| | |
|---|---|
| **From:** | Jason Jones-Hall |
| **To:** | Manston Airport; Manston Airport |
| **Cc:** | [redacted] |
| **Subject:** | DL5 Submission (Part Four) - Extraordinary Request of the ExA and Comments on Info Provided to DL4 |
| **Date:** | 29 March 2019 20:00:50 |
| **Attachments:** | ISHR_X_Five10Twelve_Submitted.pdf |

Dear Sirs

Please find attached Extraordinary Request and comments on further information provided by Applicant to Deadline 4, submitted on behalf of Five10Twelve Ltd by its Directors, Samara and Jason Jones-Hall, with regards to the DCO Application for Manston Airport.

This document outlines and evidences what we believe to be severe failures on behalf of the Applicant to provide credible evidence that is fundamental to its case, coupled with significant concerns regarding the Applicant's representations made during the Issue Specific Hearings from 20-22nd March 2019.

As a result, it is our position that continuing further with the Examination - with the extraordinary public cost and drain on public resources that this entails - cannot be in the public interest. Given the evidence presented in the attached document, we do not believe it is now possible - nor will it be possible - for the ExA to give the Secretary of State any confidence whatsoever about the manner in which any alleged benefits of the Applicant's proposal might be secured or any confidence that the Applicant is capable of delivering them.

We further believe our request to bring the Examination to a close is in the interests of an extraordinary number of more than 1,000 Interested Parties strongly opposed to the development, (as expressed through Relevant Representation), including 93% of Residents' Associations and 75% of local Community Groups.

Since it is our understanding that any decision to bring the Examination to a close before the statutory period may only be made by the Secretary of State, this request has also been made directly to the Rt Hon Chris Grayling MP.

Kind regards
Jason
--
Jason Jones-Hall
Director
Five10Twelve

Tel: [redacted]
LinkedIn: https://uk.linkedin.com/in/thejasonhall
Twitter: http://twitter.com/Five10Twelve

**MANSTON AIRPORT DEVELOPMENT ORDER EXAMINATION**

**EXTRAORDINARY REQUEST**
**AND COMMENTS ON FURTHER INFORMATION PROVIDED BY APPLICANT TO DL4**
**FROM LOCAL BUSINESS AND INTERESTED PARTY, FIVE10TWELVE LTD**

## 1. Request for Guidance/Comment from the Examining Authority

In light of a number of significant and fundamental issues and deficiencies exposed during the Open Floor and Issue Specific Hearings of 19-22nd March 2019, in addition to updates not provided as expected at DL4 and concerns with those responses that were provided by the Applicant[1], we are seeking comment from the ExA as to **whether or not the Examination can reasonably continue.**

**1.1.** In the event that the Examination should continue, we seek further comment or guidance as to what measures may be put in place to reassure the majority of the public, relevant Local Authorities and other Interested Parties that the timelines for the Examination will be sufficient to allow for consultation and comment on this growing list of issues and the ever-moveable feast presented by the Applicant's constantly shifting positions and revisions.

## 2. Conflict with National Policy Statement and 25 years of policy

As stated and evidenced in our submissions at Deadline 1[2], Deadline 4[3], and our Written summary of Oral Representation at the Open Floor Hearing of 18/3/19, submitted at Deadline 5, this DCO Application runs counter to more than 25 years of prior Government policy, reports, recommendations and decisions regarding Manston's lack of viability on the basis of its poor geography. This includes the Airports National Policy Statement and the Airports Commission report of 2013, which found Manston was not viable in the long term as ***"does not address the larger question of London & South East capacity"*** and not worthy of further

[1] **REP4-001** to **REP4-034** inclusive
[2] **REP1-044** Jason Jones-Hall, Written summary of oral submission, (deadline 1), page 22, paragraph 2
[3] **REP4-055** Five10Twelve, comments on responses to ExA WQ's

consideration for the short-to-medium term due to restrictions with supporting road and rail infrastructure[4].

## 3. Public Cost

Concerns regarding the procedural challenges and constraints caused by the Applicant's deficiencies, we would like to **put on record our concerns** with regards to the continued burden on the public generally and on public bodies/resources.

3.1. It is our understanding that whilst the costs of Examination are paid by the Applicant and its own costs covered, any other costs to any other parties are to be borne by those parties. It is our understanding that this includes our own costs, costs of other members of the public and/or campaign groups and other **costs to the public** including but not limited to resourcing and any legal and/or consultancy costs of involvement borne by Local Authorities, (Thanet District Council, Kent County Council, Canterbury City Council, Dover District Council), and statutory bodies, (e.g. Highways England, Historic England, Natural England, Public Health England, MoD/DIO, CAA etc.).

3.2. Additional **public cost - both financial and societal** - of this Application may also be considered in terms of the well-documented delays and concerns[5] with regards to the Thanet District Council Local Plan and **re-allocation of 2,500 houses from the brownfield Manston site**, as originally proposed in the Preferred Option Local Plan of 2017, to **greenfield land without appropriate infrastructure** in the current revised draft as a direct result of this DCO Application.

3.3. The hidden **opportunity cost to the town of Ramsgate** has also been touched upon by numerous Relevant Representations and oral submissions, notably that of **Ramsgate Town Council**[6], particularly with regards to

[4] **Appendix ISHR-001** Notes on Airports Commission Interim Report and Appendix 1
[5] **REP2-012** DL2 submission, Five10Twelve Ltd, Comments on Deadline 1 submissions
[6] **REP1-035** Ramsgate Town Council, DL1 submission. Written summary of oral submission put at Examination events in January 2019.

investor confidence relating to inward investment and other development opportunities - particularly around the port and marina - being impacted whilst there is still a threat that the cargo hub DCO may be approved.

4. **Funds and Resources**

During the Issue Specific Hearings (ISH) of 20 March 2019, (CPO), the ExA firmly reiterated concerns that the **Applicant's failure to provide an updated and appropriately detailed Funding Statement** presents a risk to the Examination.

4.1. To summarise, it is our understanding that as of 20 March 2019, the Applicant could provide **no credible evidence of funds** or any reasonable confirmation that there was a realistic prospect of being able to secure the necessary investment to finance the CPO, blight claims and to implement the project.

4.2. Further, significant concerns previously raised with regards to the company structure of the Applicant, source of funds and background of its founding Director, in particular, were also not addressed in any way. In fact, yet more concerns were raised under questioning with regards to *"a series of loan notes"* between parent/child companies which underpin the financing of the DCO Application to date and a **disturbing lack of transparency** with regards to payments channelled through alleged trust accounts, investor's accounts and/or solicitor's accounts.

4.3. In the event that any as-yet-undisclosed details of Applicant's and funders accounts are forthcoming, these transactions and the manner in which they were undertaken may **require further investigation under the Anti-Money Laundering Act 2018** in addition to any investigations specific to the DCO Examination that may be required by the ExA. We await the audio record of this ISH.

## 5. Need and Operations

During our Open Floor Hearing oral representation of 18th March 2019[7], we raised concerns that the **lack of experience and understanding of the Applicant** and its approach to the DCO Application and Examination process also presents a risk and/or impediment to the Examination.

5.1. The ISH of 20-22nd March 2019 only served to increase these concerns. In fact, it is our view that **no comfort could be derived on any front** from any aspect of the Applicant's case and - in key areas - it appears to have completely collapsed.

5.2. Specifically, during the ISH of 21-22nd March 2019, a number of significant concerns were raised which call into question the underlying information, data and forecasts provided by the Applicant.

5.3. This includes, but is not limited to:

### 5.3.1. Business Model

This should have been provided on application. It was requested by ExA in Written Questions of 18/1/19[8]. A further request by the ExA to provide a credible Business Model was **refused by Applicant** on grounds of *"commercial confidentiality"* during ISH of 20/3/19 and subsequently promised by Applicant during ISH of 21/3/19 for Deadline 5.

### 5.3.2. Azimuth Report

Under questioning by SHP during ISH of 21/3/19, Dr Sally Dixon, author of the Azimuth Report[9] confirmed that *"the entirety of the case on need is based on (Azimuth) Report"* and that ***"there is nothing before the Examining Authority at this time that shows that [Azimuth forecasting] is viable"***.

---

[7] **Appendix ISHR-002** Five10Twelve Written Summary or oral representation at OFH 18/3/19, provided to Deadline 5

[8] **PD-007** Written Questions, ND.1.32 and ND.1.33

[9] **APP-085** Azimuth Report

**5.3.2.1.** Questioning and interrogation of the Azimuth Report during the Need and Operations ISH on 21/3/19 also provided further cause for concern regarding validity and optimism bias of the report, with Dr Dixon confirming she has ***"very limited experience in forecasting"***.

### 5.3.3. Fleet Mix

As a result of underlying issues with the Azimuth Report and lack of clarity regarding Business Model, the Fleet Mix and ATMs by ICAO design, as they appear in the Azimuth Report[10], **cannot be relied upon** since the mix of aircraft types will inevitably be dependent on the business model and business mix. Of particular concern, for example:

- The Code C aircraft type represents the highest percentage of aircraft in the Azimuth Fleet Mix whereas cargo aircraft may more reasonably assumed to be in the heavier aircraft of Codes D and E. This was also confirmed during the ISH of 22/3/19 by Tony Freudmann for the Applicant, who went on record as saying that **QC4 aircraft are more typical of freight operations.** This is consistent with the Independent Transport Commission which states that in relation to air cargo *"aircraft are usually either conversions of older passenger aircraft or the last aircraft from a given aircraft production line… popular aircraft types for [dedicated freighter] airlines continue to include the McDonnell Douglas DC-10 (first flight 1970) and Airbus A-300 (1974)"*[11]

- The ratio of Code C aircraft type increases substantially after Yr7 in the Azimuth forecasts, based on unverified assumptions

[10] **APP-085** Azimuth Report, Vol.III, Page 12, Paragraph 3.1.1 and Page 13, Table 2
[11] **Appendix ISHR-003** The sustainability of UK Aviation, Independent Transport Commission, March 2016, Paragraph 4.23

of fleet upgrades, whereas ***"the rates of technology implementation for dedicated freighter airlines are among the lowest in the industry"***[12]

- It was also confirmed that the Fleet Mix, as set out in the Azimuth Report, **does not reflect the type of operation that was described as the Applicant's primary target market** by Chris Cain of Northpoint Aviation during the ISH of 21/3/19. This point was raised and questioned by York Aviation for Stonehill Park, with the ExA noting during the session of 21/3/19 that the Fleet Mix ***"has changed this morning"***. [13]

## 6. Noise Contours and Impact Reports

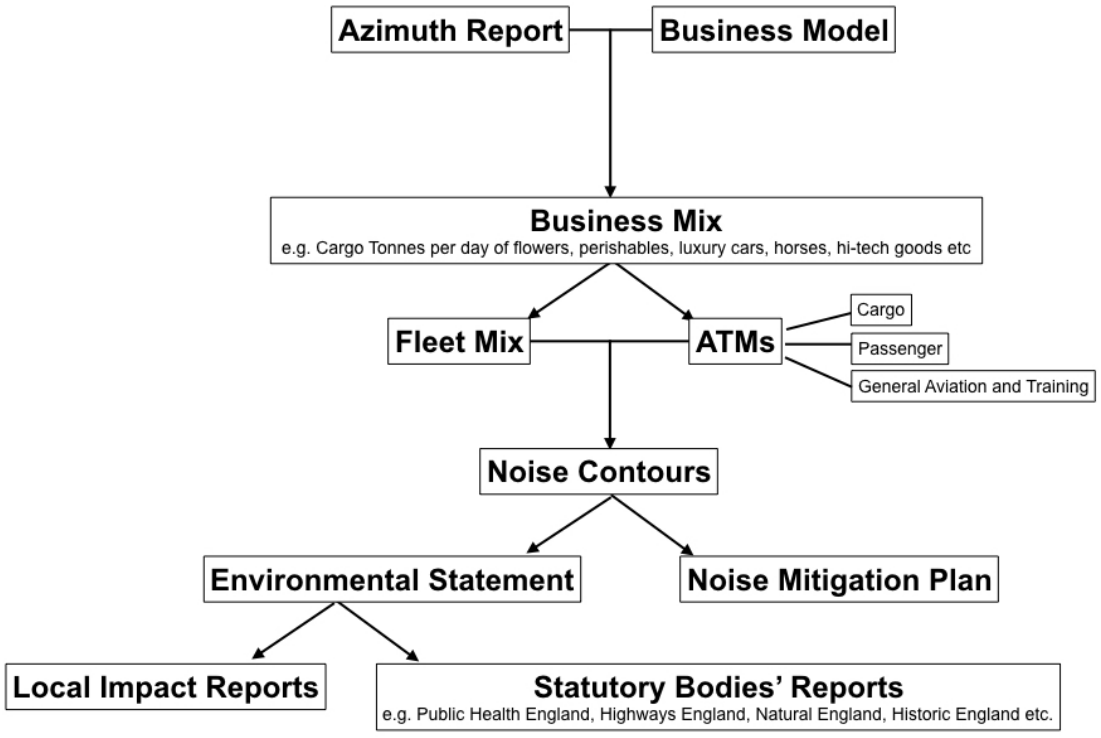
It was confirmed by Nick Hilton of the Wood Group for the Applicant that the Fleet Mix in the Azimuth Report ***"forms the basis of all forecasts used in the Environmental Statement".***[14] As such, the importance and relevance of the lack of clarity with regards to Business Model, **lack of credibility of forecasts** within the Azimuth Report and corresponding lack of certainty regarding the Fleet Mix cannot be overstated.

6.1. Since the ISH of 20-22nd March 2019, we have spoken with specialist aviation noise consultants, Bickerdike Allen, who confirmed to us that accurate Fleet Mix and ATM forecasts are the **essential components** in producing accurate noise contour maps.

6.2. To summarise, the logic model of the Environmental Statement and associated Impact Reports is represented in the diagram overleaf.

[12] *ibid*
[13] **ISH2**, "Need and Operations", 21st March 2019 at approximately 14:03hrs
[14] **ISH3**, "Need and Operations", 21st March 2019 at approximately 14:00hrs

**Diagram 1: Logic model for Environmental Statement and Impact Reports**




6.3. Concerns regarding accuracy of the Applicant's noise contour maps have been **expressed throughout the examination by numerous parties**, including but not limited to Historic England, (REP4-058), Thanet District Council LIR, (REP3-010), Canterbury City Council LIR, (REP3-246), Dover District Council (RR-0490), and numerous public representations and submissions providing evidence of both historical noise monitoring data and testimony of lived experience during previous operations, (e.g. REP1-053, RR-0537, RR-2039, RR-0530, RR-1043, RR-0009, RR-1419, RR-1994, RR-1479, RR-0631, RR-0555 etc.)

6.4. Irrespective of whether or not the ExA or Secretary of State is in a position to be able to bring the Examination to an early halt, it is clear that the current **noise contour maps cannot be relied upon** and most certainly do not represent a "worst case" scenario.

6.5. As such, in the event that the Examination should continue, we would like to **put on record a request** that following submission of the Applicant's business model - as promised by the Applicant for Deadline 5 - there should be an **independent review and re-issue of the noise contours**, which should include:

6.5.1. Independent, suitably qualified aviation consultants to produce **accurate fleet mix model(s)** based on Applicant's confirmed business model/mix and based on worst-case scenarios.

6.5.2. Independent, suitably qualified aviation consultants to produce **accurate estimates of ATMs** per fleet mix.

6.5.3. The Environmental Research and Consultancy Department, (ERCD), of the CAA to produce **independent, accurate noise models** based on revised fleet mix/ATMs and showing a wider range of contours consistent with the ExA's line of questioning regarding annoyance, disturbance and expected standards for noise mitigation.

6.6. Once revised Noise Contours have been produced, impacts of the accurate and appropriate noise contours should be considered with regards to:

- Noise Mitigation Plan
- Local Impact Reports
- Statutory Bodies' assessments and SOCG, (e.g. Public Health England, Natural England, Historic England etc).

6.7. As with the Applicant's failure to provide a revised Funding Statement so far into the process, there is clearly a **significant impact and risk to the Examination** of the Applicant's failure to provide accurate and credible information with regards to business model, forecasts and - therefore - accurate noise contours.

## 7. Public Safety Zones

It was confirmed during the ISH of 22/3/19 by Louise Congdon of York Aviation that, on the basis of the Applicant's ATMs, **Public Safety Zones (PSZ) will be required to be implemented from day one,** since PSZ should be modelled *"based on forecasts about the numbers and types of aircraft movements fifteen years ahead"*[15]

.

7.1. As the ExA is aware, the Applicant has f**ailed to provide any provision for Public Safety Zones** in its Application, in its estimate of costs for the CPO, NMP or in its Environmental Statement. If the Examination is to proceed, the Applicant should be required to provide a revised plan to account for PSZ, with an appropriate consultation period, as required.

7.2. Again, this presents a **significant risk to the Examination** and its statutory timelines.

## 8. Further Failures

In addition to the deficiencies outlined in this document, the ExA will also be aware of the Applicant's continued failures at such a late stage of the Examination with regards to:

8.1. Failure to agree a significant number of Statements of Common Ground.

8.2. Failure to agree matters outstanding with regards to Crown Lands.

8.3. Failure to agree matters outstanding with regards to Compulsory Purchase Orders and Affected Parties.

8.4. Failure to provide appropriate responses to a large number of the ExA's Written Questions, (REP3-195). Many of the Applicant's answers are

[15] **Appendix ISHR-004**: Department of Transport circular 01/2010 - Control of Development in Airport Public Safety Zones

derisory, bordering on infantile, with respect to significant issues including but by no means limited to **sustainability**[16]**, costs**[17]**, business model**[18] etc.

8.5. Consideration of the impact of the **level of *displacement*** of business described by the Applicant during ISH from existing Airports and future displacement from the proposed third runway at Heathrow with regards to the Applicant meeting the NSIP justification threshold and whether this is in the public interest.

## 9. CONCLUSION

9.1. As stated during our Open Floor Hearing oral representation of 18/3/19, and summarised in our Written Statement at Deadline 5[19], the **Applicant's lack of experience and poor handling of the fundamental issues** outlined above presents the ExA with *"an impossible task with regards to giving the Secretary of State any confidence about the manner in which any benefits might be secured or any confidence whatsoever that the Applicant is capable of delivering them."*

9.2. It would appear that there are three possible options:

9.2.1. The Examination proceeds based on the evidence and Application as submitted.

9.2.2. The Applicant is directed to answer further questions, as suggested by the ExA during ISH 20-22 March 2019, and with continued significant revisions to fundamental aspects of the Application. In this case, **concerns raised as early as the Preliminary Hearing** and reiterated in REP1-044 and REP3-223 regarding ***Wheatcroft*** must surely be a consideration.

[16] **REP4-042** Five10Twelve Comments on Applicant's responses to Written Questions, Q.F.1.15
[17] *Ibid,* Q.F.1.6
[18] *Ibid*, Q.F.1.1 / paragraph 5
[19] **Appendix ISHR-002**: Five10Twelve Written summary of oral representation at OFH 18/3/19

9.2.3. Consider whether the Examination can reasonably be continued or whether it **should be brought to an early close** based on the Applicant's failure to provide credible and fundamental information, as outlined in this document.

9.3. In light of the **continuing cost to the public purse and drain on already stretched public resources**, as outlined at paragraph 2, and in consideration of the weight of majority public and Interested Party opposition to the DCO proposal, as detailed and summarised in **REP3-224**, it is our position, as stated at paragraph 1, that continuation of the Examination **cannot be justified as being in any way in the public interest**.

# ISHR-001

## Notes on Airports Commission Interim Report and Appendix 1

Page 15 of Appendix 2 to the Airports Commission's Interim Report dated December 2013[1], titled "Assessment of Long-term Options to the Airports Commission's Interim Report dated December 2013", states at Page 16 under the title (c) **The Commission also assessed the following proposals did not fit with the Commission's remit or offer a solution to the key question of providing additional long-term capacity and connectivity for the UK:**

| **Name** | **Description** | **The Commission's View for Sift Out** |
|---|---|---|
| Manston | Policy initiatives and surface transport improvements to develop Manston as a 'reliever' airport for London and the South East, freeing up capacity at more congested airports, and reducing the need for new runway capacity to be built. | This proposal presents some potential as a reliever airport, but **does not address the larger question of London & South East capacity**. The concept of reliever airports is considered in short and medium term work. Please see Appendix 1 for further information. |

Attached is the Appendix 1: Assessment of Short-and Medium-Term Options Airports Commission: Interim Report December 2013 referred to above in the reasons given for the Commission's View for Sift Out which states on Page 30 –

| | **Surface Transport Options** | **The Commission's View** |
|---|---|---|
| 68 | Range of road and rail improvements to improve access to other airports:<br><br>Proposals covering road and rail access to a number of other airports, including (but not limited to): Bristol, Bournemouth, Cardiff, Edinburgh, Glasgow, London City, Luton, Manchester, **Manston**, Newcastle, Southampton and Southend. | The Commission recommends that some of these proposals are considered in further detail, ***specifically better accessibility to Glasgow***. The **Commission is supportive** of ongoing work by the ***Department for Transport on schemes such as the Northern Hub***. |

[1] Civil Aviation Authority – Response to Examining Authority's WQ [**REP3-231**]

Airports Commission

Airports Commission: *Interim Report*

# Appendix 1: Assessment of Short- and Medium-Term Options

December 2013

Airports Commission
6th FloorSanctuary Buildings
20 Great Smith Street
London SW1P 3BT

Web: www.gov.uk/government/organisations/airports-commission
Email: airports.enquiries@airports.gsi.gov.uk

# Contents

# Introduction

Chapter 5 of the Commission's *Interim Report* addresses the question of how the UK can make the best use of its existing airport capacity in the short- and medium-term, until any new capacity can be delivered.

