

Airspace Change:

Environmental requirements technical annex

CAP 1616a



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Introduction

- 1.1 Section 70(2)(d) of the Transport Act 2000 states that the CAA must “take account of any guidance on environmental objectives given to the CAA by the Secretary of State after the coming into force of this section” when exercising its air navigation functions, which includes making decisions on airspace change proposals and PPR (planned and permanent redistribution of air traffic) proposals. The guidance from the Secretary of State on environmental objectives is the Air Navigation Guidance 2017.¹ In order to achieve this, the CAA requires sponsors to provide an environmental assessment. Every airspace change will be different and the extent of environmental assessment will vary from case to case. It is the function of this document to assist those preparing airspace change proposals in providing sufficient environmental information for both consultation and to inform the decision-making process.
- 1.2 This document, to be read alongside the CAA’s guidance on the regulatory process for airspace change², gives an outline of relevant methodologies for use in environmental assessment. It is not a complete instruction manual on all aspects of the topic. Readers should seek expert assistance where relevant.
- 1.3 Environmental science is continually evolving and this document describes assessment methods applicable at the date of publication. New methodologies based on sound principles may well be developed. This document will therefore be subject to review and updating in order to ensure that it reflects ‘best practice’.

Airspace design

- 1.4 The environmental assessment must include a high-quality diagram of the airspace change in its entirety as well as supplementary diagrams illustrating different parts of the change, as necessary. These diagrams must show the extent of the airspace change in relation to known geographical features and centres of population.

¹ 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. <https://www.gov.uk/government/publications/uk-air-navigation-guidance-2017>

² CAP 1616 Airspace change: Guidance on the regulatory process for changing the notified airspace design and planned and permanent redistribution of air traffic, and on providing airspace information (third edition, January 2020). www.caa.co.uk/cap1616

- 1.5 Change sponsors must provide the CAA with a complete set of coordinates describing the proposed change in electronic format using World Geodetic System 1984 (WGS 84). In addition, the change sponsor must supply these locations in the form of Ordnance Survey national grid coordinates. This will give non-aviation stakeholders an accurate geographical description of the proposed arrangements. This electronic version must provide a full description of the horizontal and vertical extent of the zones and areas contained within the airspace change. It must also include coordinates in both WGS 84 and Ordnance Survey national grid formats that define the centre lines of routes including airways, standard instrument departures (SID), standard arrival routes (STAR), noise preferential routes (NPR) or any other arrangement that has the effect of positioning traffic over a particular geographical area. Coordinates for current airspace and airport arrangements can be found in the UK Integrated Aeronautical Information Package (UK IAIP).³ Details of WGS 84 latitude/longitude and the Ordnance Survey national grid coordinate system can be found on the Ordnance Survey website – this contains software that will facilitate conversion between latitude/longitude and Ordnance Survey national grid.
- 1.6 Change sponsors should provide indications of the likely lateral dispersion of traffic about the centre line of each route. This should take the form of a statistical measure of variation such as the standard deviation of lateral distance from the centre line for given distances along track in circumstances where the dispersion is variable. Change sponsors may supply the outputs from simulation or trials to demonstrate the lateral dispersion of traffic within the proposed airspace change or bring forward evidence based on actual performance on a similar kind of route. Change sponsors must explain different aspects of dispersion, for example, dispersion when following a departure routeing and when vectoring – where the aircraft will go and their likely frequency.
- 1.7 Change sponsors must provide a description of the vertical distribution of traffic in airways, SIDs, STARs, NPRs and other arrangements that have the effect of positioning traffic over a particular geographical area. For departing traffic, change sponsors should produce profiles of the most frequent type(s) of aircraft operating within the airspace. They should show vertical profiles for the maximum, typical and minimum climb rates achievable by those aircraft. A vertical profile for the slowest climbing aircraft likely to use the airspace should also be produced. All profiles should be shown graphically and the underlying data provided in a spreadsheet with all planning assumptions clearly documented.

