve operational efficiencies for aircraft.[22]
Reference Period 2	RP2	2015-2019 is the Reference Period 2 as outlined in the CAA Revised Business Plan.[23]
Remotely Piloted Aircraft Systems	RPAS	Remotely Piloted Aircraft Systems (RPAS) - commonly known as drones - have demonstrated their importance in recent military operations, particularly for surveillance and information gathering. RPAS can also offer a wide range of civil applications such as infrastructure surveillance, firefighting, disaster or environmental monitoring, as well as border control and management.[24]
Terminal Manoeuvring Area	TMA	A designated area of controlled airspace surrounding a major airport where there is a high volume of traffic.

[19] https://en.wikipedia.org/wiki/Ministry_of_Defence_(United_Kingdom)
[20] www.nats.co.uk
[21] https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=22533465
[22] https://www.macnoise.com/faq/what-performance-based-navigation-pbnrnav
[23] https://www.caa.co.uk/WorkArea/DownloadAsset.aspx?id=4294974198
[24] https://www.eda.europa.eu/what-we-do/activ ties/activ ties-search/remotely-piloted-aircraft-systems---rpas

Appendix B: FASI South Commission

[redacted]
NATS (En Route) PLC
4000 Parkway
Whiteley
Fareham
Hants
PO15 7FL

02 November

UK Airspace Modernisation: commission to NERL lead a programme to create a coordinated implementation plan for airspace changes in Southern England.

1. As co-sponsor organisations of airspace modernisation in the UK, we are writing to NATS (En Route) PLC – NERL – to commission and set out our expectations of the work of the Airspace Modernisation Oversight Group (AMOG) in relation to FASI South.

Context:

2. The Government published in 2017 a Strategic Rationale for Upgrading UK airspace, setting out the rationale for a wholesale redesign of the UK's airspace to meet future demands on this finite piece of infrastructure. Delivering this outcome will be one of the key components of the CAA's Airspace Modernisation Strategy (AMS) for the UK. This strategy pulls together the relevant government policies that airspace modernisation must deliver, and how they should be delivered, including setting out the need for relevant industry bodies to have clear deployment plans in place.

3. As set out in CAA's letter to NERL of 25th September 2018, we think NERL is best placed to be responsible for drawing together a UK-wide coordinated implementation plan for airspace changes (or airspace change masterplan) between the start of RP3 and 2040. In developing this plan, NERL shall engage effectively with relevant organisations, such as the airports using the airspace in question and will be the sponsors of airspace change. In addition to developing this masterplan, we expect NERL to sponsor a number of individual airspace design changes set out in the plan. The CAA proposes to enshrine this new strategic airspace role for NERL, in its economic licence.

4. As part of this role, we expect NERL at the earliest possible opportunity to create an Airspace Modernisation Oversight Group (AMOG) that will, as a matter of urgency, lead the FASI South Programme to create a single coordinated implementation plan for airspace changes in Southern England (a south east airspace change masterplan, or masterplan for short).

5. The FASI-S masterplan is required for the following reasons:

- To create a single plan that aligns the airspace delivery aspirations of NERL and the 14 airports within the FASI-S programme and to give the DfT and CAA, as co-sponsors of airspace modernisation, confidence that a credible and implementable plan exists and that the sponsors understand what is required of them to deliver this change.
- To enable CAA to understand how individual airspace change proposals relate to each other and therefore take better informed decisions.
- To inform the use of potential new legislative powers to compel airspace change to happen, where required. Our assumption is that being included in the masterplan would be one of the triggers for the use of these powers.
- To identify opportunities to improve airspace design that will deliver a wider set of benefits, not just to increase capacity.