This Appendix supports that Chapter and provides an overview of the basis on which the Commission made its recommendations in this area.

- **Section 1:** Describes the process that the Commission followed in considering options for making the best use of existing capacity.
- **Section 2:** Provides a full list of the components of the Commission's recommendations on this subject (which include some further components to those included in the main body of the *Interim Report*).
- **Section 3:** Lists the measures for making the best use of existing capacity that were submitted to the Commission as part of its call for evidence, along with the conclusion that the Commission reached on each proposal.

Section 1:

# The Commission's process

## Overview

**1.1** The Commission's Terms of Reference[1] state that, as part of its *Interim Report*, it should present:

- its recommendations for immediate actions to improve the use of existing runway capacity in the next 5 years – consistent with credible long-term options.

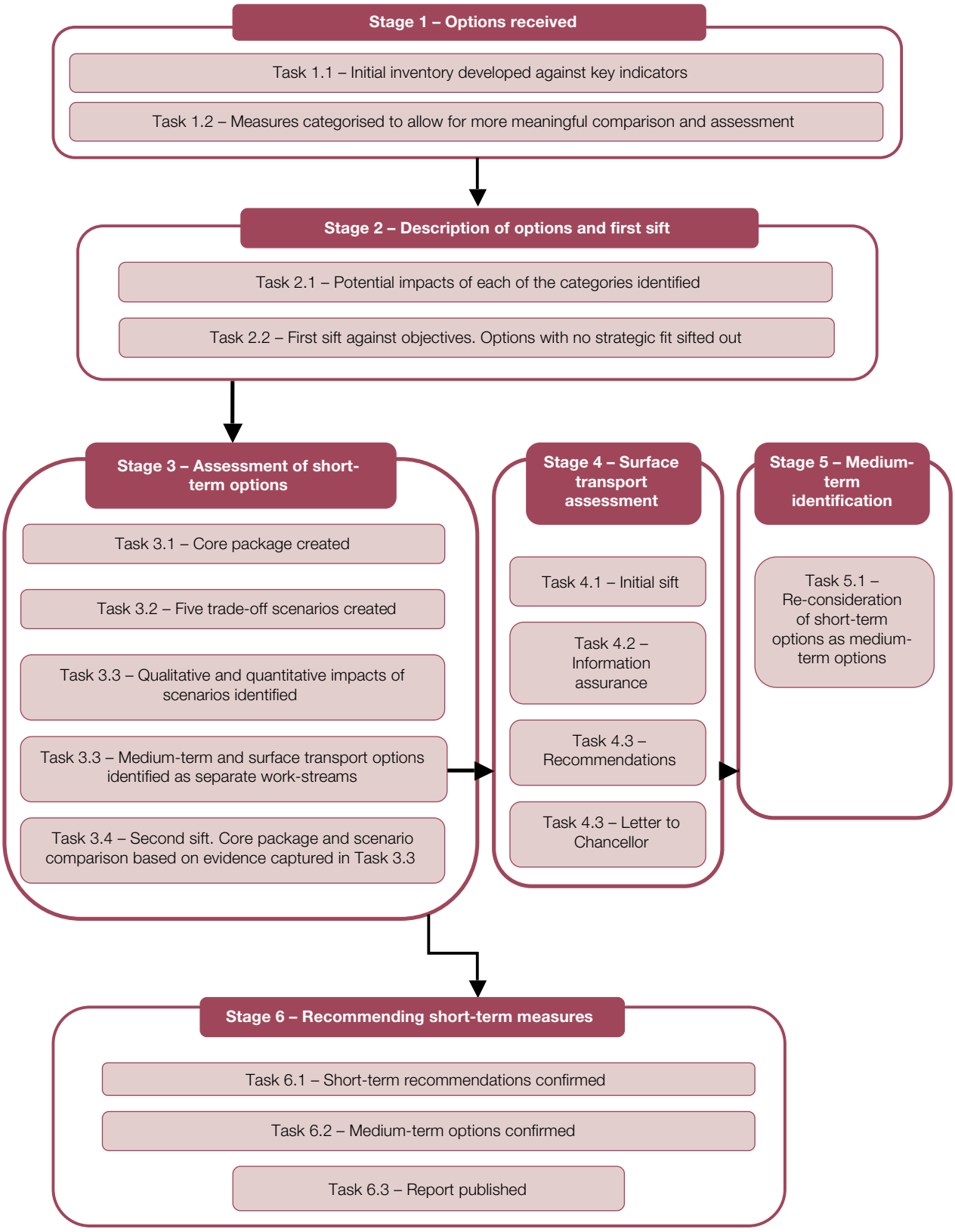
**1.2** The Commission determined that the Terms of Reference required it to identify a set of measures which could be implemented relatively quickly and without prejudice to the deliverability of any of the longer-term options for new capacity taken forward for further development in Phase 2. The Commission's recommendations as set out in Chapter 5 and this Appendix fall into this category.

**1.3** The Commission also determined that some of the options around existing infrastructure would have longer delivery timescales or adverse interactions with certain longer-term options. The Commission recognised that it would not be possible to make recommendations on them in the *Interim Report*. They would need to be considered alongside long-term options in Phase 2, as part of a transition strategy.

**1.4** In February 2013, the *Guidance Document 01: Submitting evidence and proposals to the Airports Commission'*[2] requested that any proposals for improving the use of existing capacity were submitted to the Commission by 17 May 2013. The process that followed this date is set out in Figure 1.1 below:

1 https://www.gov.uk/government/organisations/airports-commission/about/terms-of-reference
2 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/70285/submitting-evidence-airports-commission.pdf

**Figure 1.1 The methodology**



**1.5** As part of **Stage 1**, the Commission considered the options received in submissions against its own initial inventory of options. Following this, the Commission broke down the measures under consideration by category (with categories including, but not limited to, 'airport operations', 'airspace operations', 'slot allocation' and 'surface transport').

**1.6** In **Stage 2**, the Commission collected more detailed information on measures to improve its understanding of their potential impacts. In some cases, this required meetings between the Secretariat and parties who had suggested measures or offered commentary on them. Relevant parties here included airports, airlines and community groups, as well as industry bodies such as Airport Coordination Limited (ACL), which is responsible for slot allocation. The Secretariat put more extensive arrangements in place with the Civil Aviation Authority (CAA), NATS and Network Rail, recognising the more detailed level of advice required in those organisations' areas of expertise. In July, the Commission conducted a first sift, which identified measures that clearly did not fit with its remit. It also identified options whose delivery timescales or potential for conflict with some long-term options under consideration meant that, while they might have merit, recommendations would not be possible in the *Interim Report*.

**1.7** In **Stage 3**, the Commission continued to develop its understanding of measures and to develop qualitative and quantitative assessments of their impacts. Many of the measures under consideration had complicated interactions and dependencies and were therefore best considered as part of packages rather than in isolation. The Commission identified a central set of measures to enhance resilience that did not conflict with other measures under consideration. This 'core package' would later evolve into the Optimisation Strategy described in **Chapter 5** of the *Interim Report*. The Commission also tested a number of scenarios for going further (eg. creating new capacity, further enhancing resilience, doing more to offset the adverse consequences of aviation). While none of these scenarios was adopted wholesale, elements of them were eventually incorporated back into the core package and form part of the recommendations (most notably the creation of an Independent Aviation Noise Authority).

**1.8** **Stage 4** was largely conducted in parallel with Stage 3. The Commission identified that the assessment of surface transport proposals would be better conducted, so far as possible, in a manner that incorporated elements of existing surface transport appraisal mechanisms, so as to accelerate their delivery should Government choose to accept the Commission's recommendations in this area. Surface transport appraisal was therefore taken forward as a discrete workstream. The

Commission identified an opportunity for early progress on its recommendations in this area and therefore decided that the Chairman should write to the Chancellor of the Exchequer to set out surface transport recommendations ahead of the Autumn Statement. This letter was sent on 26 November. HM Treasury announced in its National Infrastructure Plan, published on 5 December, that it would begin the process of taking forward these recommendations.

**1.9** **Stage 5** was also conducted in parallel with Stages 3 and 4. This stage involved further assessment and development of those options identified in Stage 2 whose delivery times or potential conflicts meant that recommendations would not be possible in the *Interim Report* (medium-term options). The assessment undertaken was less detailed than that on other options, recognising that further work would be needed in Phase 2.

**1.10** In **Stage 6**, the Commission confirmed the contents of the Optimisation Strategy, as well as other short-term recommendations such as those around industry governance. This was done on the basis of assessments carried out in Stages 3 and 4.

Section 2:

# List of recommendations

**2.1** The full list of the components of the Commission's recommendations for making the best use of existing airport capacity, ordered by theme, is set out below. The glossary included in the *Interim Report* explains the terminology used in these recommendations.

## Airport operations

**2.2** Recommendations are:

- The industry should implement Airport Collaborative Decision Making (ACDM) quickly and seize the opportunity it provides to make use of the data collected by the system to help inform the definition of airport schedules and to monitor compliance against these. Added to this, those airports with more than 30,000 Air Transport Movements (ATMs) should invest in the provision of Departure Planning Information (DPI) into the airport and airspace network by April 2015 to ensure the most efficient use of airspace over the UK.
- Heathrow Airport should conduct a trial to smooth the peak in demand from arriving aircraft after 06:00 – which often results in both runways being used for arrivals – to allow for more flights in the 05:00-05:59 hour and, as a result, limit the use of both runways for arrivals to those days when the most significant delays are experienced. The trial should be undertaken by 2015 at the latest, once all stakeholders have been appropriately consulted and dispensation has been sought from the night noise regime from the Secretary of State for Transport.
- Recognising the limited number of tools available to Heathrow airport in responding to delay, the Commission recommends that:
  - Following consultation, the airport should continue to operate enhanced Tactically Enhanced Arrivals Mode (TEAM) – with a reduced trigger point of 10 minutes' delay on arrival – to allow delays to be tackled as they start building up, taking advantage of more accurate schedule information so as to balance demand for arrivals and departures; and

  - The Government should support the airport in its efforts to expedite the re-definition of its departure routes both to mitigate noise impacts and to enable increased departure flow rates when necessary.

- Dual arrivals – through the use of TEAM – are not currently operated in the most efficient way, as Heathrow's runways are considered to be too close together. This results in the arrivals needing to be offset from each other on approach, adding complexity and additional workload for air traffic control into the operation. Heathrow should begin work with the CAA to build the case for declaring its arrival runways to be independent of each other, removing the dependency between successive arrivals, thereby optimising the use of TEAM.
- Runway alternation provides those living under Heathrow's flight paths with predictable respite from noise. Runway alternation should be enabled as rapidly as possible for easterly operations. This will provide respite for those, particularly in Windsor, who do not currently benefit from alternation.
- Given developments in aircraft technology over time, the Government should review the need for a westerly preference with a view to introducing a 'no preference' policy.
- The Commission recommends that reduced engine taxi – the practice where one or more engines are shut down for taxiing to and from the runway so as to reduce emissions on the ground – forms part of standard airline practice at UK airports which, together with airport ground vehicle fleet renewal plans setting priorities to procure electric vehicles wherever possible, will contribute to quieter and cleaner UK airports.

## Airspace operations

**2.3** Recommendations are:

- The Government should facilitate moves by industry to redesign airspace within the London area to a performance-based navigation standard allowing for closer spaced departure routes where possible. Airports should also work closely with NATS to consider the feasibility and implementation of alternating arrival and departure routes to offer respite for local communities living under these aircraft paths.
- Work to end the current practice of aircraft holding in circular stacks is welcomed. NATS should encourage greater adherence to schedule by airlines through stricter enforcement of aircraft required time of arrival at fixed points en route.

- Work to implement Time Based Separation at Heathrow should be taken forward urgently, with a view to implementation by 2015, followed by implementation at Gatwick.
- Current ground-based navigational systems supporting aircraft on their approach are not robust enough to operate effectively during periods of low visibility and do not make best use of available modern technology. The industry should prioritise the development and implementation of these systems to improve resilience during periods of low visibility, particularly as this currently leads to a reduction in the landing rate.
- The Commission supports the principle of consultation and thinks it is right that local communities are involved in the decision making process for changes that will affect them. The outcomes of consultation should be fully taken into account at the design stage governing any airspace change process and the CAA, as the body with responsibility for airspace changes, should play an instrumental role in balancing the costs and benefits of any airspace change. The Government should not form part of this decision making process, as there are organisations better placed to play this role in determining the balance of costs and benefits of every operational change proposed. Therefore, the Commission recommends the Government devolves its responsibility for airspace changes to the CAA, advised as appropriate by a newly established Independent Aviation Noise Authority.
- Considering the environmental benefits that can be derived from more direct aircraft routings, NATS and the Ministry of Defence should continue to work together to agree a strategy for ensuring airspace is only closed for military use when it is absolutely required.

## Industry governance

**2.4** Recommendations are:

- The Commission recommends that the delivery of the measures identified in relation to the optimisation of UK airports and airspace, particularly where they form part of the Future Airspace Strategy and London Airspace Management Programme, requires the involvement of top-level representatives from the most directly involved organisations. The Commission therefore recommends the establishment of a Senior Delivery Group with Board-level representatives from the CAA, NATS and the major airports in London and the South East who have overall responsibility for the delivery of the Future Airspace Strategy.

- The Group should be chaired by the Chief Executive of one of the member organisations listed above and should report on a six-monthly basis by means of a published progress report. The first report should provide industry with a detailed timetable for delivery, with clear milestones and dependencies identified.
- The Group should be responsible for holding individual airports to account for making sure that improvements to punctuality and scheduled performance driven by the FAS and the wider Optimisation Strategy are matched by appropriate changes to the airport's local operation models.

## Slots and scheduling

**2.5** Recommendations are:

- With the increase in information available through ACDM, linear holding and weather forecasting, airports should be able to generate a strategic plan for delivery of the schedule one day in advance to identify where there will be pinch points in the schedule or where it will not be met. This would allow for preventative action to be taken in advance where necessary, and for cancellations to be managed in a controlled way with passengers being informed in advance.

## Regulation

**2.6** Recommendations are:

- The Commission recommends that an independent body be established with a duty to provide statutory advice to the Government and the CAA on issues relating to aircraft noise. The Government and the CAA should be required to publish their reasoning in any cases where their decisions diverge from the advice provided by the body.
- The establishment of an Independent Aircraft Noise Authority would require primary legislation. In the meantime, the industry should not wait for the establishment of this body before beginning the process of implementing of the Optimisation Strategy.

## Surface transport

**2.7** Recommendations are:

- The Government should attach a greater strategic priority to transport investments which improve surface access to our airports.

- The Commission further recommends a package of specific surface transport improvements, described in full in Chapter 5 of the *Interim Report*.

## Air services agreements

**2.8** Recommendation is:

- Government should continue to pursue its current policy of encouraging overseas airlines to apply for fifth freedom rights at less congested UK airports, subject to the Government satisfying itself that the grant of such rights will not be likely to distort competition in the relevant market.

Section 3:

# Proposals received and Commission conclusions

| | Airport operations options | The Commission's view |
|---|---|---|
| 1 | *Application of the alternation regime on easterly operations:* Heathrow's runways are operated in segregated mode where one runway is used for arrivals and the other for departures. The arrival and departure runways are alternated at 15:00 each day to give those living under the flight paths respite from noise. For historical reasons, there is no alternation of the runways on easterly operations. This measure would support a move to a full alternation regime. | Please see recommendation in Section 2 of this document. |
| 2 | *Removal or change to the westerly preference criteria:* Heathrow's runways are oriented east-west and due to the prevailing wind the airport operates mainly with arrivals and departures to the west, i.e. flying into the wind. This is supplemented by a 'westerly preference' during daytime operations, which means that the airport continues to operate in a westerly direction until the easterly component of the wind (effectively the tailwind) exceeds 5 knots. This measure would support a change to this preference either by (a) removing it so that aircraft would always operate into the wind; or (b) increasing it so that a 10 knot easterly (tailwind) would be needed before the switch were made away from westerly to easterly operations. | Please see recommendation in Section 2 of this document. |
| 3 | *Use of displaced thresholds:* This would allow aircraft to land further towards the centre of the runway, meaning that their approach paths would be higher and therefore less noisy than at present when entering the airport perimeter. This measure has been proposed in relation to London Heathrow but could be considered in relation to other airports in the UK. | The Commission sees merit in considering further the feasibility of displaced thresholds at Heathrow. Further work is required to understand the full costs and benefits of this proposal, including the infrastructure changes required, the safety risks, the impact on runway occupancy and therefore capacity, and the corresponding noise impacts before a recommendation can be made. However, this proposal should be considered further as part of the work to develop the long-term options. |

| | Airport operations options | The Commission's view |
|---|---|---|
| 4 | *Putting an end to the routine use of both runways for arrivals between 06:00 and 07:00:*<br>This would see a redistribution of existing flights in the early morning arrival period permitting an increased number of arrivals in the 05:00 – 06:00 period in order to reduce the use of both runways for arrivals in the early morning period to mitigate community disturbance. | Please see recommendation in Section 2 of this document. |
| 5 | *Introducing measures assessed during the recent Operational Freedoms trial at Heathrow including 'early vectoring' to improve departure rates; tactically using both runways for arrivals when there are delays and using the southern runway for the arrival of A380s and for Terminal 4 arrivals:*<br>These measures were trialled as part of the Operational Freedoms trial in 2012/13 at Heathrow to enable a more flexible approach to the operation of the runway infrastructure. The original objective of the Operational Freedoms trial was to test the way in which changes to operational practices might have a beneficial effect on the reduction in delays experienced by users, improvement in flight punctuality and the increased resilience of the flying schedule.<br><br>The specific measures proposed are as follows:<br><br>**'Early vectoring'** – Aircraft departing from Heathrow follow set departure routes (known as Noise Preferential Routes or NPRs). The choice of departure route used by aircraft is mostly decided on their destination. Those heading to Scandinavia for example will use northerly departure routes whereas those destined for southern Europe will use southerly departure routes. Due to the fact that the majority of the destinations served by Heathrow are destined towards the south, this can often cause delay on departure. 'Early vectoring' was the procedure tested during the trial which saw departures using southerly departure routes being redirected from the departure route earlier than is usual. This meant the separations between aircraft could be reduced from two minutes to one minute on these southerly departures. | Please see recommendation in Section 2 of this document. |

| | Airport operations options | The Commission's view |
|---|---|---|
| | **Tactically using both runways for arrivals** – Heathrow's runways are operated in segregated mode where one runway is used for arrivals and the other for departures. When the build-up of arriving aircraft results in severe delays, air traffic control is allowed to land aircraft on both runways. This is known as Tactically Enhanced Arrivals Mode (TEAM). This measure was only used when specific trigger conditions were met. For information on these triggers please refer to Heathrow Airport's website at: http://www.heathrowairport.com/noise/noise-in-your-area/operational-freedoms-trial<br><br>**Using the southern runway for the arrival of A380s and for Terminal 4 arrivals** – The A380 is the biggest aircraft that operates at Heathrow. Due to the vortex it produces, aircraft behind it have to allow a greater distance when coming in to land. This can lead to a delay in the arrivals programme. This measure would take A380s out of the arrival sequence to land on the designated departure runway so as not to disrupt the arrival flow. The use of the southern runway for Terminal 4 arrivals is intended to reduce the time needed for aircraft to taxi to the terminal on arrival as Terminal 4 is situated south of the southern runway. This could potentially reduce ground noise and emissions and avoid the need to cross the southern runway, therefore reducing disruption. | |
| 6 | *Mixed mode at Heathrow:*<br>Introduction of mixed mode operations for Heathrow runways would allow both runways to be used for arrivals as well as departures, whereas a single runway is currently used for arrivals and the other for departures. This measure has been proposed in two forms: to increase capacity at Heathrow (which would necessitate an additional planning condition to allow for more aircraft movements) and to increase resilience (not necessitating a change to the number of aircraft movements allowed under the planning rules applied at Heathrow) either as a tactical solution when delays reach certain levels or as a full time measure. | The Commission's view is that mixed mode – both for resilience and for additional capacity – should not form part of its recommendations for making best use of existing capacity in the short-term. Instead, the option should be given further consideration as part of the transition scenarios for the long-term options taken forward for further development. More information on the Commission's consideration of mixed mode can be found in Chapter 5 of the *Interim Report*. |