³ <http://www.nats-uk.ead-it.com/public/index.php.html>

Traffic forecasts

- 1.8 The amount of air traffic is an important consideration in the assessment of airspace changes and their environmental impact. Change sponsors will have made an assessment of traffic forecasts before reaching the conclusion that an airspace change should be considered. Forecasting is not an exact science and no one pretends that the future will turn out exactly as predicted. There are many factors outside the control of the change sponsor and it would not be reasonable to hold the change sponsor to account for deviating from forecasts unless traffic levels breach binding constraints (for example, planning agreements, environmental legislation or limits imposed by Government policy). Nonetheless, forecasts are essential to the airspace change process, not only providing justification for changes, but also enabling the impact of changes to be properly considered. In planning changes to airspace arrangements, change sponsors may have conducted real and/or fast time simulations of air traffic for a number of options. Such simulations will help to establish whether options will provide the required airspace capacity.
- 1.9 Change sponsors must include traffic forecasts in their environmental assessment. Information on air traffic must include the current level of traffic using the present airspace arrangement and a forecast. The forecast will need to indicate the traffic growth on the different routes contained within the airspace change volume. The sources used for the forecast must be documented.
- 1.10 Forecasts must be for at least 10 years from the planned implementation date of the airspace change. There may be good reasons for varying this – for example, to use data that has already been made available to the general public at planning inquiries, in airport master plans or other business plans. It may also be necessary to provide forecasts further into the future than 10 years; for example, extensive airspace changes.
- 1.11 There are considerable uncertainties in forecasting growth in air traffic. Traffic forecasts will be affected by consumer demand, industry confidence and a range of social, technological and environmental considerations. It may be appropriate for change sponsors to outline the key factors and their likely impact. In these circumstances, change sponsors should consider generating a range of forecasts based on several scenarios that reflect those uncertainties (for example, low, central and high cases). For some change proposals it may be necessary for traffic forecasts to contain not only numbers but also types of aircraft, particularly if the mix of aircraft types is expected to change over the period of the forecasts. Where such a change in fleet mix is anticipated,

the sponsor must ensure that it is considered and if necessary reflected in the traffic forecasts.

Noise: standard metrics

L_{Aeq} contours

- 1.12 The most commonly used method of portraying aircraft noise impact in the UK is the L_{Aeq} noise exposure contour. Noise exposure contours show a set of closed lines on a map. Each contour shows places where people get the same amounts of noise from aircraft, measured as L_{Aeq}. L_{Aeq} is measured in a unit called dB which stands for 'decibel'. The 'A' subscript means A-weighted (which matches the frequency response of the human ear) and the 'eq' subscript is an abbreviation of the word equivalent, i.e. L_{Aeq} is the equivalent continuous sound level. They are analogous to the contours on an ordinary map showing places at the same height. Noise exposure is generally used to indicate the noise environment averaged over a time interval. Research indicates that L_{Aeq} is a good predictor of a community's disturbance from aircraft noise.
- 1.13 Conventional noise exposure contours, which are produced regularly for major airports, are calculated for an average summer day over the period from 16 June to 15 September inclusive, for traffic in the busiest 16 hours of the day, between 0700 and 2300 local time. These are known as L_{Aeq, 16 hours} contours. This calculation produces a cautious estimate of (i.e. tends to over-estimate) noise exposure. This is mainly because airports are generally busier during the summer and a higher number of movements is likely to produce higher L_{Aeq} values. Aircraft tend to climb less well in higher temperatures so, because they are closer to the ground, L_{Aeq} values will tend to be higher than in colder weather.
- 1.14 Where changes to airspace are proposed during nighttime, aircraft noise must be calculated for an average summer night over the period from 16 June to 15 September inclusive, for traffic in the busiest 8 hours of the night, between 2300 and 0700 local time. These are known as L_{Aeq, 8 hours} contours.
- 1.15 Runway usage can vary considerably from year to year due to variations in wind direction. It is therefore recommended that average summer day contours be produced using long-term average runway usage. Where sufficient data is available this should be based on the last 20 years' runway usage. If less than 20 years' data is available, it should be based on available data.

- 1.16 L_{Aeq} contours are the source of input data for assessing noise impacts using the Department for Transport's WebTAG and therefore even if sponsors do not portray L_{Aeq} contours as a means of explaining noise impacts to local communities, the outputs from noise modelling undertaken to generate L_{Aeq} contours will still be required. Guidance on WebTAG is provided by the Department for Transport.⁴
- 1.17 Change sponsors should portray $L_{Aeq, 16 \text{ hours}}$ noise exposure contours as a means of explaining noise impacts for airports where the proposed option is likely to result in a change in traffic patterns or traffic volumes or fleet mix below 4,000 feet, or else provide a rationale why the proposed change will not result in a change to L_{Aeq} contours. That rationale must be approved by the CAA. If L_{Aeq} contours are produced, at least four sets of contours should be produced:
- current situation (baseline) – these may already be available as part of the airport's regular environmental reporting or as part of the airport master plan
 - situation immediately following the airspace change; this may be achieved by reproducing the current situation contours (i.e. using the same traffic volumes and fleet mix, but revising for any changes to routes and/or traffic patterns that will arise as a result of implementing the proposed change)
 - situation after traffic has increased but assuming the proposed change had not been implemented (10 years after intended implementation)
 - situation after traffic has increased under the new arrangements (10 years after intended implementation).
- 1.18 The height of 4,000 feet was selected as the criterion for L_{Aeq} contours because aircraft operating above this altitude are unlikely to affect the size or shape of L_{Aeq} contours, and are therefore also unlikely to result in changes to significant adverse effects as determined by WebTAG. However, for the largest airports, the population noise exposure information required for input to WebTAG may extend to areas where aircraft are above 4,000 feet.
- 1.19 The contours must be produced using a recognised and validated noise model such as the UK Aircraft Noise Contour Model (ANCON) or the US Aviation Environmental Design Tool (AEDT). For consistency and comparison purposes, if a noise model is already in use at an airport, the same model should be used for the assessment of any airspace change proposal related to that airport.