Commission:

6. Within the context described above and noting that the programme will have a number of stages of development, we require that the AMOG, under NERL's leadership and programme management, prepares a south east masterplan that meets the following criteria:

a) Identifies where airspace changes could be developed in Southern England in light of:

- Forecast growth in demand for aviation across all sectors and the required airspace capacity to accommodate that growth;
- airspace bottlenecks where delays to consumers could be alleviated by capacity;
- areas where planned development on the ground such as new runways will require new airspace designs;
- areas where more direct routes are possible that could, for example, reduce controlled airspace.

b) Identifies other changes that may be required deliver one or more of the following benefits:

- where airspace changes are needed to deliver a safety benefit, for example, changes that ensure route separation.
- where airspace changes can reduce noise (more specifically, reduce the total adverse effects of noise, as set out in the Air Navigation Guidance 2017).
- where airspace changes can deliver air quality or fuel efficiency benefits.
- where airspace changes are needed to allow improved access to airspace for all users, for example where the existence of controlled airspace is no longer justified.
- where airspace changes are needed to enable the military to fulfil their training requirements and national security functions.
- where airspace changes are needed to introduce new technology, for example the introduction of performance-based navigation.

c) Identifies:

- the operational concepts required to deliver these changes and their level of maturity.
- the set of assumptions on which the proposed changes are based and are dependent.
- the key risks associated with delivering the plan and how they could be mitigated.
- the recommended coherent sequence of individual or modules of changes against the evaluated alternatives.
- the preferred timescale for their adherence against each step of the CAA's CAP1616 process and subsequent implementation.
- the party responsible for taking each individual airspace change forward.
- the interdependencies between individual changes.
- the degree of commitment offered by each individual party.

7. We would also like to know the minimum number of changes that are necessary to ensure that major airspace projects (e.g. to accommodate new runway capacity) are viable.

8. We recognise that some of the work to create the FASI-S masterplan is already underway, for example through the NERL Feasibility Assessment, the LTMA Working Group and work by individual airports on potential airspace changes. We would expect the further work on each of these projects to be reflected in the output of this commission.

9. In establishing the AMOG, we require to NERL to provide to the DfT and the CAA by end November its formal proposals that address the following:

- how they will ensure that the AMOG working group contains the necessary skills and capabilities drawn from a blend of its own, qualified third party and airport resources;
- the governance arrangements that will give all stakeholders confidence of equal access to this process;
- how they will assure the independence of their role in this process (e.g. via non-executive membership on the governance group), and how NSL's commercial relationship with some stakeholders would not confer any additional status or influence to any particular stakeholder in the process.

10. We expect NERL to deliver a fully developed FASI-S masterplan by the end of June 2019. We expect NERL to report monthly to the AMS Delivery Monitoring and Oversight (DMO) team (currently being set up in the CAA) on the progress with the development of the masterplan and its subsequent implementation. The format of this reporting will be agreed separately.

11. Recognising the need to build and maintain momentum on this essential programme, we expect NERL to work with airspace users – as the key beneficiaries of airspace modernisation – to put in place the necessary arrangements to begin this work now. We understand NERL is already engaging with airspace users to agree financial support through the FAS Facilitation Fund and would urge NERL and airspace users to conclude this discussion as a matter of priority. We have also written to the FAS Investment Board to set out our support for the use of the FAS Facilitation Fund for this purpose, subject to the conditions set out in paragraph 9. Continuing the principle that the key beneficiaries pay, we understand NERL intends to include provision for efficiently incurred costs of the AMOG programme management function over 2020 to 2024, in its RP3 Business Plan.

12. As noted at the start of this letter, the Airspace Modernisation Strategy requires a concerted industry effort to deliver airspace modernisation. This letter commissions work necessary to deliver one of the initiatives in the Airspace Modernisation Strategy. Further commissions will be prepared in due course, including a commission for further work from NERL to build on their Feasibility Assessment and the new airspace design concept they set out in that report, which will inform the airspace changes in the FASI-S programme.

Tim Johnson
CAA Director of Policy

Sarah Bishop
DfT Deputy Director

Notes

We want to hear from you

Customer and stakeholder perspectives – including those from the general public – are very important to us. We aim to be responsive to your views in the services we provide. Please do get in touch as we welcome feedback.

www.nats.aero