| | Airport operations options | The Commission's view |
|---|---|---|
| 7 | *Airport Collaborative Decision Making (ACDM):*<br>This measure is about partners (airport operators, aircraft operators/ground handlers, air traffic control and the Network Manager) working together more efficiently and transparently in the way they make decisions and share data. At an airport level, the ACDM system would aim to improve the overall efficiency of operations with a particular focus on aircraft turnaround times and the pre-departure sequence. One of the main outputs of the ACDM process is intended to be more accurate information about aircraft Target Take Off Times which could then be used across the European Air Traffic Management Network to plan air traffic movements further into the system. | Please see recommendation in Section 2 of this document. |
| 8 | *Linking all airfields to air traffic management for information exchange:*<br>This measure would support the implementation of simple interfaces for electronic data exchange between smaller airports and the air traffic management network to ensure air traffic managers across the network have as complete a picture as possible of current and near term operations. | Please see recommendation in Section 2 of this document. |
| 9 | *National and local capacity management cells:*<br>This proposal supports the establishment of airport bodies representing the range of airport stakeholders. The aim of these bodies is to manage demand levels as well as prioritising access to airports and airspace to minimise the impact of adverse conditions. | The Commission notes that Gatwick and Heathrow airports have established capacity management cells to balance demand and capacity, particularly to manage major disruption. If capacity management cells would be beneficial on a national level, industry should work together to identify an appropriate body to take this forward. |
| 10 | *Reduced engine taxi:*<br>This measure would involve aircraft taxiing to and from the runway using a reduced number of engines. This has the potential to reduce fuel burn and therefore emissions such as carbon dioxide and nitrogen oxides. | Please see recommendation in Section 2 of this document. |
| 11 | *Use of electric vehicles airside:*<br>This proposal supports the use of electric vehicles for airside operations to decrease the emissions associated with ground operations. | Please see recommendation in Section 2 of this document. |

| | Airport operations options | The Commission's view |
|---|---|---|
| 12 | *Traffic light systems for aircraft to maximise runway utilisation:*<br>This measure has been proposed to reduce the time taken for aircraft to exit the taxiway onto the runway by providing aircrew with an indication that their air traffic control clearance is imminent through a traffic light system. This would allow them to initiate final checks and power settings and thus move onto the runway sooner than would otherwise be the case, because it is suggested that there is a small delay incurred due to the reaction time between air traffic control giving an instruction to proceed and the aircrew enacting that decision. | The Commission does not recommend this measure. There are no existing precedents for this system and it is not clear what the benefits of this proposal are. |
| 13 | *More use of remote stands:*<br>This measure proposes the use of additional remote stands away from the main terminal areas to provide additional parking space for aircraft to reduce congestion on the busiest parts of the airfield. | The Commission believes that this measure is for airports and their own master-planning. The Commission does not recommend this measure. |

| | Airspace operations options | The Commission's view |
|---|---|---|
| 14 | *Airspace restructuring:*<br>This measure supports the implementation of major programmes, including the Single European Sky (SES)/ Single European Sky Air Traffic Management Research (SESAR), Future Airspace Strategy (FAS), the London Airspace Management Programme (LAMP) and the more specific airspace changes that underpin them. It also includes aircraft departing at steeper angles of ascent so that the aircraft reaches higher altitudes earlier. The Single European Sky (SES) initiative was established to simplify and harmonise airspace structures across Europe. As part of the Single European Sky initiative, SESAR (Single European Sky ATM Research) represents its technological dimension. In the UK and Ireland NATS are setting out a plan to modernise airspace by 2020 supporting the Future Airspace Strategy, part of which includes the London Airspace Management Programme. These programmes are intended to redesign airspace structures to exploit aircraft abilities to fly precise and efficient trajectories using performance based navigation. | Please see recommendation in Section 2 of this document. |

| | Airspace operations options | The Commission's view |
|---|---|---|
| 15 | *Civil/military airspace optimisation:*<br>This measure proposes the reprioritisation of access to airspace from military to civil operations. Currently airspace is structured so that military authorities have control of some areas where weapons testing occurs from time to time for example. Under current arrangements within the so called flexible use of airspace, this airspace is released for civil use when it is not required by the military. Decisions to release airspace for civil use are taken by military authorities. This measure would impose a limit on military operations that impinge on civil traffic, effectively releasing the airspace for more civil use. | Please see recommendation in Section 2 of this document. |
| 16 | *Creation of a known-surveillance environment:*<br>This would lead to the definition of areas of airspace within which all aircraft must carry technology that identifies them and makes them visible to air traffic control all of the time. | The Commission recommends that the CAA and NATS should re-consider the options for managing the risk of infringements into airspace around airport arrival and departure routes from aircraft not fitted with transponders. |
| 17 | *Incentivisation of flights' arrival punctuality instead of departure punctuality:*<br>This would move the main performance incentive from on-time departure to on-time arrival to align the objectives of individual airlines to those of the overall system more than at present. Currently the main incentive for airline performance is focused on departures, measured as the time that the aircraft leaves its stand compared to its scheduled time. This incentive can cause perverse behaviours that compound to the detriment of the system as a whole. These behaviours include: (a) excessive buffers in schedules, to ensure on-time arrival in time for on-time or early departure, which can cause bunching in arrivals that leads to delay and in turn leads to increased buffers in the schedule; (b) early push-back from stand that can cause queues in the airport perimeter and departure delays. | The Commission does not consider it possible in the short-term to achieve whole industry shift to arrival punctuality, which is what would be needed to implement this effectively. Industry should, however, work to consider incentivising arrival punctuality in the context of improved performance and schedule adherence as part of the transition to long-term options to make best use of additional capacity when it comes on stream. |
| 18 | *Redefining the triggers for the application of low visibility procedures (LVP):*<br>This measure would lead to improved planning for reduced runway visibility due to fog and cloud at an early stage to improve resilience against low visibility. Low visibility procedures are enacted when either the runway visible range or cloud ceiling is below minima defined on an airport-by-airport basis. There is currently no differential between LVP caused by reduced runway visual range (fog) and low cloud ceiling. Pre-emptive action is taken, usually the day before, to manage disruption due to the application of LVP. This action is based on the weather forecast and can lead to changes in the number of aircraft that are allowed to land and take off from the runway. | The Commission recommends industry continues to work to review the triggers associated with low visibility procedures, particularly those associated with low cloud. |

| | Airspace operations options | The Commission's view |
|---|---|---|
| 19 | *Distributing departure routes within noise preferential route (NPR) swathes:*<br>This would change the policy of concentrating aircraft on only a few flight paths to one of using a greater number of routes in a pattern that could provide additional predictable periods of respite from aircraft flying. | Please see recommendation in Section 2 of this document. |
| 20 | *Arrival queue management:*<br>This measure has been proposed to address the management of inbound delay. At present air traffic control manage holding delays in two forms: (a) holding on the ground at the origin airport arranged through Eurocontrol through Air Traffic Flow Management, and (b) holding in the air. This occurs in four stacks which are used to buffer inbound aircraft to Heathrow. This measure proposes the absorption of delays associated with sequencing for access to runways further upstream on the aircraft's flight path thereby reducing the need for more localised holding in stacks or through extended approach paths. | Please see recommendation in Section 2 of this document. |
| 21 | *Enhanced processes against weather disruption through the use of Time Based Separation (TBS) and through the use of alternative navigational technology:*<br>Inbound delays are exacerbated during periods of bad weather when the number of aircraft able to land on the runway is reduced. This is principally because of the need to maintain safe separation between approaching aircraft in an arrivals stream. In high (head) winds and low visibility, the separation between aircraft needs to be increased: in the first case to maintain the separation standards defined in terms of distance between aircraft, and in the second case to ensure the safe functioning of the precision guidance system (the Instrument Landing System – ILS) for approaching aircraft to guide them to land on a runway. In busy airports the number of arrivals are packed together to allow for maximum runway throughput. As such, they are more prone to weather disrupting their operations. This measure would address the impacts of high winds on runway throughput by moving to a process based on separations in time between successive aircraft in the sequence (time based separations) rather than distance-based separation as at present. It would allow for the arrival traffic to be reduced to a lesser extent than currently occurs. This measure also supports the transition to a Microwave Landing System (MLS) already used by British Airways, instead of the current Instrument Landing System (ILS). MLS is considered to perform better in all weather conditions than ILS. | Please see recommendation in Section 2 of this document. |

| | Airspace operations options | The Commission's view |
|---|---|---|
| 22 | *Steeper approaches into airports, including both continuous and stepped:*<br>This measure would increase the height of aircraft as they make their final approach to the airport, thereby reducing noise. Approach paths could either be at a continuous approach angle (between 3.2 and 3.5 degrees) or be stepped at different angles (with a steeper intermediate approach followed by the standard 3 degree airport approach). | The Commission supports the principle of steeper approaches but has not been able to prove a strong noise benefit from the introduction of 3.2 degree approaches at Heathrow. Steeper approaches at steeper angles do not appear feasible at Heathrow due to the current fleet mix, with the impact on the landing rate unknown. The Commission considers these issues should form part of any future trials of steeper approaches and, if the benefits can be proved, that steps be taken to implement them. |
| 23 | *Dual approaches to a single runway:*<br>This would use differential approach path angles to reduce the separation needed because of aircraft wake vortex constraints, thereby increasing the arrival flow on the runway. | There appear to be significant concerns about the operational viability of this measure and uncertainty about its benefits. In addition, the complexity of preparing safety cases would be likely to push implementation past the short-term. |
| 24 | *Multiple approaches to a single runway to guarantee respite:*<br>This measure would allow for a change to the policy of concentrating aircraft on only a few flight paths to one of using a greater number of routes in a pattern which could provide predictable periods of respite from aircraft flying. | Please see recommendation in Section 2 of this document. |
| 25 | *Independent parallel approaches at Heathrow:*<br>This measure supports the use of both runways simultaneously for arrivals at Heathrow, allowing independent parallel approaches that would maximise arrival runway throughput. At present when both runways are used for arrivals, the air traffic stream on one runway is dependent on the traffic stream on the other. This means that aircraft must be offset from each other, meaning that the arrival flows are not optimised. | Please see recommendation in Section 2 of this document. |

| | Airspace operations options | The Commission's view |
|---|---|---|
| 26 | *New service concepts:*<br>Currently queues of aircraft are managed on a first-come, first-served basis. This can sometimes result in behaviours that are detrimental to the performance of the system as a whole, eg. in incentivising flights to be at the front of the queue, for example when the airport opens after the night period or after periods of disruption. This can cause bunching and increased aircraft queue lengths on arrival, particularly at busy airports like Heathrow. This measure would result in the application of the most appropriate method of aircraft queue management, selected from 'first-come, first-served' (as at present), 'on-time, first-served' (where priority is given to flights that are on-time) or 'best-equipped, best-served' (where priority would be given to the most capable aircraft). | The Commission understands the benefits that could be derived from moving away from a system of first come, first served but considers that in the short term without additional capacity, this is an unrealistic expectation. There is, however, merit in considering whether a system that prioritised better equipped aircraft would provide an incentive for airlines to invest in performance based navigation capability, which could facilitate the introduction of the Future Airspace Strategy and the Commission's recommendations. |
| 27 | *Linking airspace slot management to airport slots:*<br>This measure proposes the management of airport and airspace slots linked, strategically in terms of capacity declaration but also tactically, as was applied to the London airport system during the London 2012 Olympic Games. | The Commission is not recommending this option as it would likely create a regulatory burden, distorting the business jet market. |
| 28 | *Optimised departure separation using advanced aircraft navigational technology:*<br>Currently, aircraft fly along Standard Instrument Departure routes (SIDS) that are defined as the centreline of established Noise Preferential Routes (NPRs). SIDS are single routes and departing aircraft using the same SID fly in sequence along the route with their minimum separations as defined by the air traffic control baseline rules. For a constant stream of aircraft departing down the same SID, these separation rules are a constraining factor on the frequency of departures. This measure is seeking to offset the angle between SIDS so that the departures no longer need to fly in sequence down one SID. This would effectively relax the required minimum separation required therefore increasing the frequency that aircraft can depart the runway. Most aircraft are now equipped with advanced navigational capability, which means they can accurately navigate routes without extensive air traffic control intervention. This concept would require airspace change and potentially a redefinition of NPR but could enable aircraft to be dispersed within the NPR rather than being concentrated on the centreline as at present. | Please see recommendation in Section 2 of this document. |

| | Slot/scheduling options | The Commission's view |
|---|---|---|
| 29 | *Return to direct Government control regarding the allocation of slots:*<br>The measure proposes Government asserting control over the allocation of slots at UK airports, distributing them in accordance with its assessment of the national interest. | The Commission does not recommend this measure. There has never been direct Government control of slot allocation. Government taking control would place it in violation of European and broader international treaty commitments. |
| 30 | *Use of Public Service Obligation (or other means) to safeguard UK regional access to Heathrow:*<br>This measure proposes the use of Public Service Obligations (PSOs) or, alternatively, financial or regulatory instruments to ensure the continuance of flights from UK regions into Heathrow Airport. | The Commission does not recommend this measure. The rules surrounding PSOs would not allow for this, and the Commission are unconvinced of the benefits of this measure. |
| 31 | *Designate different airports to serve different types of traffic:*<br>This measure would use Traffic Distribution Rules (or other mechanisms) to allocate certain categories of flight (e.g. short-haul, long-haul, domestic, general aviation) to specific airports. | The Commission does not recommend this measure. The Commission believes that the Government's levers of influence in this area are minimal and that attempting to impose changes to traffic distribution would be rendered unworkable by the commercial realities of the industry. |
| 32 | *Reduce capacity declaration at airports and ensure the efficient utilisation of slots:*<br>This measure would provide a lower capacity declaration at airports, to manage down congestion over time (or prevent airports reaching full capacity) so as to minimise the impacts of congestion on resilience. The proposal would be for a greater focus to be provided on the efficient utilisation of slots through the slot allocation process. | The Commission does not recommend this measure. International treaties would render the implementation of this measure effectively unworkable. |
| 33 | *Changes to market based slot allocation mechanisms (eg slot auctioning or slot rentals):*<br>This would change the systems for slot allocation to permit more diverse market-based solutions, such as slot auctions, allowing the system to better respond to changes in demand. | The Commission does not recommend this measure. While the Commission believes that there may be a case for a review of slot allocation mechanisms in the longer term, it does not see any prospect of change in the short or medium term. Changes to slot mechanisms would require agreement at the European and broader international level, which would be difficult to achieve. |

| | Slot/scheduling options | The Commission's view |
|---|---|---|
| 34 | *Financial incentives to use slots for routes to emerging markets:*<br>This option would provide financial incentives for airlines to use slots to provide new routes to emerging markets rather than serving existing 'thick' routes, with a view to enhancing connectivity to these regions. | The Commission does not recommend this measure. The Commission believes that there is a high potential for gaming of the system and the creation of perverse incentives, together with the risk of market distortion. Changes to slot mechanisms would require agreement at the European and broader international level, which would be difficult to achieve. |
| 35 | *Operation of an optimised, daily service plan:*<br>This measure proposes operating to an optimised daily service plan to produce, ensure compliance with and deliver an optimal on-the-day arrival and departure schedule based on accurate predictions of runway throughput rates. | Please see recommendation in Section 2 of this document. |

| | Regulatory options | The Commission's view |
|---|---|---|
| 36 | *End economic regulation of airports:*<br>This would see the end of the Civil Aviation Authority's economic regulation of airports, with a particular view to allowing the consequent rise in landing charges at the most congested airports to redistribute traffic around the network. | The Commission will consider the regulatory structures that might underpin the delivery of future airport infrastructure as part of Phase 2. |
| 37 | *Reduce landing charges at Heathrow and Gatwick:*<br>This proposal would introduce a tougher cap on landing charges at these airports via the regulatory framework with the intention of reducing ticket prices for passengers and driving operating efficiencies. | The Commission recognises that it is the role of the CAA to regulate the aviation sector and believes that this measure may have some merit in being further considered as part of the wider regulatory framework considerations in Phase 2 as appropriate. |
| 38 | *Prohibit certain aircraft types (e.g. freighters) from congested airports:*<br>This measure would require aircraft whose perceived need to use a 'hub' airport is lower than others to use airports other than Heathrow. | The Commission does not recommend this measure. The Commission believes that the market has already provided incentives that have minimised the use of the types of flight under consideration at the most congested airports. |
| 39 | *Ban general and business aviation from congested airports:*<br>This would prevent general and business aviation flights from using Heathrow (and potentially Gatwick), with the intention of improving capacity usage at those airports. | The Commission does not recommend this measure. The Commission believes that the market has already provided incentives that have minimised the use of the types of flight under consideration at the most congested airports. |

| | Regulatory options | The Commission's view |
|---|---|---|
| 40 | *Remove restrictions on usage of general aviation airfields (e.g. to allow for scheduled flights):* This measure would remove the restrictions under which some airfields primarily serving the general aviation community currently operate, allowing them to accommodate scheduled flights, relieving pressure elsewhere in the network. | The Commission favours this measure in principle but believes that this should be assessed on a case-by-case basis and the decision left to the airfield and local authority. |
| 41 | *Streamline planning process for new airport infrastructure:* This is proposing a reform to the UK's planning laws to accelerate the process for delivering new airport infrastructure. | The Commission believes that this measure has merit in being further considered as part of Phase two as appropriate |
| 42 | *Establish an independent noise regulator:* This measure would lead to the creation of an independent body responsible for the regulation of aircraft (and potentially other sources of) noise, to introduce transparency and consistency into the system. | The creation of an Independent Aviation Noise Authority forms part of the Commission's Optimisation Strategy. |
| 43 | *Border control reforms:* A number of measures have been proposed, including reforms to the UK's visa system, an increase in the number of border control staff at airports, and the provision of US border-control facilities in UK airports. | This is not technically within the Commission's remit, although the Commission recognises that this forms an important part of passenger experience. The Commission invites the Government to consider this further. |
| 44 | *Minimum aircraft size rules at congested airports:* This measure would prohibit small aircraft from using the most congested airports via licence condition. | The Commission does not recommend this. Evidence shows that the market is already working to remove smaller aircraft that are not essential for supporting the passenger base required for larger aircraft on long haul routes and providing connectivity for more distant UK regions. |

| | Air Passenger Duty (APD) options | The Commission's view |
|---|---|---|
| 45 | *Reduce or abolish Air Passenger Duty:* This would reduce the level of Air Passenger Duty (or remove it altogether) to increase the financial viability of routes connecting the UK to new destinations. | The Commission did not feel that changes to the overall scale of APD were deliverable. |
| 46 | *Increase Air Passenger Duty:* This measure proposes an increase in Air Passenger Duty (or the introduction of equivalent new taxation) to reduce the demand for flying. | The Commission did not feel that changes to the overall scale of APD were deliverable. |
| 47 | *Devolve to Scottish and Welsh Governments:* This would allow the devolved administrations to set the rate of Air Passenger Duty that would be applied at Scottish and Welsh airports. | The Commission was concerned that this proposal had the potential to create market distortions between airport pairs such as Bristol/Cardiff and Edinburgh/Newcastle. |

| | Air Passenger Duty (APD) options | The Commission's view |
|---|---|---|
| 48 | *Apply to transfer passengers:*<br>This proposal would change the rules surrounding Air Passenger Duty so that it applies to passengers connecting via UK airports without leaving the 'airside' area of the airport. | The Commission did not feel that the emerging analysis on the value of transfer traffic had made a case for this measure at this time. |
| 49 | *Regional variation of Air Passenger Duty:*<br>This would apply a lower rate of Air Passenger Duty at airports outside of London and the South East. | The Commission considered 49 and 50 together, with a primary focus upon 50, due to the perception that there would be fewer legal barriers. The Commission does not recommend taking forward these options. While they create some benefits for less congested airport, the overall impact was likely to drive a shift towards smaller aircraft and constrain the UK's overall connectivity. |
| 50 | *Variation of Air Passenger Duty by airport congestion:*<br>This measure would seek to apply a higher rate of Air Passenger Duty at highly congested airports, which could be used to offset a lower rate elsewhere. | |
| 51 | *Temporary Air Passenger Duty reduction or 'holiday' for new routes:*<br>This proposal would make passengers using new routes exempt from Air Passenger Duty for an initial period (perhaps two years) or apply a reduced rate. | The Commission does not recommend this measure. The Commission noted the potential for 'perverse incentives' within this measure, as well as the potential legal (competition) obstacles. |