⁴ Annex C of the Secretary of State's Air Navigation Guidance 2017.

- 1.20 Terrain adjustments must be included in the calculation process (i.e. the height of the aircraft relative to the ground is accounted for). These corrections are limited to geometrical corrections for aircraft-receiver distances and elevation angles. It is not necessary to include consideration of other more complex effects, such as absorption of sound over uneven ground surfaces or noise screening or reflections from topographical features or buildings.
- 1.21 Contours should be portrayed from 51 dB $L_{Aeq, 16 \text{ hours}}$ (for daytime) and 45 dB $L_{Aeq, 8 \text{ hours}}$ (for nighttime) at 3 dB intervals. Department for Transport policy is that these values represent the Lowest Observed Adverse Effect (LOAEL), the point at which it regards adverse effects begin to be seen on a community basis.⁵ In order to explain noise impacts, a table should be produced showing the following data for each 3 dB contour interval:
- area (km²)
 - population (thousands) – rounded to the nearest hundred.
- 1.22 It is sometimes useful to include the number of households within each contour, especially if issues of mitigation and compensation are relevant.
- 1.23 Note:
- this table should show cumulative totals for areas/populations/households; for example, the population for 51 dB L_{Aeq} will include residents living in all higher contours
 - the source and date of population data used must be noted; population data should be based on the latest available national census as a minimum, but more recent updated population data is preferred
 - the areas calculated should be cumulative and specify total area within each contour, including that within the airport perimeter
 - where change sponsors wish to exclude parts of the area within contours – for example, excluding the portion of a contour falling over sea – this may be shown additionally and separately from the main table of data
 - change sponsors should include a count of the number of schools, hospitals and other special buildings within the noise exposure contours.
- 1.24 Contours for assessment should be provided to the CAA in both of the following formats:
- electronic files in the form of a comma-delimited ASCII text file containing three fields as an ordered set (i.e. coordinates should be

⁵ Paragraph 3.5 of the Secretary of State's Air Navigation Guidance 2017.

in the order that describes the closed curve) defining the contours in Ordnance Survey national grid in metres:

Field	Field name	Units
1	Level	dB
2	Easting	six figure easting OS national grid reference (metres)
3	Northing	six figure northing OS national grid reference (metres)

- paper version overlaid on a good quality 1:50 000 Ordnance Survey map; however, it may be more appropriate to present contours on 1:25 000 or 1:10 000 Ordnance Survey maps.

1.25 Ordnance Survey national grid coordinates are required because they are the common standard for noise exposure contours and population/household databases in the UK. Change sponsors should ensure that they are familiar with conversion from latitude and longitude to Ordnance Survey national grid coordinates.

1.26 An additional portrayal of contours for a general audience may be provided overlaid on a more convenient map (for example, an ordinary road map with a more suitable scale for publication in documents). The underlying map and contours must be sufficiently clear for an affected resident to be able to identify the extent of the contours in relation to their home and other geographical features. As such, the underlying map must show key geographical features, for example, streets, railway lines and rivers.

100% mode noise contours

1.27 Average summer day contours reflect the direction of usage of an airport's runway(s) during the summer period. For safety reasons aircraft take-off and land into wind, and therefore the runway direction in use will change depending on wind direction. While summer average day noise contours reflect noise exposure for an average summer day, because they represent an average of the two runway directions available, they do not represent the noise associated with a single runway direction. 100% mode noise contours address this by depicting the summer average day flight operations for a single operating mode. Since a runway can be used in one of two directions, there will be two 100% mode noise contours, one for each runway direction. Taking the example of London Stansted, whose runway is orientated north-east (runway 04) and south-west (runway 22), the long-term average summer day runway use is 72% runway 04 and 28% runway 22. 100% mode contours would depict 100% of the average summer day operations on runway 04 and 22 respectively.