| | Air services agreements | The Commission's view |
|---|---|---|
| 52 | *Liberalisation of bilateral air services agreements to support the granting of Fifth Freedoms at regional airports:*<br>This proposal would lead to the reduction or removal of the restrictions associated with air services agreements for air services travelling from an origin airport through a UK airport and on to third airport, where either or both of the origin airport or final destination is outside of the UK. | The Commission supports the Government's position but recognises it is not possible to go further within EU law. |
| 53 | *Liberalisation of bilateral air services agreements on a bilateral or unilateral basis:*<br>This measure would reduce or remove the restrictions associated with bilateral air services agreements for point-to-point services between the UK and third countries, on a bilateral or unilateral basis. | The Commission did not consider that this measure was desirable, due to the likely State Aid issues. |

| | Surface transport options | The Commission's view |
|---|---|---|
| 54 | *'Code sharing' between airlines and rail operators:*<br>This would enable the sale of integrated tickets that combine both air and rail portions into a single ticket and journey plan. | The Commission suggests that if airlines are interested in pursuing this measure, they discuss the franchise terms and conditions with the rail operator. The Commission is supportive of this measure in principle, but recognises that the Government lacks any real drivers to make this happen. |
| 55 | *Expansion of the UK high speed rail network:*<br>This measure proposes the construction of new high speed lines between UK cities to provide an alternative to domestic air travel. | This is not technically within the Commission's remit for Phase 1, but it may consider high speed rail connections to specific airports as part of Phase 2. |
| 56 | *Provision of direct high speed rail services to more continental destinations:*<br>This measure would lead to the introduction of high speed rail services between London (and potentially other UK cities) and continental cities beyond Paris and Brussels, to provide an alternative to short haul flights. | The Commission is supportive of efforts to extend the UK's high speed rail connectivity, but recognises that capacity constraints around the Channel Tunnel will limit the extent of what can be achieved. |
| 57 | *HS2 spur to Heathrow:*<br>This proposes building a spur from HS2 into Heathrow Airport to improve the airport's surface access, particularly from non-London urban centres. | The Commission will return to this proposal in Phase 2. |
| 58 | *Enhanced rail links between existing airports:*<br>These measures would be delivered through either the construction of new lines, or alterations to existing surface patterns to provide direct rail connections between existing London and South East airports, facilitating a 'virtual hub' concept. | The Commission does not believe that present or likely short to medium-term future demand would justify dedicated services between existing airports in light of the impacts upon congested commuter flows. |

| | Surface transport options | The Commission's view |
|---|---|---|
| 59 | *Other improvements to road and rail networks to improve access to Heathrow:*<br>• A range of proposals were submitted. These include:<br>• Complete planned Piccadilly line upgrade<br>• Create central London downtown air terminal adjacent to a key railway station<br>• Enable London Waterloo to Heathrow rail services from Eurostar platforms to T5<br>• Relocate Heathrow's bus and coach station to an intermodal interchange on the motorway network<br>• Great Western main line western connection to London Heathrow<br>• Enhanced highway capacity between the South West and Heathrow (e.g. M4, M3, A3)<br>• Improvements to M25 corridor to ensure it is not a constraint on access<br>• A Piccadilly line service to Park Royal to interchange with Central Line<br>• New high speed rail station and terminal adjacent to the Great Western main line<br>• High speed monorail to Northolt (to support as a reliever airport)<br>• Southern Access Study to increase accessibility from the south to Heathrow | The Commission is supportive of those schemes the Department for Transport is already funding, such as Western Rail Access to Heathrow and Crossrail. The Commission will return to other surface access improvements for Heathrow as part of Phase 2, though options involving enhanced links between Heathrow and Northolt will not be taken forward. See also the Commission's view for proposal number 83 on Northolt. |
| 60 | *Remodelling of Gatwick Airport station:*<br>This proposes improvements to the station, with a particular view to improving accessibility for passengers with luggage. | The Commission puts forward this measure as part of the short-term recommendations. |
| 61 | *Enhancement of Gatwick Express:*<br>This would lead to the reintroduction of the 'dedicated' Gatwick Express service (without the onward journey to Brighton) and the provision of more suitable rolling stock. | The Commission recommends that there is no degradation of the current service quality on the Gatwick service and is supportive of refurbishing the rolling stock. It believes that the case for a dedicated 'not onward' to Brighton service may need to be revisited in Phase 2. |

| | Surface transport options | The Commission's view |
|---|---|---|
| 62 | *Other improvements to existing road and rail networks to improve access to Gatwick:*<br>A range of proposals were submitted, including:<br>• Additional platform at Redhill to support more services to Reading<br>• Incremental Brighton Main Line capacity enhancements<br>• Old Oak Common interchange for linking Gatwick to HS2<br>• Increased Lower Thames Crossing capacity<br>• Direct rail services between Gatwick and other London and South East airports<br>• Highways Route Study of congestion pinch points (e.g. M25-M23 Interchange and M23-Gatwick turn-off) | The Commission is supportive of those schemes the Department for Transport is already funding, such as Redhill enhancements and the additional platform at Gatwick Airport station. The Commission is proposing the further enhancement of Gatwick Airport station as part of its recommendations. The Commission is further recommending that Government and Network Rail should accelerate the development of options for enhancing the Brighton main line and that Government and the Highways Agency should develop a network study with a focus on relieving capacity pinch points around the airport. |
| 63 | *Improvements to existing road and rail networks to improve access to Stansted:*<br>A range of proposals were submitted, including:<br>• West Anglia main line improvements including 4 tracking in Lea Valley to allow for an increase in services and to achieve maximum 30 minute rail travel time to Stansted from central London<br>• Reinstate rail link to Braintree to connect Stansted to the Great Eastern main line(and services on that line north or south to Felixstowe, Harwich and Thames Ports)<br>• Route improvements on the A120/M11 and West Anglian railway line if there is expansion beyond current permitted levels<br>• Direct rail services between Stansted and other London and South East airports<br>• Monitor congestion levels around Stansted | The Commission is recommending a study into enhancing the rail line between London and Stansted as part of its *Interim Report*. It is also recommending that congestion levels on roads around Stansted be kept under review. |
| 64 | *Take Crossrail/Crossrail 2 to Stansted:*<br>This measure is seeking to modify the existing Crossrail scheme or the proposed Crossrail 2 scheme so that it serves Stansted Airport. | Crossrail is at a relatively late stage of delivery. The Commission does not, therefore, believe it is practical to fundamentally alter the nature of the service at this stage by extending it to Stansted. Extension of Crossrail 2 to Stansted is likely to involve costs that could only be justified alongside Stansted expansion. |

| | Surface transport options | The Commission's view |
|---|---|---|
| 65 | *Restored Whitacre Link to improve access to Birmingham airport:*<br>This would lead to the reintroduction of services on the (disused) Whitacre Link to enable better rail access to Birmingham Airport from different directions. | The Commission is not convinced that there is a credible business case for this option. |
| 66 | *Other surface transport improvements relating to Birmingham airport:*<br>A range of proposals were received, covering heavy and light rail and roads. These include:<br>• Improved HS2 interchange with Birmingham Airport<br>• Birmingham Gateway Project<br>• Coventry-Nuneaton line improvements<br>• London Midland speed enhancements (Project 110)<br>• Upgrades to enable 59 minute journey time Euston-Birmingham Airport<br>• Midland Metro to Airport;<br>• M42/Junction 6 improvements<br>• Birmingham New Street station baggage drop off (check in facilities). | The Commission is supportive of those schemes the Department for Transport is already funding, such as the Birmingham Gateway Project and the London Midland speed enhancements. Road congestion around the airport should be kept under review. However, other options should be considered by Local Transport Authorities, primarily on their local social and economic benefits. |
| 67 | *Rename 'Birmingham International' station to 'Birmingham Airport':*<br>This measure proposes to rename station to facilitate journey planning for users unfamiliar with the airport. | The Commission believes that if the Airport wishes to take forward this option, it should itself progress it with its local stakeholders and the train operator. |
| 68 | *Range of road and rail improvements to improve access to other airports:*<br>Proposals covering road and rail access to a number of other airports, including (but not limited to): Bristol, Bournemouth, Cardiff, Edinburgh, Glasgow, London City, Luton, Manchester, Manston, Newcastle, Southampton and Southend. | The Commission recommends that some of these proposals are considered in further detail, specifically better accessibility to Glasgow. The Commission is supportive of ongoing work by the Department for Transport on schemes such as the Northern Hub. |
| 69 | *Check in/bag drop at rail stations:*<br>This measure would provide facilities for passengers to conduct check-in and bag-drop activities at stations serving airports, reducing the need for terminal capacity. | The Commission believes that this measure may be worth considering alongside specific long-term options as part of Phase 2. |
| 70 | *Develop an integrated surface transport strategy:*<br>This measure would see transport planning strategy methodologies adapted to make more account of the needs of airports and users of aviation. | The Commission is supportive of aviation needs being properly included in any future integrated surface transport strategy. The Commission invites the Department for Transport to consider this further. |

| | Options for financial incentives to promote behavioural change | The Commission's view |
|---|---|---|
| 71 | *Route development funds to promote new routes:* This measure would be intended to promote increased connectivity providing financial support for the introduction of new routes for a certain period of time (likely two years) after their introduction. | The Commission believes that there are significant practical and legal obstacles for the Government in doing this, but would support airports who wished to advance this option independently. |
| 72 | *Higher landing charges at congested airports:* This would lead to the introduction of a congestion charging element into landing charges at the busiest airports, to incentivise airlines to make greater use of other, less congested airports. | This Commission considers that this is undesirable for similar reasons to the use of 'APD congestion charging'. |
| 73 | *Market non-London cities as destinations in their own right:* This measure proposes a marketing campaign to promote inbound tourism to non-London UK cities, balancing demand for aviation capacity away from London and the South East. | The Commission support work to market UK cities as destinations in their own right. |
| 74 | *'Fly local' marketing campaign:* This measure proposes the launch of a marketing campaign to promote the use of local airports for journeys where they offer a viable alternative. | The Commission does not recommend this, on the grounds that it does not believe that it would be a helpful market intervention. |

| | Night flight and enhanced mitigation options | The Commission's view |
|---|---|---|
| 75 | *Night flights:* A range of measures have been proposed in relation to the night flights regime at Heathrow, Gatwick and Stansted airports seeking to increase, decrease or maintain the current number of air transport movements at the relevant airports. | The Commission is recommending a trial to smooth the early morning arrivals peak between 06:00 and 06:59 at Heathrow to allow for more flights between the 05:00 to 05:59 period to limit the use of both runways to those days when the most significant delays are experienced, thus providing more certainty for those not expecting to be overflown as part of their half-day respite arrangements. Any further consideration of night flights will be undertaken by the Commission in Phase 2 as part of the development of the long-term options shortlisted. |

| | Night flight and enhanced mitigation options | The Commission's view |
|---|---|---|
| 76 | *Development of planning restrictions and section 106 agreements around airports:*<br>This measure supports the development of clear guidance on the planning, policy and compensatory action that would be considered appropriate to address significant environmental and community effects at the local level around airports. | The Commission considers that an Independent Aviation Noise Authority should have a statutory role in providing input to planning inquiries relating to new housing developments in the vicinity of existing airports. The Commission expects to consider this issue further in the next phase of its work as part of its assessment of the shortlisted long-term options. |
| 77 | *Incentivise quieter aircraft through landing charges:*<br>This would see quieter aircraft being incentivised through a variable landing charge regime which saw louder aircraft being charged higher landing charges than quieter aircraft. | The Commission believes that these measures have merit in being further considered as part of Phase 2 as appropriate. |
| 78 | *Introduce higher night time landing charges:*<br>This proposal would see the introduction of a variable landing charge regime which charged night aircraft movements higher landing charges than those operating during the daytime. | |
| 79 | *Implement a quota count (QC) system for daytime air traffic movements and/or extend the quota count system to other airports:*<br>This measure proposes an expansion in the current use of QC categories as a method for incorporating noise management into airport capacity management. The QC system allows each night flight to be individually counted against an overall noise quota (or noise budget) for an airport according to the QC rating (i.e. the noisiness) of the aircraft used. This measure would extend this QC system to day time operations. | The concept of noise envelopes – including the implementation of a quota count system – will be considered further in Phase 2, taking account of the shortlisted options under consideration. |
| 80 | *Introduction of a comprehensive noise compensatory regime at airports:*<br>This would lead to the development of an agreed noise compensatory package based on best practice across all airports. | The Commission considers that the role of an Independent Aviation Noise Authority should include responsibilities for advising the Secretary of State for Transport and the CAA in respect of appropriate noise compensation schemes. The Commission expects to consider this issue further in the next phase of its work as part of its assessment of the shortlisted long-term options. |

| | Night flight and enhanced mitigation options | The Commission's view |
|---|---|---|
| 81 | *Development of a noise envelope concept:*<br>This measure proposes the definition of a noise envelope around airports within which aviation growth could be managed with consideration for technology and operational changes leading to a reduction in noise impacts per plane. | The Commission will consider the concept of noise envelopes further in Phase 2, taking account of the short listed options under consideration. Noise envelopes could be an effective way of managing the noise impacts of any new airport or runway development. |

| | Traffic distribution rules | The Commission's view |
|---|---|---|
| 82 | *Promote 'reliever airports' concept:*<br>This would provide support and/or financial incentives to encourage the growth of airports providing dedicated support for the business and general aviation markets, with the potential additional benefit of reducing the use of congested airports for this traffic. | The Commission is supportive of the reliever airports concept. The Commission recognises that this may be the best way to cater for the needs of business users without disrupting the wider airport system. The Commission acknowledges, however, that the UK's competitive, privatised ownership model does not lend itself to a strict replication of the 'New York system'. The Commission recognises that airports such as Luton have successfully built their share of the business jet market and is not convinced of the need for Government intervention. |
| 83 | *Promote use of Northolt to accommodate some Heathrow traffic:*<br>This measure would make further use of RAF Northolt to accommodate some small aircraft that would otherwise use Heathrow, providing a fast, regular surface transport link (and potentially road improvements) between the two airports.<br>More ambitious versions of this proposal would see the runway at Northolt lengthened (to allow for use by larger aircraft) and realigned (to reduce conflicts with Heathrow's airspace). | The Commission does not recommend this option. The Commission has concluded that Northolt's current runway length and alignment place significant restrictions upon its use. Furthermore, that the population affected by noise from increased operations at Northolt would be substantial, and that extending and realigning Northolt's runway would require planning processes of comparable length and difficulty to the construction of one net additional runway at Heathrow. |
| 84 | *Introduction of a helicopter link between Heathrow and Gatwick airports:*<br>This proposal is seeking to remove restrictions in place to allow for a fast and frequent helicopter link between Heathrow and Gatwick airports to facilitate a virtual hub concept. | The Commission does not recommend this. There is no clear evidence of substantial demand for interchange and a helicopter shuttle would not appear to represent a cost effective or environmentally proportionate solution. |

# ISHR-002

Written summary of oral representation at OFH 18/3/19, provided to DL5

**MANSTON AIRPORT DEVELOPMENT ORDER EXAMINATION**

**SUBMISSION FOR DEADLINE 5 (Part Three)**
**WRITTEN SUMMARY OF ORAL REPRESENTATION MADE AT**
**OPEN FLOOR HEARING OF 18/3/19**
**FROM LOCAL BUSINESS AND INTERESTED PARTY, FIVE10TWELVE LTD**

1. I'm not going to waste any time here addressing the Applicant's flimsy 'need' case, save to say it runs counter to more than 25 years of successive government reports and policy statements that have repeatedly assessed and consistently ruled out Manston.

2. But apparently the Applicant knows best.

3. Be that as it may, the National Policy Statement for Airports - the NPS - states that a balance must be struck between the adverse impacts of airport development and any potential benefits.

4. Adverse effects of any airport are well-documented.

5. In the case of Manston, however, a determining factor to date has been the rather unique adverse effects caused by the orientation of the runway and the proximity of the site to Ramsgate, resulting in aircraft flying over the heads of a town of 40,000 people at altitudes of 300 to 600ft.

6. The NPS further states at 4.4 that in considering any proposed airport developments a balance must be struck between the adverse impacts and any potential benefits and - I quote - *"**The Secretary of State will have regard to the manner in which benefits are secured, and the level of confidence in their delivery"**.*

**7.** Which brings us to the question of Operations.

8. And here - again - there is a crucial difference between **this** DCO Application and plans being put forwards by Heathrow, Gatwick, East Midlands, Manchester, Doncaster, Stansted, Luton, and Kent's existing airport at Lydd.

9. The difference is that those other plans are being put forwards by actual, successful airport operators.

10. In this case, however, the Applicant appears to have now given up even trying to pretend that it has any such credentials.

11. Having been challenged to evidence the 20-plus-years experience of airport operations on the team, they have **failed to provide any CVs or detailed career histories of the Directors**. And anyone who has read my submission in response to the Applicant's answers to the ExA's Funding and Resources questions[1] will know exactly why that is.

12. The Applicant made no attempt to claim any successful Airport Ops experience in its response to the ExA's Funding Questions, saying at F.1.15 they will "bring in" "*suitably qualified and experienced professionals in Airport Operations* ***following the grant of any DCO***" .

13. This gives a clear indication that the **Applicant's only interest is in getting the land**. They make no attempt to hide this. They are openly saying they will figure out all that complicated "developing and running an Airport" stuff later on. They just want the land.

14. It gets worse. The **Applicant goes on to absolve itself of any responsibility** for delivering any operational success and makes some quite extraordinary statements implying that actually that's up to the CAA, saying (and I quote):

[1] **REP4-042** Five10Twelve Comments on Applicant's responses to Written Questions, Q.F.1.1

"***The Applicant recognises the vital role <u>of the aviation regulatory community</u> in delivering this project"***[2] *and*

***"it <u>is the responsibility of the CAA</u> to ensure that the holders of an Aerodrome Licence are financially and operationally competent and suitable persons"***[3]

So, if it all goes wrong, as it did so spectacularly with Mr Freudmann's previous attempts at Odense in 2005[4] - and Manston - and at Lahr[5] immediately before embarking on this current vanity project in 2013, apparently it will be the CAA's fault.

15. There are many fundamental issues with this, which - with the greatest respect to the Examining Authority - present you with **an impossible task with regards to giving the Secretary of State any confidence** at about the manner in which any benefits might be secured or any confidence whatsoever that the Applicant is capable of delivering them.

16. But before we even get to the operational issues, the Applicant's own application and derisory responses to the ExA's questions also make it painfully clear that there are no *"suitably qualified and experienced professionals in Airport Operations"* on the Applicant's team.

17. How many more times do we have to read statements like :

"This will **now** be provided at the ***next*** deadline" or...
"We have not produced any detailed costings for this" or...
"We do not feel it is necessary to provide this information"?

And increasingly - and worryingly for the ExA ….
"Will will produce this ***after the DCO is granted***"

[2] **REP4-042** Five10Twelve Comments on Applicant's responses to Written Questions, F.1.15
[3] *ibid*
[4] *Ibid,* F.1.1, Paragraphs 1.9-1.11
[5] *Ibid,* Paragraphs 1.25-1.30

18. How many more statutory bodies - from the CAA to KCC - need to tell the same story of things not being following through? Appropriate policies not being respected? Noise modelling and other EIS work being based on unsupported assumptions? Work having to be re-done to the point that Wheatcroft is just hanging around the doorway waiting to burst in at any moment?

19. **Right now** and throughout this process, the lack of any credible airport operations experience is *already* **a serious risk and impediment to this DCO**, it's a risk to the examination and it's a significant factor in the Applicant's continued inability to evidence it has the necessary finance and funding in place.

20. The Applicant will no doubt say that it's OK, because they've brought in industry experts to help with the application. But here, again, their **lack of experience and understanding cannot be ignored**.

21. I know you have heard already - and will hear plenty more - about the Azimuth Report and the validity, or otherwise, of Dr Sally Dixon's work. Without even going into that whole minefield here, can you imagine Heathrow or Gatwick or any other experienced airport operator commissioning a report upon which their entire DCO case is based from an **independent freelancer with little or no experience** of success in this field, when the ink on her recently completed PhD is barely even dry?[6]

22. The Applicant will no doubt claim that none of this matters because they have also bought in lots of top notch industry professionals too - they claim they have spent £13 million - although this too, has not been evidenced - on the likes of Osprey and RPS and Northpoint and CBRE.

23. But there is overwhelming evidence that the scope of those consultant's work has been constrained by the Applicant's lack of resources and the optimism bias of the Applicant's preferred 'best case' scenarios.

24. And if - as in this DCO Applicant's case - you don't know what you're doing - if you don't know those "*known unknowns*" and "*unknowns unknowns*" - then the brief and scope you are able to provide to any consultant is also going to be **constrained by that lack of knowledge and experience**. They don't know the right questions to

[6] **REP3-223** Five10Twelve DL3 Submission, Response to Relevant Representations, Paragraph 5

ask because they don't know what they don't know. Even the best consultants are only as good as the brief and scope they are given.

25. As for the lack of resources, even if we generously take the Applicant at its word that they have spent £13m to date, this pales into insignificance in comparison with the £57m that Stansted Airport spent in consultancy fees on its own expansion to 2008[7].

26. That same Competition Commission report was another one of many which found that Manston, specifically, was not a viable option for South East airport expansion. And, like every other report, this also wasn't for commercial or operational viability reasons - which will always be debatable - but because of its poor location, which is not[8].

27. In conclusion, there are so many issues with all of this, which - with the greatest respect to the Examining Authority - present you with an **impossible task** in giving the Secretary of State any confidence that the alleged cargo airport 'benefits' can be delivered.

28. My question to the ExA, is whether you can have any confidence whatsoever in recommending that 25 years of previous governmental recommendations and appraisals regarding Manston's viability should be reversed on account of **this** Applicant's say so?

29. Are you ready to put your trust - and ours - in **this** Applicant to successfully deliver, when if things go wrong - as they inevitably will - then just at happened under Mr Freudmann's watch at Odense and at Black Forest Lahr - it will be up to public bodies - and the public purse - to pick up the pieces and repair all the considerable damage that this has caused?

---

[7] **Appendix OFH-001** Excerpt from 2009 Competition Commission investigation into BAA Airports market, page 102, paragraph 4.39

[8] **Appendix OFH-002** Excerpt from 2009 Competition Commission investigation into BAA Airports market, page 98, paragraph 4.15 (e)

**Full 2009 Competition Commission Report available at:**
https://webarchive.nationalarchives.gov.uk/20140402170726/http:/www.competition-commission.org.uk/assets/competitioncommission/docs/pdf/non-inquiry/rep_pub/reports/2009/fulltext/545.pdf )

# ISHR-003

## The Sustainability of UK Aviation
## Independent Transport Commission (ITC)
## March 2016

# The sustainability of UK Aviation:

## Trends in the mitigation of noise and emissions

Peter Hind and RDC Aviation Ltd

March 2016

INDEPENDENT **TRANSPORT** COMMISSION

## Published by the Independent Transport Commission

The **Independent Transport Commission (ITC)** is one of Britain's leading research charities with a mission to explore all aspects of transport and land use policy. Through our independent research work and educational events we aim to improve and better inform public policy making. For more information on our current research and activities please see our website: **www.theitc.org.uk**

Independent Transport Commission
70 Cowcross Street
London
EC1M 6EJ

Tel No: **0207 253 5510**
**www.theitc.org.uk**

Registered Charity No. 1080134


## Acknowledgements:

This report was authored by Peter Hind and RDC Aviation, with advice from the ITC Steering Group comprising Dr Stephen Hickey, Simon Linnett, Professor Peter Jones and Dr Matthew Niblett. The ITC would like to record its gratitude to Peter and the RDC Aviation team, including Dan Irvine who was responsible for much of the data collection and analysis for the report. Both the ITC and RDC would like to thank representatives from the following organisations who have kindly provided help and advice with the research and data provision: NATS, Heathrow Airport, Gatwick Airport, Heathrow Hub, Sustainable Aviation, Finavia and Airbus with special thanks to Simon Warr, Ian Jopson, George Davies, Alison Addy, Haldane Dodd, Brian Pearce, Andy Jefferson and Andreas Arvanitakis

The ITC would also like to record its gratitude to its Core Benefactors, a list of whom can be found on the main ITC website. The views expressed in this paper are those of the authors and do not necessarily represent the collegiate view of the ITC.

**March 2016**

# Foreword from the ITC Chairman

The ITC has demonstrated through several research reports the importance of good international aviation connectivity for Britain, and the particular benefits of hosting a top, globally-connected, hub airport. We have therefore encouraged the Government to act swiftly and implement the Airports Commission's recommendations to allow the delivery of new aviation infrastructure.

That the Government has not yet done so is due to concerns about the environmental impacts of aviation, particularly in three areas: noise, carbon emissions, and local air quality. The Government announced in December 2015 that it would be conducting further work on noise and local air quality, as well as addressing sustainability concerns that have arisen over airport expansion, before it takes a decision on airport expansion. The ITC agrees that these are crucial issues. We have commissioned this report to explore the trajectory of improvements in aviation sustainability and to reach an assessment on whether these will continue.

This report, by aviation sustainability experts at RDC Aviation, has examined a wide range of sources relating to the noise, carbon emissions and pollutants that arise from aviation operations in the UK. The report indicates that technological and other improvements are available to mitigate any increases in noise, $CO_2$ and oxides of Nitrogen (NOx) emissions arising from airport expansion. Progress in these areas has been rapid over the past 30 years and the evidence suggests that improvements are likely to continue.

The researchers analysed NOx emissions and concluded that the contribution of these pollutants to poor air quality, even in the vicinity of airports, is caused principally by surface transport. The issue clearly needs to be tackled irrespective of airport expansion, and the report suggests tools exist to enable this to happen.

Aircraft noise is the other major local sustainability issue. The report points to the very significant progress in reducing noise impacts over the past 30 years and evidence that progress will continue. While clearly the measured noise impact is greater in areas of denser population, it is difficult for us to evaluate that impact when aircraft and significant other ambient noise exists. Noise could be reduced if the airport approach paths were managed with that objective, rather than, as for the rest of the flight, fuel economy.

Carbon emissions, meanwhile, are also likely to continue to reduce through progress in aircraft efficiency and operations. This is a global issue where unilateral action alone is insufficient. Significantly, the research suggests that, as well as its economic benefits, the 'hub' operational model produces up to 24% less carbon per passenger than the same connectivity provided through point-to-point services.

Finally, the report recognises that technology alone is not enough. It flags the need to build public confidence and trust, for example through a regulator with independence and powers to monitor and control sensitive issues such as noise.

The report concludes that although these environmental challenges are important and difficult, they are not insuperable. If tackled vigorously and transparently, it is possible for the UK to drive down the environmental costs of aviation while realising the great connectivity benefits that an expanded hub can provide. The challenge now is to move forward and actually deliver!

**Dr Stephen Hickey**
**Chairman of the Aviation working group**
**Independent Transport Commission**

# The sustainability of UK Aviation:
## Trends in the mitigation of noise and emissions

## Table of Contents

# Executive Summary

This study forms part of a series of papers that the ITC is commissioning on UK aviation strategy and how to meet our international connectivity needs. It has been produced following the studies undertaken by the Airports Commission into Airport capacity and the subsequent decision by the Government to undertake more research into the environmental effects before deciding on where to build the new capacity.

The aviation industry has come a long way in efficiency and sustainability through improvements in operations and technology since jet engines first soared over UK skies. However, as the industry continues to grow it will face a number of key challenges if it is to do so without adverse impacts on the environment and local communities. We see three core areas in which the industry must continue to improve: noise, local air quality and $CO_2$ emissions. Our analysis suggests that, over the coming decades, it is foreseeable that a range of solutions will enable forecasts of future growth to be delivered within acceptable environmental boundaries, even without step-changes in technology.

At a global level, we consider the most important of these to be the reduction in emissions of the greenhouse gases that contribute to climate change, but this is also the most difficult to reconcile since it will require global standards and international cooperation to achieve a workable solution without market distortion. Still, with progress being made by the United Nation's International Civil Aviation Organisation (ICAO), this is not an impossible problem to solve, and we suggest that even without mass-uptake in biofuels there are opportunities to mitigate and reduce the contribution of $CO_2$ from air transport. Market-based mechanisms such as carbon trading coupled with continued advances in airframe technology and operating procedure improvements can all contribute to reducing fuel burn and $CO_2$ emissions. Our work suggests that the hub-and-spoke model is the more efficient method of transporting passengers and freight across a wide range of routes – through the use of larger, more efficient aircraft – when it comes to $CO_2$, although the model concentrates noise at the hub location.

At a local level, the more apparent issues are those of noise and local air quality. Our research shows that whilst these pose significant challenges within the UK, neither are insurmountable. Aircraft noise has been falling year-by-year with new technology improvements and is substantially lower than 30 years ago, while improvements in the technology behind aircraft navigation will offer much improved opportunities for noise respite. Our findings show a 'technology implementation gap' from the late-1980s to very recent times, with almost no completely new airframe development, other than the Boeing 777 in 1995, until the Airbus A380 in 2005. Consequently much of today's fleet, particularly in the long-haul segment, is operating legacy equipment with airframes and engines designed in the 1980s and 90s. The very recent introduction of aircraft built on new technology, the Boeing 787 (commercial launch, 2012) and Airbus A350 (2015), will deliver quantifiable improvements in noise and are expected to quickly proliferate the global fleet, replacing the old equipment. Short-term fixes such as sharing standard operating procedures between airlines can play a part in ensuring avoidable noise, such as that caused by the drag from landing gear, can be minimised across all operators using a particular airport.

Local air quality remains an important issue, particularly in the communities immediately around any airport. Whilst the Airports Commission was unable to confirm that some of the expansion proposals would not breach EU limits, the most significant observation here is that Oxides of Nitrogen (NOx) output is a product of the whole transport spectrum and not primarily aviation. Road transport accounts for just under one third of NOx emissions in the UK[1], with the proportion increasing in areas of intense vehicle concentration such as the M25 and M4 road network around Heathrow, which carries over 300,000 vehicle journeys per day[2]. Road travel has seen significant reductions in NOx and other harmful gases in recent years, and unlike aviation it has the opportunity to embrace green propulsion within the next decade or two, meaning that in the long term, even with growth in aircraft movements, there is opportunity to improve air quality around our airports. That is not to dismiss the need to reduce airport-based NOx emissions, which are mostly generated by aircraft taxiing and running the Auxiliary Power Unit (APU) while stationary. Moving to biofuel powered Ground Power Units (GPUs) or clean Fixed Electrical Ground Power (FEGP) with single-engine taxi, provide immediate alternatives to current procedures and will reduce NOx output.

For these local issues it is especially important to engage with the communities, so that they can understand and influence the way the airports operate and what is being done to reduce the impact on noise and emissions. These include consultation on and full disclosure of long-term proposals for flight paths and periods of respite; legally binding targets; and the creation of tools to aid in monitoring aircraft, such as the WebTrak tool in use at Helsinki airport.

Policy at a UK and international level can also provide a focus on bringing forward solutions. Government mandates to use alternative fuels can bring forward investment in such technology; the ICAO noise chapters provide a mechanism for airports to penalise noisy aircraft and for governments to ban them from airspace. We note that there is sometimes a trade-off between environmental objectives where, for example, a more noise efficient route may be less $CO_2$ efficient. Development of a flight-level environmental scoring metric which balances noise around airports with $CO_2$ for other phases of flight, similar to the NATS 3Di measure, could be used to highlight which airlines operate with environmental sensitivity rather than just in the most fuel efficient way. Mandated use of some flight paths could be considered to offset the flexibility airlines have in their daily flight planning, coupled with a coherent strategy on noise from government, mandating how to use flight paths to limit the impact on communities. We support the creation of an independent noise authority with powers to research and recommend best practise, monitor performance and fine operators for breaching agreed targets. Likewise, existing and planned market-based mechanisms should be adapted to recognise that different objectives apply for flight phases close to airports.

By UK standards the London airports have high levels of access by public transport, but these remain behind the global leaders. In order for any new capacity to be delivered sustainably, it needs to be developed in the context of the wider transport network and not as a standalone project. This means, as far as possible, closer integration with the rail network to provide easy dispersion of traffic not just to London but the rest of the South East, Midlands and West.

1 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/486085/Emissions_of_air_pollutants_statistical_release_2015_-_Final__2_.pdf

2 Department for Transport – Annual road traffic census counts

# 1. Introduction

**1.1** This paper has been commissioned by the Independent Transport Commission (ITC), Britain's leading research charity focused on transport, land-use and planning issues, and written by the independent consultancy firm RDC Aviation Ltd. (RDC).

**1.2** Previous studies by the ITC have concluded that the hub model is the optimal choice for improving the UK's long-haul connectivity and therefore the prospects for the UK as an international economy. In order to meet future demand projections, it has been identified that a hub with a minimum of three runways would be required.

**1.3** The ITC analysis has been published following the recommendations of the government-appointed Airports Commission and the UK government's subsequent response. The Commission investigated the options available to the South East UK's airport capacity problem, concluding that a hub model must be pursued and that the optimal location for additional capacity is at London's Heathrow Airport. The UK government has requested more work be undertaken to understand the environmental costs of the proposals. The aim of this ITC paper is not to compare the proposals, but to investigate the overall sustainability of UK aviation in this context.

## Airports Commission Findings and Government Response

**1.4** The conclusions of the Airports Commission highlighted that although additional capacity is urgently needed, it must be delivered using a "balanced approach" that ensures the long-term sustainability of the project.

**1.5** This report builds on and supplements the previous publications of both the ITC and the Airports Commission by assessing the capability of UK aviation to develop sustainably in the medium to long-term future. In this report, sustainability is viewed as meeting the demand for air travel whilst not increasing, and where possible decreasing, the social and environmental impacts of its operation, both in terms of local impacts (air quality and noise) and global impacts (specifically climate change).

**1.6** The Airports Commission concluded that sustainability is highly important for the delivery of much needed capacity to London's airports but that it is also achievable. Of the schemes that were considered, the Commission concluded that a second runway at Gatwick would have the least impact in terms of noise, air quality and $CO_2$. We also note that the sustainability of a scheme is a factor of the type of setting/locality that each occupies, and that decision makers will need to look at the core areas of noise, air quality and carbon, alongside the broader environmental, social and economic sustainability aspects of a major infrastructure scheme such as airport capacity expansion. However, it was also concluded that the impacts were not significant enough to outweigh the economic argument in favour of Heathrow, and therefore overall the Commission recommended a third runway to be built at Heathrow.

**1.7** There are challenges in unravelling the incremental noise attributable to aircraft flying over West London and there is scope for substantial additional research in this area. Present policy is based around concentrating noise, which produces greater periods

of exposure for fewer people. Understanding whether this approach is preferable to dispersing noise around a wider population base but for shorter periods should be a core aim. Both Heathrow runway proposals offer different solutions in this respect, with Heathrow Hub giving potential to move the whole noise envelope approximately two-miles west when capacity allows, whilst the Heathrow scheme offers options for more respite periods. Both schemes enable alternation of the runways being used for landing and take-off to some extent, and thereby provide scope for extended periods of respite for residents. The Commission believe that this, along with improving technology and the use of displaced thresholds, will significantly reduce the noise impact on the community after the construction of a new runway.

**1.8** In terms of emissions, the Airports Commission could not be certain that some EU limits on air quality would not be breached with expansion of Heathrow, but requested more work be undertaken before setting concrete conclusions on this and acknowledged that the mitigation measures put forward were credible. The forecasts suggested all expansion schemes are likely to increase $CO_2$ emissions by varying extents, although this could be mitigated to an extent by carbon trading and/or carbon capping.

**1.9** The UK government's response to this, published in December 2015, declares that while it is agreed that more capacity is needed, more research into the environmental effects of the proposals needs to be undertaken to ensure that the decision creates a sustainable future for UK aviation. The Secretary of State for Transport, The Rt Hon Patrick McLoughlin said: *"The case for aviation expansion is clear – but it's vitally important we get the decision right so that it will benefit generations to come. We will undertake more work on environmental impacts, including air quality, noise and carbon."*

## UK's Commitments on Climate Change

**1.10** The UK has been one of the leaders worldwide in addressing the climate change problem. It was a signatory on the Kyoto Protocol, which committed the UK to reducing greenhouse gas emissions to 12.5% below 1990 levels by 2012 – a task which was successfully accomplished, with emissions actually falling to 27% below 1990 levels in 2011 (Committee on Climate Change). However, the UK remains committed to reducing emissions further, and the 2008 climate change act has set the target of reducing greenhouse gas emissions to 80% below 1990 levels by 2050. Furthermore, as a part of the European Union the UK has agreed to several more specific measures for tackling climate change, these include the emissions trading scheme and a commitment for the transport sector to use 15% renewable fuels by 2020.

**1.11** There have been a number of practical difficulties in placing aviation within these targets in the past, as the multi-national nature of the industry makes it difficult to assign responsibility for emissions. Indeed at the latest meeting of the United Nations Framework Convention on Climate Change (COP21) aviation, along with maritime, was not specifically covered by the milestone agreement. However, it is clearly important aviation is included in these targets as soon as possible and rightly held accountable for its environmental impacts.

# 2. Sustainability and Air Transport – A Background

**2.1** Air transport's impact on climate change through $CO_2$ emissions has been well documented in the mainstream media. It is the industry's largest pollutant and has been shown to have a direct effect on climate change. It is formed by the combustion of fuel in aircraft engines and therefore is a direct linear function of fuel burn, which means that airlines have a significant incentive to reduce their $CO_2$ emissions indirectly by reducing their fuel costs, which can account for up to 40% of operating cost on some routes. Therefore whilst $CO_2$ emissions remain a long-term challenge for the industry, it is an issue that can be tackled through technological developments and market forces.

## Industry Position

**2.2** The aviation industry has been developing its environmental agenda for many years and although growth in air transport has meant an increase in total emissions and frequency of noise at many airports, at an individual flight level aircraft are now more fuel efficient and quieter than ever before. Efforts were focused more on noise reduction in the early years of the jet engine, while the last two-decades have seen fuel burn and emissions output become of equal importance. Sustainability is now recognised as being critical to future expansion rather than simply an aspiration.

**2.3** The International Air Transport Association's (IATA) goal for aviation emissions over the next 35 years is for the industry to reduce its carbon footprint to half that of a baseline year (2005). It has developed a four-pillar strategy to achieve this, focusing on technology, operations, infrastructure and carbon trading as the key levers of improvement. The core ambition is for airlines to increase fuel efficiency at a rate of 1.5% per annum to 2020; carbon neutral growth after 2020; and by 2050 to have achieved a reduction of 50% in $CO_2$ emissions against the 2005 baseline. For this to be achievable at a global level, within the backdrop of growing demand for air travel, each of the four-pillars will need to deliver potential savings unless there is a step-change in technology.

**2.4** Our analysis shows that long-term fuel efficiency of 1.6% should be achieved simply through the proliferation of new aircraft replacing old and that a range of other measures can deliver additional fuel savings at a flight-level. The industry is already participating in various market-based mechanisms (MBMs) – intra-European flights have been included in the Europe's Emissions Trading Scheme since 2012, meaning emissions are monitored, reported and accounted for along with the other industries within the scheme.

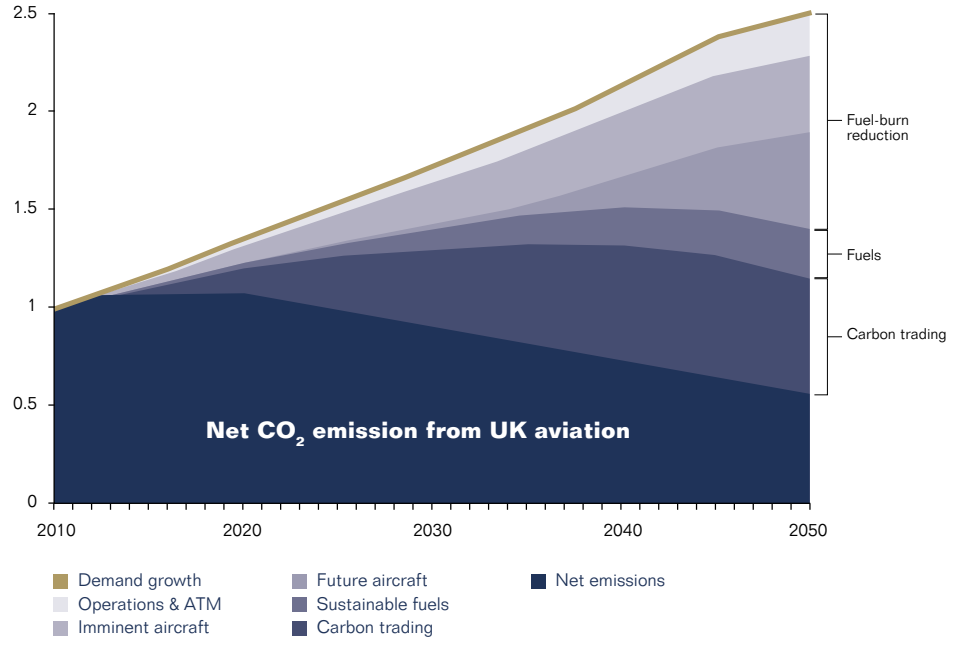
**2.5** Although the recent UNFCCC COP21 meeting concluded with the adoption of the Paris Agreement, it lacked any specific reference to international aviation. The UN agency responsible for aviation, ICAO, has committed to the implementation of a MBM solution covering international aviation from 2020 and will be discussing high level resolution text in May 2016, ahead of presenting recommendations at its 39th Assembly later in the year.

**2.6** Alongside IATA and ICAO sit a number of other groups looking into the long term sustainability options for air transport, notably Sustainable Aviation; Air Transport Action Group (ATAG); and the US-led Commercial Aviation Alternative Fuels Initiative (CAAFI). What is unusual about these groups, compared to other industries, is they pull together the spectrum of industry participants rather than acting as a lobby group representing the views of one side of the industry. Sustainable Aviation, for example, counts airlines, airports, airframe and engine manufacturers and air navigation service providers amongst its members. This collaborative approach ensures expert input and common understanding can be used to develop workable solutions.

## Emissions Roadmap

**2.7** Looking at how the UK can meet its emissions objectives, the roadmap developed by Sustainable Aviation shows the effect of various improvements in fuel burn on UK emissions to 2050. By carefully considering the relative potential of improvements from operations, new aircraft, sustainable fuels and carbon trading, Sustainable Aviation predicts that with contributions from all these areas, UK aviation can accommodate significant growth to 2050 without substantially increasing its contribution to $CO_2$ levels.

Figure 1: Sustainable Aviation Carbon Roadmap

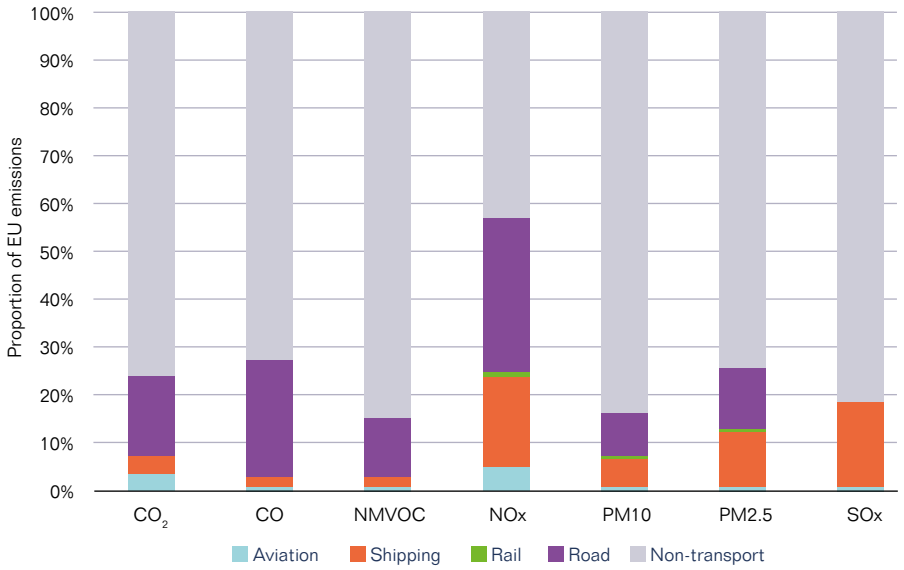



*Source: Sustainable Aviation $CO_2$ Roadmap*

## Local Air Quality

**2.8** Whilst $CO_2$ is the greatest contributor towards the global climate change problem, at a local level several emissions are known to be contributors to local air quality problems, which recently have been highlighted in a number of challenges against expanding London's airport capacity. In urban areas road traffic is the dominant source of pollutants affecting local air quality. Figure 2 shows how aviation's contribution to these harmful emissions compares with both other transport modes and the EU as a whole.

Figure 2: EU Emissions by Transport Mode




Key to Abbreviations: $CO_2$ = Carbon Dioxide; CO = Carbon Monoxide; NMVOC = Non-methane volatile organic compounds; NOx = nitrogen oxides; PM10 = Particulate matter 10 microns or lower; PM2.5 = Particulate matter 2.5 microns or lower; SOx = sulphur oxides.

*Source: European Environment Agency (EEA)*

**2.9** Although various emissions are created in flight, aviation only generates a significant contribution to overall emissions in the cases of $CO_2$ and NOx. Unlike $CO_2$, the production of NOx is not directly linked to fuel burn, and therefore there has been a strong push from industry to regulate and minimise NOx production, particularly in new aircraft. Above about 200m aircraft do not make a significant contribution to local air quality.[3] The largest source of NOx at airports is usually not the aircraft but the surface access routes; however road travel in particular is also making strong progress in reducing NOx emissions (see chapter 6) and therefore the impact of NOx at airports is expected to decrease over time.

3 Rogers, H.L., Lee, D.S., Raper, D.W., de, F., Forster, P.M., Wilson, C.W., Newton, P.J., 2002. The impacts of aviation on the atmosphere. The Aeronautical Journal. 106, 521–546. Copy available at http://uk-air.defra.gov.uk/assets/documents/ozone-u6/aviation_impacts.pdf

## Noise

**2.10** Noise from aviation and its supporting operations is a key issue at airports across the world. It is frequently perceived as a nuisance and detriment to quality of life, and can be a significant barrier to the growth of an airport and its related aviation facilities. This problem is greatest in the evening, night and early morning when people are more likely to be at home and it can have a serious impact on sleep patterns and the quality of life of local residents. This is a problem that airlines and airports are actively engaged in rectifying, as limits on night flying ("curfews") can harm an airline's profitability for overnight freight and long flights that must arrive/depart at inconvenient times in order to comply with curfews. However, as discussed in the ITC's previous work, we do not believe a UK hub needs 24 hour operations to be effective.

**2.11** The most direct cause of noise from aircraft is from the combustion of fuel in engines. This is typically louder on take-off but is also significant on approach when aircraft are in line with the runway for several miles before touchdown. It generally peaks on touch-down as reverse thrusters are deployed to bring the aircraft to a safe and swift stop.

**2.12** Noise improvements from technology have typically come from engines, but as these have become significantly quieter, other aspects of the aircraft are increasingly being studied for their own noise improvements. This particularly considers the frame of the aircraft itself, and the noises that are created as high-speed air rushes across it. Noise can also be made by the turbulence created by hot air from the engines mixing with cold surrounding air – a particular solution to this problem can be seen on the serrated edges of the nacelles on the Rolls Royce Trent 1000 and General Electric GEnx engines that power the Boeing 787 Dreamliner (below).

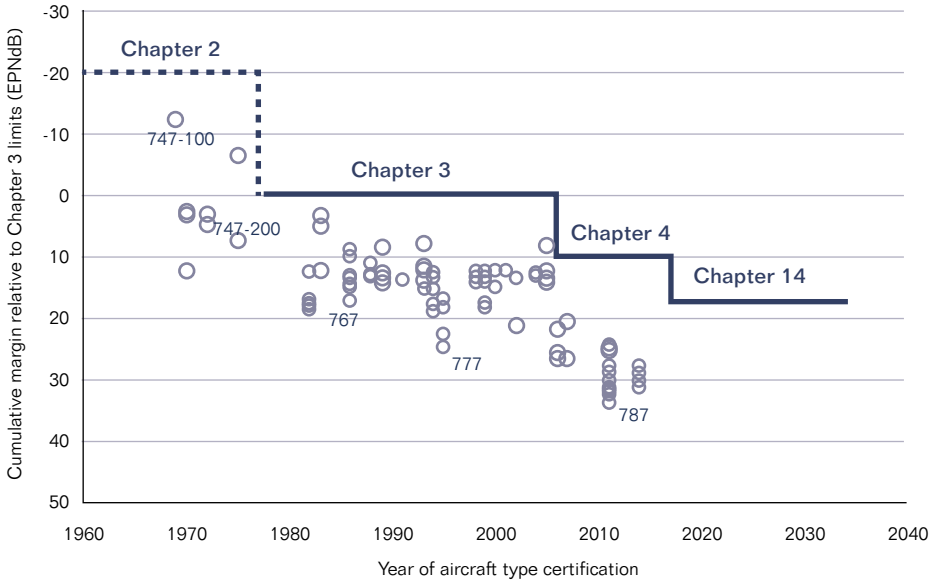
Figure 3: Rolls Royce Trent 1000

*Source: Wikimedia Commons*

**2.13** Noise problems from aviation are not limited to aircraft operations. Airports, as the focal point for transport interchanges, generate additional noise from airport-based vehicle operations as well as surface access traffic using the local road and rail infrastructure.

**2.14** Noise can be regulated in a number of ways. On an industry-wide scale, the International Civil Aviation Organisation (ICAO) provides a pre-emptive regulation measure through the categorisation of aircraft into noise "chapters". Airports and authorities can then place limits on noise by chapter of aircraft, either through a total ban, time restrictions or quota limits. There is therefore an incentive for manufacturers to reduce noise output from their aircraft in order to fit into the more flexible of these noise chapters. Chapter 2 aircraft have been completely banned from flying in European airspace since 2002, and chapter 3 will be expected to follow in due course. This measure effectively performs as a 'one way valve', as aircraft are only allowed to become quieter and never noisier. This also leads to improved technology, both for new aircraft and for the retrofitting of older aircraft with quieter or cleaner equipment such as hush-kits. The noise chapters have been displayed in figure 4 with wide-body aircraft plotted, showing the progression of chapter 4 and beyond compared to a baseline of chapter 3.

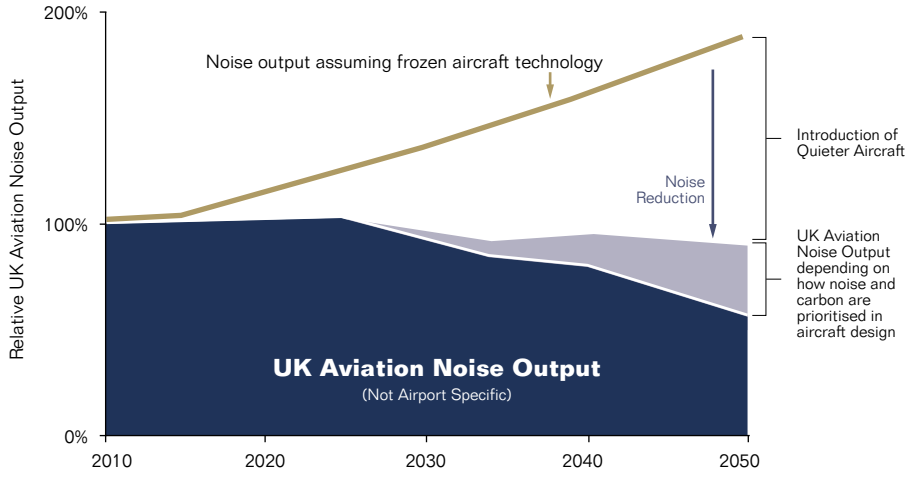
Figure 4 - ICAO noise chapter performance of wide-body aircraft since 1960




*Source: EASA European Aviation Environmental Report*

**2.15** The noise roadmap compiled by Sustainable Aviation produced the diagram below as a sign of how the industry is expected to develop to 2050 assuming a strong level of growth. The most significant reductions are seen to come from improvements in technology and the implementation of the best technology that is available today, keeping overall noise output below 2010 levels even with significant traffic growth. This roadmap does not include other potential reductions in noise such as from operational and behavioural changes that are described later in this paper.

Figure 5: Sustainable Aviation Noise Roadmap




*Source: Sustainable Aviation Noise Roadmap*

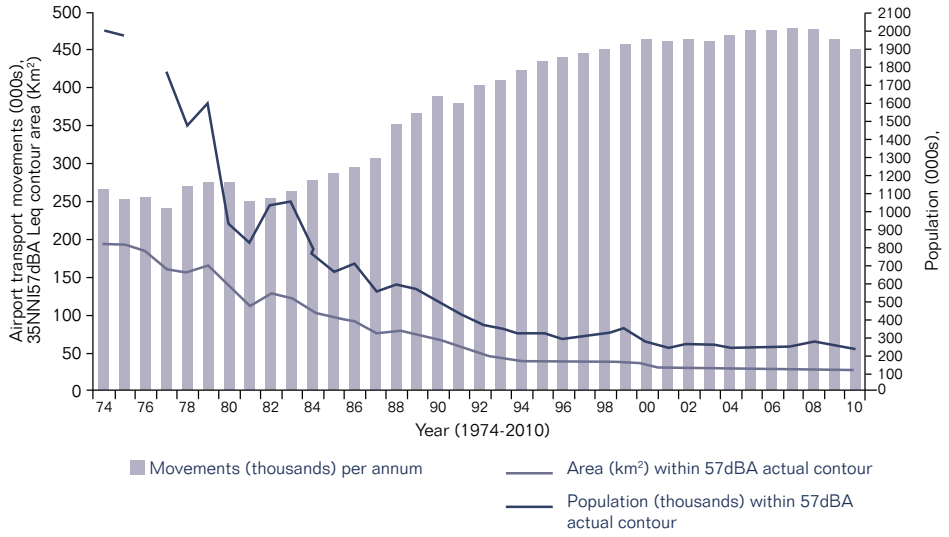
**2.16** Unfortunately, the solutions to the aviation industry's problems of noise and emissions are not always mutually compatible. Some solutions to one problem may come at the cost of another. This is highlighted by Sustainable Aviation as a potential area for noise improvement depending on where priorities are placed. Perhaps the clearest trade-off is in the design of airport flight-paths – for many local communities, re-routed flightpaths may be desired to avoid densely populated areas; however by flying indirectly more fuel will be burnt and therefore the impact from $CO_2$ and other gases on the global climate change problem will be greater. Other examples of these trade-offs exist in aircraft technology, where a noise reducing design on the fuselage may be aerodynamically less efficient, and a more fuel (and therefore carbon) efficient engine design, such as open rotor, may prove to be noisier than the jet engines they replace. Sustainability can only be achieved where these various demands are carefully evaluated and balanced alongside economic impacts to develop the optimal approach.

## Noise Progress

**2.17** Noise measurement and reporting is a complex area and whilst we know that aircraft are becoming quieter, and will continue to do so, understanding the impact on communities is challenging. The tolerance of resident groups affected by noise will differ based on a range of individual factors, as will the willingness of others to consider changes to flight-paths that might bring new areas into the noise envelope. One solution is to provide a long-term noise roadmap for the UKs major airports that considers how growth forecasts would be accommodated in a re-optimised UK airspace using next-generation navigation methods and working with communities to implement a binding agreement. An independent noise authority along the lines of that recommended by the Airports Commission should be a priority in ensuring any targets are implemented and adhered to.

**2.18** The noise improvements that have been made in the last half decade have been recorded by some airports and show progress has been made through the continued reduction in aircraft noise. The diagram below shows how the population within the 57dBA noise contour around Heathrow has decreased at a greater rate than the increase in movements from air transport.

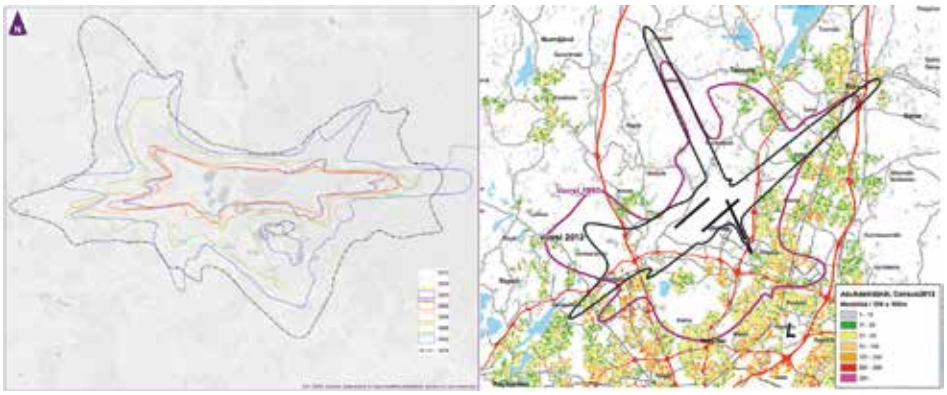
Figure 6: Land Area and Population Within the 57dBA Noise Contour




*Source: Heathrow Airport Ltd.*

**2.19** The impact of quieter aircraft can be illustrated from the noise maps of Heathrow and Helsinki airports, which are shown in Figure 7. Both charts show the size of the noise envelope over time and suggest that a combination of engine/airframe improvements and changes to navigation patterns can dramatically alter the shape of noise nuisance.

Figure 7: Shrinking Airport Noise Contours: Heathrow, 1974-2012 (left) and Helsinki, 1990-2013 (right)



*Source: Heathrow Airport Ltd, Helsinki Airport[4].*

**2.20** There is, of course, a limit to the progress that can be made in aircraft noise and ultimately the area beneath the final flight path, in which the aircraft is configured for landing and in line with the runway, will inevitably be the most affected by noise. That said, there remain ways to mitigate this by use of displaced thresholds or, in the case of the Heathrow Hub proposal, using the western runway for landing, in which case the noise contour could move 3km west at certain times of the day. Many of the Airports Commission proposals also promote the use of runway alternation, where runways used for arrivals or departures are changed predictably across the day to offer periods of respite. This is something that can only be offered when spare capacity is available.



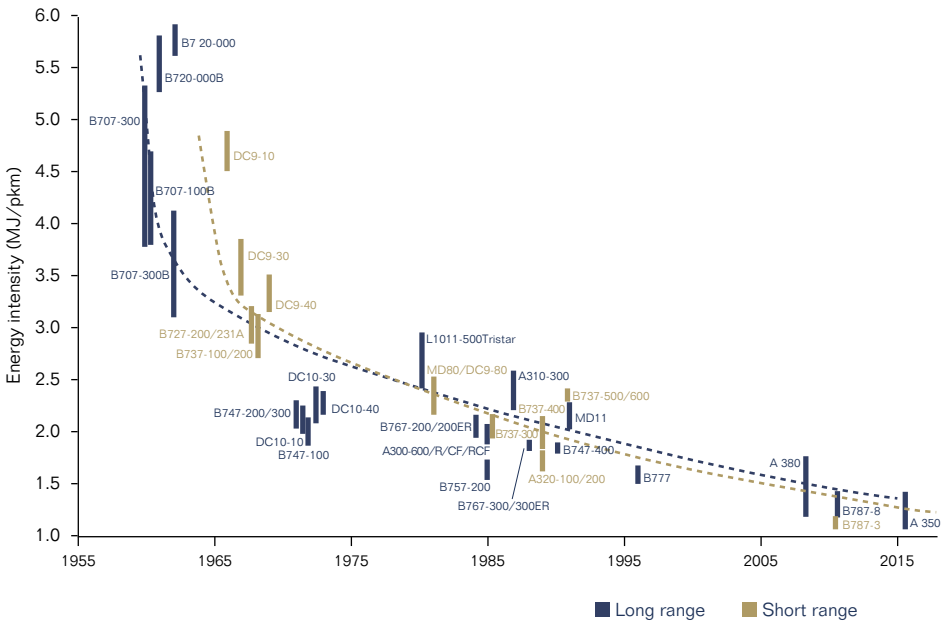
4 http://vuosikertomus.finavia.fi/en/2014/responsibility/responsibility-information/environmental-information/aircraft-noise-control/

# 3. Aircraft Design

**3.1** Improvement in the efficiency of technology is frequently cited as the main source of improvements in sustainability for the industry. The Committee for Climate Change (CCC) 2008 report into aviation and climate change predicted a 0.8% increase in fuel efficiency per annum as a result of these improvements, increasing to 1.5% with funding support for these new developments. This figure sits below our estimate of 1.6% before new developments.

**3.2** The improvements in technology can be easily demonstrated by the diagram below, produced by the International Energy Agency (IEA). Whilst it is immediately apparent that the greatest increases in efficiency were made in the early years of the jet age, the industry is continuing on a steep path of improvement. There was also a significant gap in the development of new technology between 1998 and 2008, other than the Boeing 777. Most of the aircraft in operation today are still of the pre-1998 generation but this is likely to rapidly swing towards the newer generation over the next few years, bringing with it substantial improvements in emissions and noise.

Figure 8: Aircraft Efficiency Gains since 1955




*Source: IEA, 2009*

**3.3** Engines have understandably been the focus of most of the technological improvements for aviation in recent years, as they are responsible for both the greatest noise output and the vast majority of emissions outputs. The technology has taken great leaps since the beginning of the "jet age" in the 1950s. The most visual difference is the switch from turbojet engines (known for their "cigar" shape) to the more modern and efficient turbofans.

**3.4** Turbofans have been incrementally improved by increases in the bypass ratio – that is, the ratio of the amount of air that passes through the fan but not the engine core to the amount of air that passes through the core itself. In practice this leads to larger, stubbier engines and increased fuel efficiency.

**3.5** Further improvements in turbofan performance are expected to arrive in the next generation of aircraft. One variety of improvement is known as a "geared" turbofan, which uses a series of gears to operate various compressor stages at different speeds. This is more efficient, providing greater thrust per unit of energy burned, and the reduction of the fan-tip speed below the speed of sound creates considerably less noise. Pratt and Whitney claim that their PW1000G geared turbofan engine will burn 16% less fuel than the current equivalent engines and reduce noise footprints by up to 75%.

**3.6** A turboprop is an alternative engine that is often preferred by regional and some low cost airlines. These engines provide a fuel efficiency benefit over turbofans that leads to lower emissions and lower operating costs. However, as well as being significantly noisier than turbojets, most turboprops lack the speed to be able to compete over longer distances.

**3.7** A study by Aviation Economics and Loughborough University[5] found that the narrow-body category of aircraft (formed mainly of variants of the Boeing 737 and Airbus A320 families) has become very efficient, able to offer a fuel burn of around 200g per seat per minute in the approach phase of flight, and there is a vast gap between these aircraft and the smaller wide-body aircraft in terms of efficiency.

**3.8** At the opposite end of the spectrum, "jumbo" sized aircraft are also becoming significantly more efficient. These were highlighted by the older 747-400 (530g of $CO_2$ per seat per minute) and its cutting-edge replacement Airbus A380 (320g of $CO_2$ per seat per minute), showing the vast improvements that have been made in technology in the 29 years between the aircraft developments.

**3.9** Whilst engine technology has improved substantially over previous decades, there remain a large number of opportunities for further improvement. In the short-term, increases of the propulsive efficiency through higher bypass engines may still yield the greatest improvements, however more radical engine designs may be needed in the mid to long term.

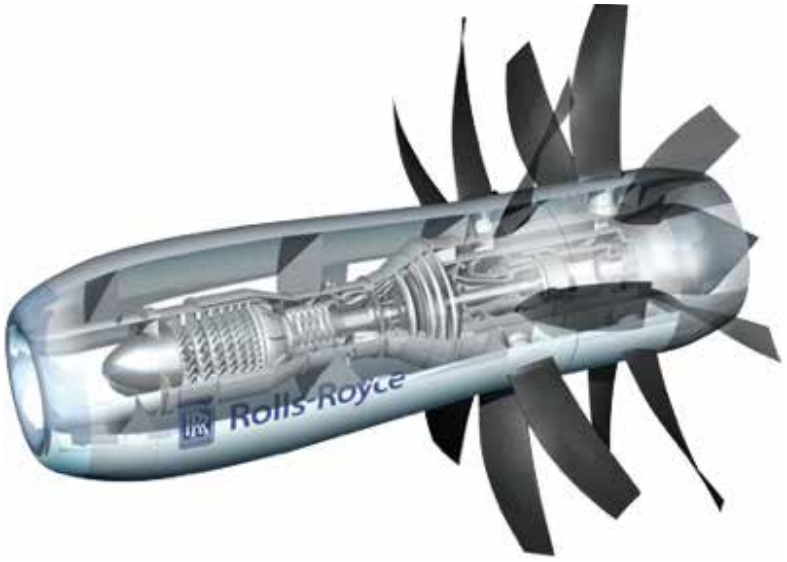


5 Irvine, Budd, Ison & Kitching (2015) "The environmental effects of peak hour air traffic congestion: the case of London Heathrow Airport" 73

## Open Rotor

**3.10** Open rotor engines are one particular design that the aviation industry has highlighted for future potential. These utilise many of the fuel efficiency gains of a turboprop engine whilst still maintaining the long distance speed that can be achieved with a turbofan. By increasing the fuel efficiency, emissions will be kept to a minimum. General Electric estimates that the first generation of open rotor aircraft could burn 15% less fuel than the current series of 737 aircraft. One potential issue with the open rotor design that will need to be resolved is that it would be expected to be noisier than an equivalent turbofan engine. Passengers have also been found to be sceptical to the use of propeller-based engines (viewed as old and less safe) and so the issue of passenger acceptance must also be addressed.

Figure 9: Open Rotor Engine




*Source: Rolls Royce*

**3.11** In the very long-term, the aviation industry must look to switch to a green propulsion option. The technology is currently not advanced enough to power a large airliner, however a number of milestones have been made with much smaller aircraft which demonstrate the feasibility of the technology. More information on these can be found in Chapter 7.

## Wing

**3.12** The wing of an aircraft is one of the most critical aspects in determining the efficiency of the airframe and how much noise it may generate in flight. An interesting case study in the improvements made in wing technology can be seen from Boeing's 737 family of aircraft. These aircraft have been manufactured since the 1960s and have undergone several significant redesigns in that time. From the 737 'Classic' series to the 737 'Next Generation' series (introduced in 1998), the wing span was increased significantly (by around 20%) to increase fuel efficiency and general performance. Blended winglets offer a 3.5% saving on fuel for an average length trip by the aircraft, while the newer split-scimitar winglets offer a further 1.6% fuel saving.

Figure 10: Split Scimitar Winglets

*Source: Wikimedia Commons*

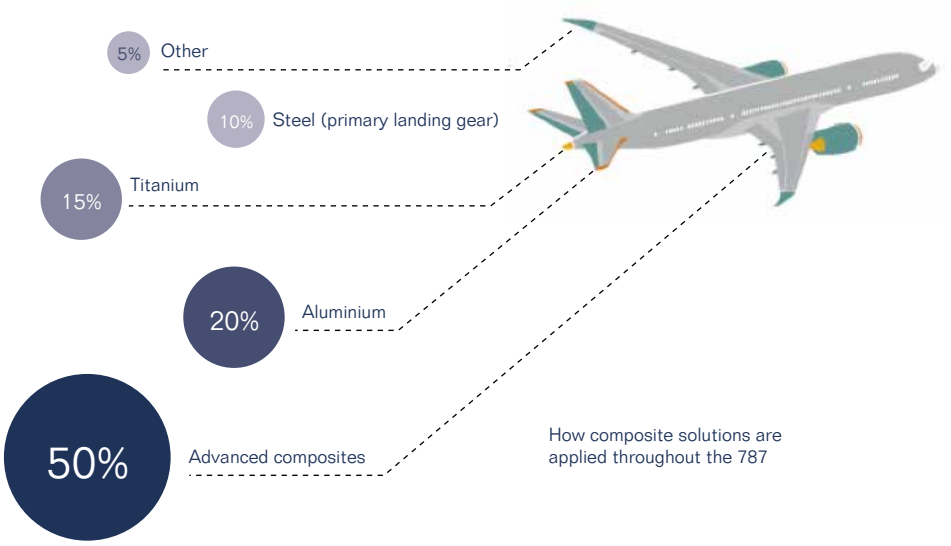
**3.13** The Airbus A320 is one of the most popular airliners flying today but has gained a reputation among residents under the flightpaths of some airports for its distinctive "whining" sound. This is caused by air rushing over circular openings on the underside of the wing, creating an effect similar to that of blowing over the top of a bottle. Airlines and airports have identified this and a solution has been created, reducing the noise impact by around 6dB. New aircraft now come with this update fitted and older aircraft are in the process of being retrofitted.

**3.14** In the long-term, efficiency of wing designs is likely to be improved by the use of laminar flow control – this means controlling the air flowing over the top of the wing and avoiding it becoming "turbulent" until as far back along the wing as possible. Estimates suggest this could save 4-5% in fuel burn (Airbus).

## Airframe

**3.15** The latest generation of new aircraft, the Airbus A350 and Boeing 787, are the first aircraft to be developed primarily with composite materials rather than aluminium or other metals. There are currently 375 of these types flying, representing just 24% of the total order-book to date. Both aircraft feature over 50% composite materials. For the Boeing 787 this represents a 20% weight reduction over a conventional aluminium design. The effect of this is that less thrust is required to propel the aircraft, and therefore not only is fuel efficiency dramatically increased but noise from the aircraft is lower.

Figure 11: Airframe Composition – Boeing 787

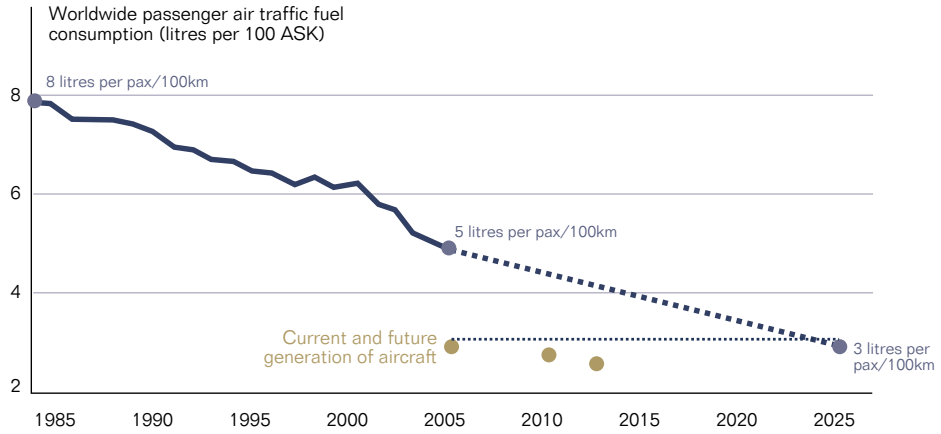



*Source: Boeing*

## Fuel Efficiency over Time

**3.16** Fuel efficiency of aviation has developed continually since the 1960s. Studies undertaken by the International Council on Clean Transportation (ICCT)[6] found that the gains were particularly large in the 60s and 70s, and though efficiency gains have slowed since 1990, they are estimated to be less than 50% of 1960 levels. A further study has been made by the International Coordinating Council of Aerospace Industries Associations (ICCAIA) using a metric of fuel burn per person per 100km. This interpretation suggests that fuel efficiency gains have continued since 2000, perhaps driven by a greater focus on improving load factors, which would not be accounted for in the ICCT model.

Figure 12: Fuel Efficiency and Forecast v Today




*Source: ICAO and ICCAIA*

**3.17** This diagram also displays the current fuel efficiency of the latest cutting edge aircraft (shown in gold). These aircraft currently burn around 60% of the overall industry average fuel consumption. The forecast here then makes the reasonable assumption that the industry average will reach this level by around 2025.



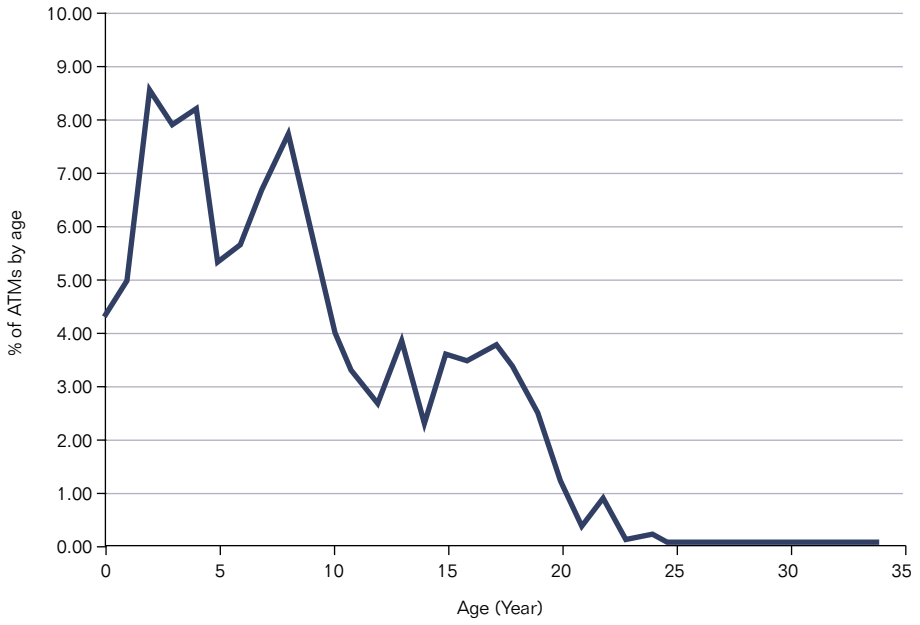
6 ICCT report – "Fuel efficiency trends for new commercial jet aircraft:1960 to 2014"

## Speed of Technology Implementation/Aircraft Life Cycles

**3.18** It stands to reason that the improvements in aircraft technology are limited in their impact by the speed at which they are taken up by the airlines. For all airlines, aircraft are a substantial investment leased or depreciated over long periods, and the economics of retiring old aircraft early to move to more efficient new airframes does not add up – the additional cost to change outweighs the savings. The balance sheet life of aircraft, and the cost element factored into airfares, is generally based on the life-cycle cost over 10 to 20 years. Furthermore, as the returns on operating new aircraft are long-term, a smaller or newer airline may look to purchase second-hand aircraft rather than the latest model (low cost airlines are the exception to this – see chapter 3). This means that it can take a very long time for a new and more efficient aircraft to completely replace the older, less efficient fleet.

**3.19** Shown below is a diagram from a study undertaken by consultants Ecometrics Research and Consulting (EMRC) and the AEA Technology (AEA) for the Department for Transport (DfT) on the sustainability opportunities in aviation. It showed the age of the UK fleet in 2007, demonstrating that the vast majority of the fleet at that stage was young (under 10 years old). However, there are several important aspects that this does not show. Firstly, by operating on a "per ATM" basis, the greatest emphasis is wrongly placed on short-haul flights, when research has shown the majority of emissions are burned on long-haul. Secondly, the study focuses only on UK airlines, ignoring the fact that foreign airlines flying to the UK are equally responsible for UK emissions. Finally, it is important to look at the age of the technology, rather than the age of the airframe itself, as this is a far bigger factor in emissions and noise output.

Figure 13: UK Fleet, Average Age

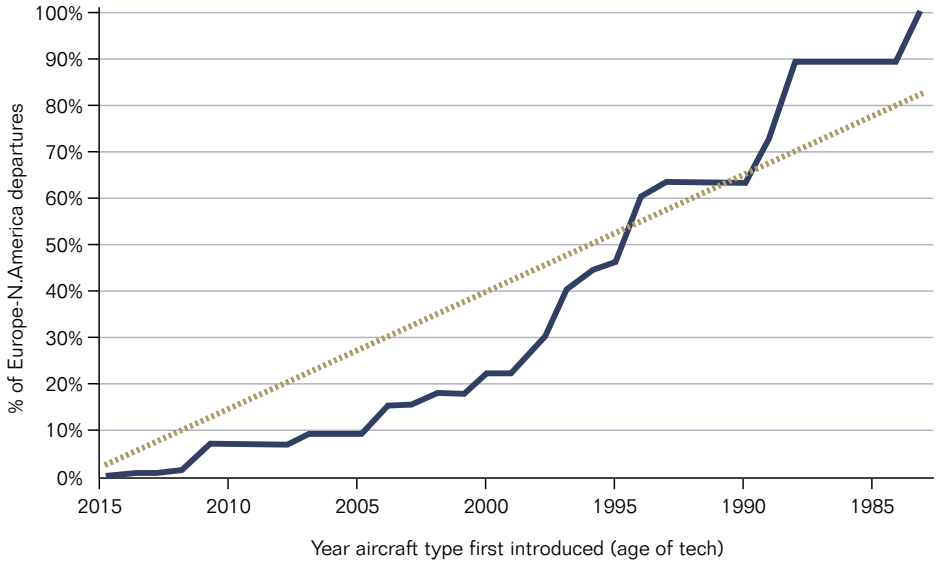



*Source: EMRC/AEA (for DfT)*

## Case Study – Trans Atlantic Market

**3.20** The figure below shows the technology age of aircraft operating in the transatlantic market (age based on date of first commercial flight for type). The transatlantic market has been chosen as it mostly negates the issue of varying distances affecting the "per ATM" metric and the North Atlantic crossing is operated by a reasonable selection of common aircraft with clearly defined aircraft models – the short-haul market view is clouded by dozens of smaller improvements over time to a small number of very popular models. The chart is slightly skewed by the presence of the 747-400, which was exceptionally popular in the 1990s/early 2000s and is soon approaching its retirement age, however the clear trend can be seen. The rate of technology uptake is around 2.5% per year, such that over 50% of the technology in operation is under 20 years old; however, the trend from the last 10 years has seen a very poor uptake of new technology, partly due to the lack of new technology to acquire.

Figure 14: Europe to North America Proportion of Flights in 2015 by Technology Age

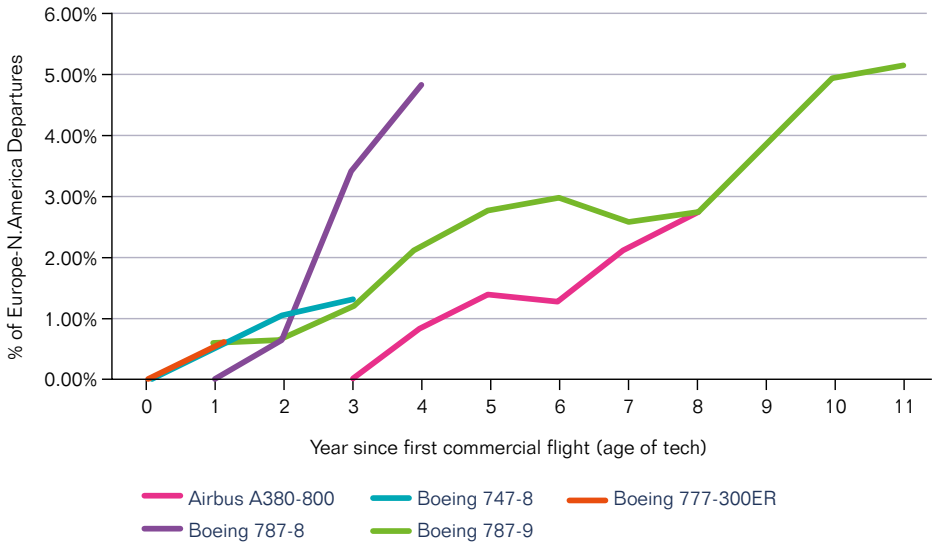



*Source: Capstats.com*

**3.21** To understand this situation further, the trend for five of the most popular recent aircraft models has been plotted on Figure 15 opposite. The oldest model of the chart, the 777-300ER is essentially an update of a slightly earlier model with improved range and performance. The steady rate of growth for this aircraft is therefore as would be expected. It is the last of the previous generation of wide-body aircraft, and the remaining four represent the latest generation. The Airbus A380 has been slow to enter the North Atlantic, not appearing in schedules until 2012, but has since developed strongly as British Airways, Air France and Lufthansa have taken more deliveries of the type. The newer aircraft types entering service since 2011 display a greater promise for the uptake of new technology. The 787-8 in particular has already

reached levels comparable with the 777-300ER despite being in commercial service for only four years. This therefore suggests that the apparent slowdown in technology uptake observed in the previous chart is more representative of a brief gap in technology generations and that the latest technology should be invested in coming years at least at the rate of 2.5% per year.

Figure 15: Uptake of New Technology, Trans-Atlantic Market




*Source: Capstats.com*

**3.22** The rate of technology uptake is critical to the sustainability of the aviation industry. Although to a certain extent the industry is able to address this itself thanks to the cost savings made from operating new aircraft, the prohibitive cost of these new airframes remains a significant problem, especially when older models are available for a mere fraction of the price, and the benefits of retiring an old airframe (i.e. scrap value) are also low. Furthermore, in times of low fuel prices, the incentive to fly more efficient equipment is reduced. Changes to the regulations regarding the operating lives of aircraft could provide a benefit to sustainability, however it is important that any national or EU-wide regulations encourage new aircraft investment, rather than simply punish operators of older aircraft, and that regulation is universal to avoid harming British or European airlines at the extent of international competitors.

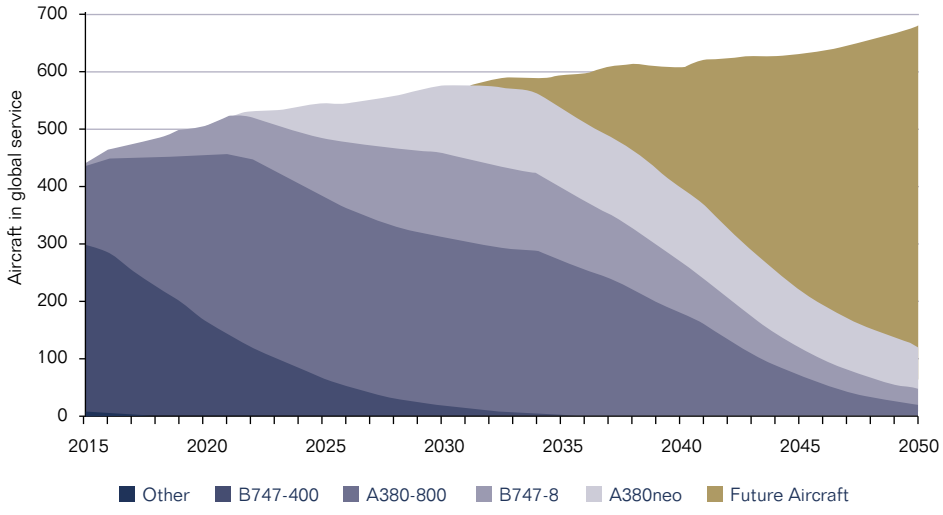
**3.23** We have produced an estimate of the global fleet to 2050 using known production rates of new aircraft and estimated retirement rates of current aircraft based on their age. Airbus and Boeing both publish forecasts against which we compared our own, although the manufacturer's forecasts both stop at 2034, which is when many analysts expect the next generation of aircraft to begin operations. In the forecasts presented here, an assumed "future aircraft" of unknown technology and manufacturer is presented to show how great of an impact this will have by 2050.

**3.24** "Jumbo" sized aircraft (definition here being an aircraft featuring multiple floors and with four engines) is a small and unpredictable market, a characteristic well represented by the varying opinions of the two manufacturers, with Airbus forecasting significant demand for new aircraft in the next 20 years and Boeing forecasting a modest decrease in overall number of aircraft over the same period. Whilst it is too early to confirm which of these forecasts will be correct, orders for the two types in this category, the A380 and 747-8 have been infrequent as airlines are showing a preference for the slightly smaller, twin-engine aircraft such as the 777 and A350.

**3.25** The Boeing 747-400 is still the dominant workhorse, comprising 66% of the global jumbo fleet; however it is in the process of retirement, with the second largest UK operator of the type, Virgin Atlantic, having made its final 747 flight in early 2016. The two replacements, Boeing's 747-8 and Airbus' A380-800 are selling modestly and production looks set to continue only until around 2022. Other than Dubai-based Emirates, which has 77, only 102 A380s are in operation to date. Airbus has suggested an upgraded A380neo design which could take over the production line for potentially around 10 years, but would be unlikely to out-sell its predecessor unless substantial efficiency gains are made.

**3.26** This means that between 2030 and 2040 the industry will be looking for a new aircraft to fill this size market. Radical technologies such as blended wing bodies could give this market a renaissance if the efficiency gains are there, but if they are not the industry would likely shift its focus back to smaller aircraft. Therefore this particular area of the aviation market has to be viewed with great uncertainty beyond 2040, and consequently our forecast for this sector of the market is relatively conservative.

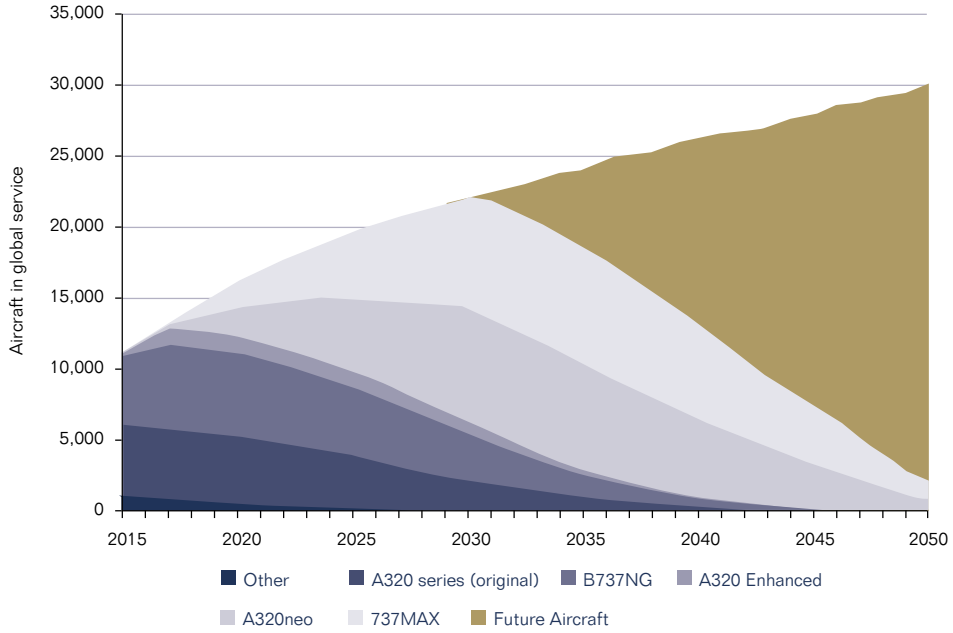
Figure 16: Future Shape of Jumbo Fleet




*Source: RDC analysis*

**3.27** The narrow-body sector has seen the highest growth rates over previous decades, and all forecasts suggest that will continue. Currently Airbus's A320 and Boeing's 737 types dominate the market, with roughly 50% each. Both programmes have recently reached the end of their production cycle and will be replaced with the A320neo and 737MAX respectively – accounting for 50% of airframes by around 2026. It is expected that these two product lines will carry on the dominant position of their predecessors and potentially outsell them. Based on previous product cycles it seems likely that a replacement for, or the next upgrade of these would enter the market in the early 2030s, and account for 50% of the fleet by around 2040. In both instances the speed of aircraft turnover in the narrow-body market means the new generation reaches this 50% point within 10 years of entering service.

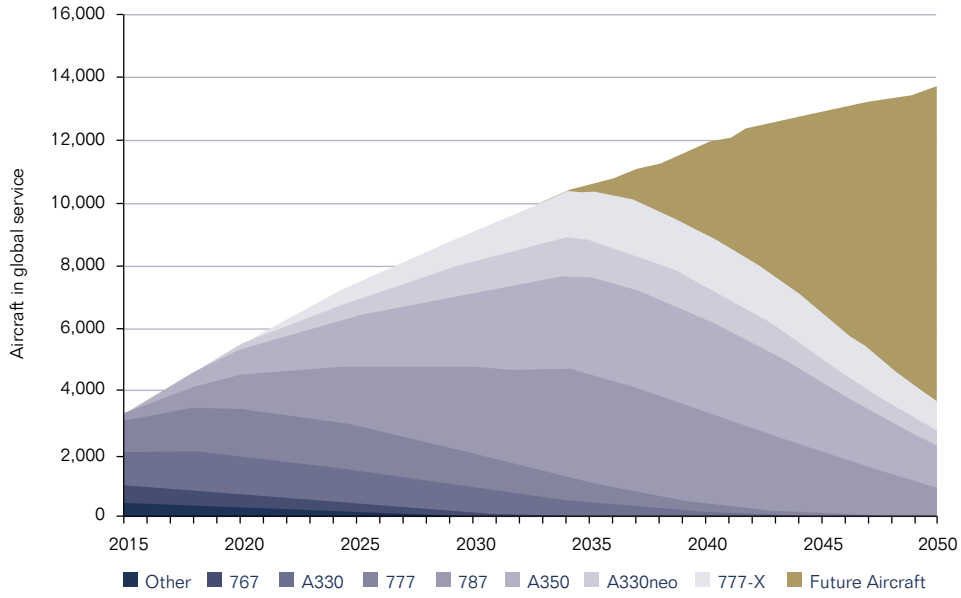
Figure 17: Future Shape of Narrow-body Fleet




*Source: RDC analysis*

**3.28** In the widebody market, the situation is a little more complex. A number of different aircraft models exist from each of the two major manufacturers, filling a variety of roles and needs, primarily on the long-haul market. The most popular aircraft from each manufacturer in 2015 are the A330 and 777, together accounting for around 61% of the total wide-body fleet. Both models are being substantially upgraded, to the A330neo and 777x respectively, which should see at least a decade of successful production. The greater change in this sector will be from the entirely new-build 787 and A350.

Figure 18: Future Shape of Widebody Fleet

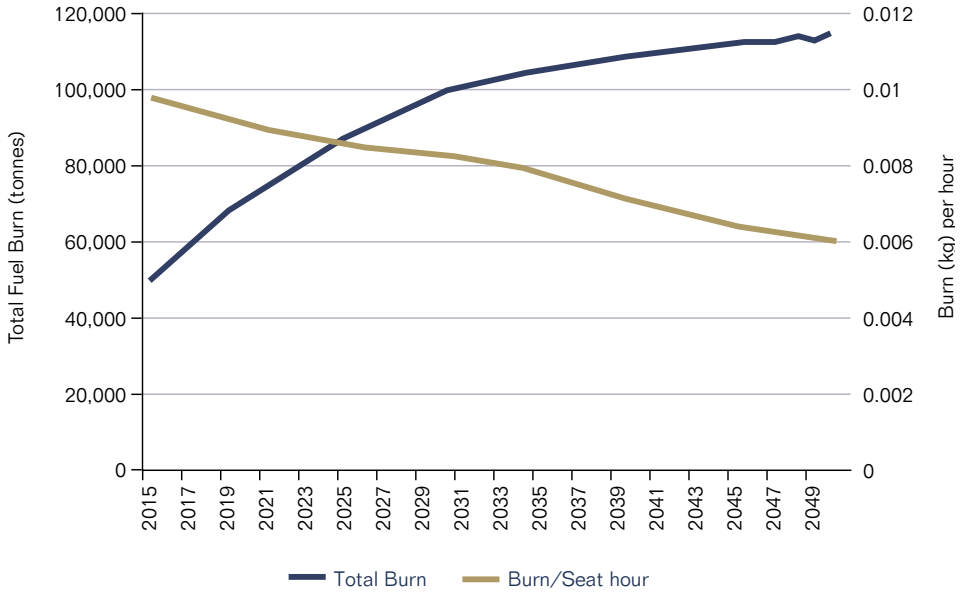



*Source: RDC analysis*

**3.29** These technology cycle forecasts have been compiled together with RDC data on fuel consumption to provide a forecast of fuel consumption up to 2050. It must be stressed that while the near-term forecasts are very stable, beyond 2030 (when as-yet-unplanned aircraft enter service) it is difficult to predict with absolute certainty how the industry will perform. This forecast is deliberately conservative due to the magnitude of these unknowns, however the opportunity for large-scale reductions with the introduction of new technology is vast and should not be understated. In all segments, we expect the majority of aircraft flying in 2045 to be types that are not currently on the drawing board.

**3.30** The forecast suggests that the rate of fuel burn improvements by implementation of technology should be fairly constant at around 1.6% per year, meaning that 45% less fuel would be burnt per seat hour by 2050. Whilst this is a substantial rate of consistent improvement, when put in the context of rising demand for aviation, particularly from developing countries, the total fuel burn from global aviation would still be expected to increase at a rate of around 2.5% per year. However, this model does not consider the effects from other changes and improvements, such as operational efficiencies and alternative fuels. These matters will be addressed in the following sections.

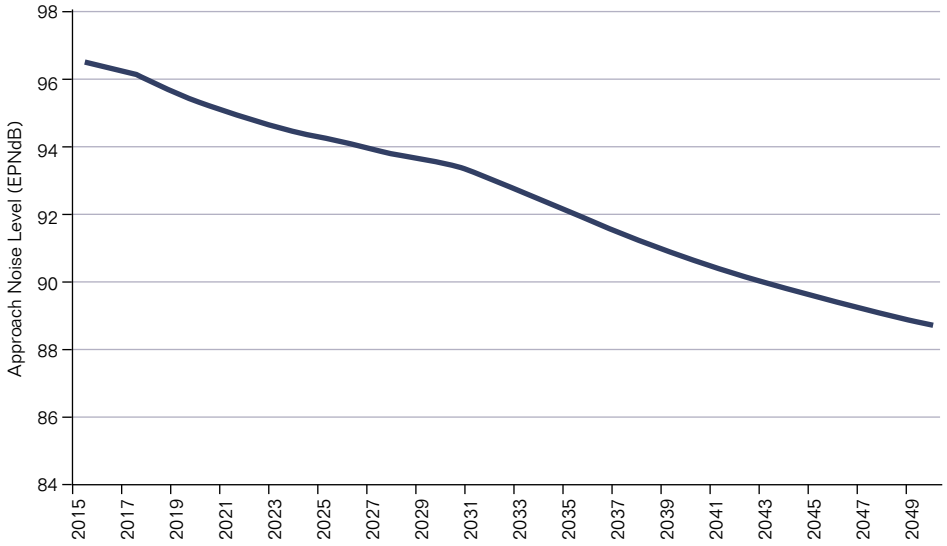
Figure 19: Global Industry Fuel Burn Forecast (tech improvements only)




*Source: RDC analysis*

**3.31** A similar forecast can be made for noise, which is shown in figure 20 below. This has been calculated using noise data from EASA (European Aviation Safety Agency) for current aircraft, supplemented by industry predictions for new aircraft types and extrapolating trends for aircraft as-yet unplanned. This forecast shows that the current generation of aircraft will reduce the average approach noise by around 5dB by 2035. The technology that will come on line after that could take the reduction as far as 8dB below current levels by 2050.

Figure 20: Future Noise Forecast for Aircraft >100 seats




| Situation | Sound Pressure Level (LpA) dB(A) |
|---|---|
| Threshold of pain | 130 |
| Threshold of discomfort | 120 |
| Chainsaw at 1m | 110 |
| Disco, 1m from speaker | 100 |
| Diesel truck pass-by, 10m | 90 |
| Kerbside of busy road, 5m | 80 |
| Vacuum cleaner, 1m | 70 |
| Conversational speech, 1m | 60 |
| Quiet office | 50 |
| Room in a quiet, suburban area | 40 |
| Quiet library | 30 |
| Background in TV studio | 20 |
| Rustling leaves in the distance | 0 |
| Hearing threshold | 0 |

*Source: EASAS, Airports Commission*

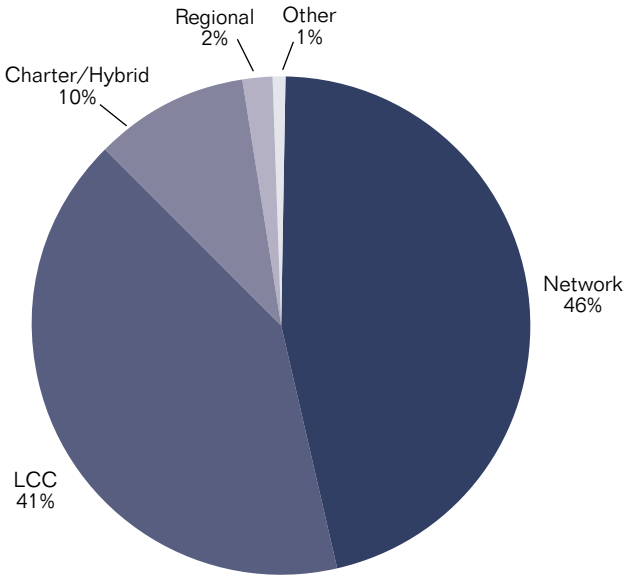
**3.32** The Effective Perceived Noise (EPNdB) metric is used in aviation to measure the "annoyance" of aircraft noise on local residents. It takes a weighted average of the aircraft noise on both approach and departure, to provide a comparable figure of annoyance. Aircraft currently in operation average around 96.5EPNdB (a scale based on taking averages of several readings of both arrival and departure), which is above the noise of a diesel truck at 10m, on the Airports Commission scale.

**3.33** These forecasts for fuel-burn and noise are able to provide an indication of the type and performance of aircraft that may be operating at around the time that new capacity is built at either Heathrow or Gatwick airports. Our analysis shows the average aircraft will burn 15% less fuel (and therefore $CO_2$) by 2030 and be around 4dB quieter, with trends set to continue long after this date. These improvements could potentially be fast-tracked and increased with the use of policy measures to incentivise the renewal of UK and European fleets.

# 4. Airline Business Models – Environmental or Economic Sustainability

**4.1** The shape of the airline industry has changed substantially over the last two decades. From the widespread implementation of low cost business models in Europe and Asia to the rapid rise of "super-hubs" in the Middle East, all of these changes are having an effect on the industry's sustainability in one form or another, and this is the subject that will be addressed in this chapter.

Figure 21: Composition of Current UK Market




Source: Capstats.com

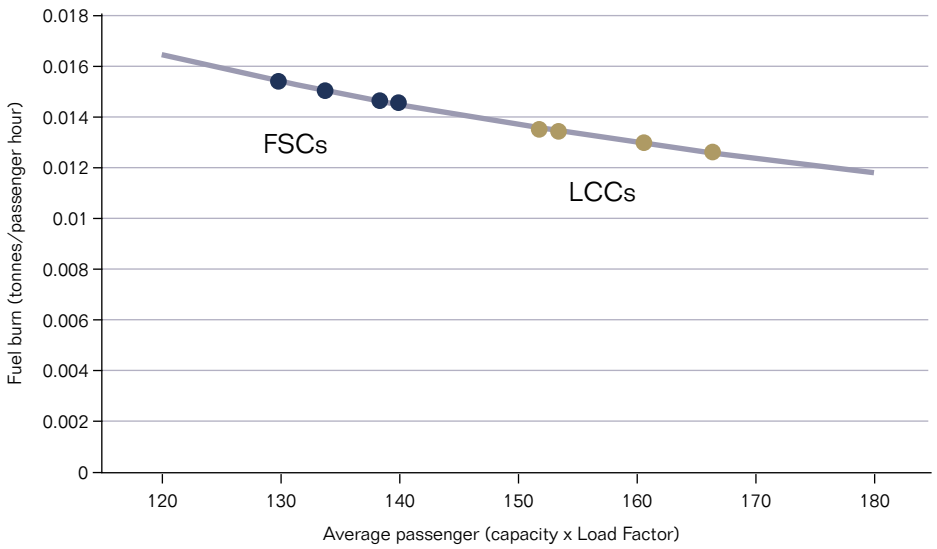
## Low Cost Carriers

**4.2** Perhaps the biggest change the airline industry has seen in recent years (especially in Europe) has been the rise of the low cost carriers (LCCs). These airlines established themselves in the late 90s and early 2000's thanks mainly to widespread liberalisation of the laws surrounding international air traffic and therefore the removal of considerable barriers to entry, creating the possibility for new airlines to challenge longstanding monopolies and oligopolies.

**4.3** One of the key aspects of these business models is a highly efficient system of yield management, ensuring almost all the seats on board the aircraft are sold. This, combined with operating higher density seat configurations, means that LCCs will fly many more passengers than a traditional carrier using the same type of aircraft. Therefore this makes them more fuel efficient on a per passenger basis.

**4.4** The effect of this can be seen in the figure 22 opposite. The fuel burn per passenger hour has been calculated for a Boeing 737-800 with various levels of passengers on board and a selection of LCCs and network carriers have been plotted according to their seat capacity and average load factor. This shows that the LCCs are burning around 2kg less fuel for every passenger hour, equivalent to a saving of around 13% in $CO_2$ per passenger.

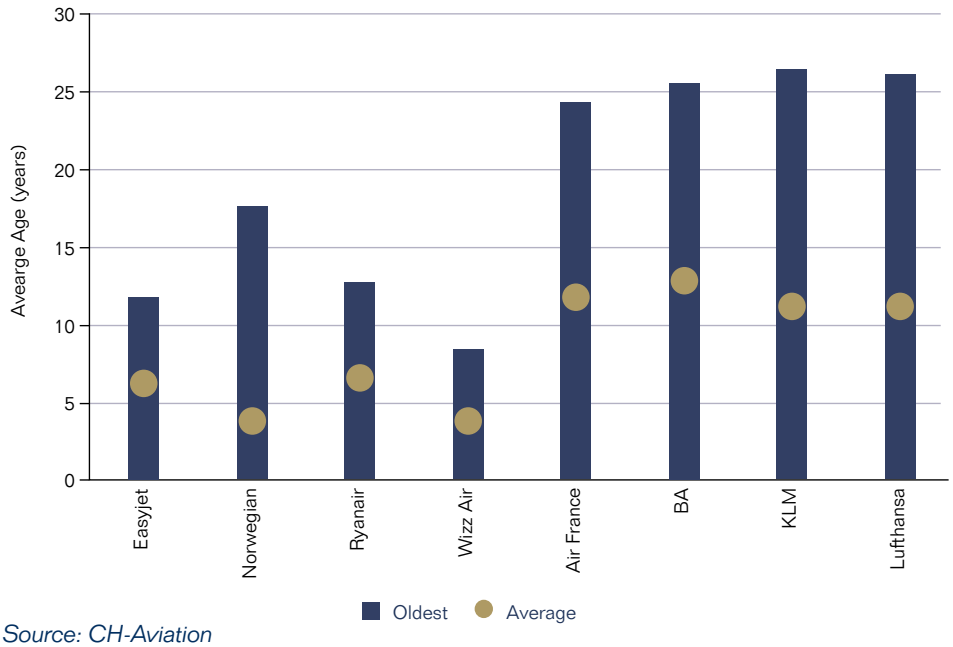
Figure 22: Average Fuel Burn by Airline Type




*Source: RDC Apex. Airlines: Ryanair, Norwegian, Pegasus, Transavia, KLM, Qantas, Turkish and SAS.*

**4.5** A further consideration that can be made in favour of LCCs is that they generally operate a much younger fleet than their competitors. This is not a universal rule, as the "original" LCC, Texas' Southwest Airlines operates several aircraft that are over 25 years old; however for more modern LCCs in Europe and Asia, a constant stream of new aircraft deliveries and the phasing out of aircraft after just six or seven years is commonplace.

Figure 23: Average Fleet Ages for LCCs and Network Carriers




*Source: CH-Aviation*

**4.6** The Figure 23 on the previous page shows a visualisation of this phenomenon, with four of the largest LCCs in Europe compared with four of the largest traditional network carriers. As well as being on average five to six years older, the aircraft life cycle in a network carrier appears to be over twenty years, while for an LCC it is no more than twelve. This means in practice an LCC is more likely to implement the latest environmentally sustainable aircraft sooner (see chapter 2), and dispose of outdated equipment earlier by shortening its life cycle through more intensive utilisation. However, these aircraft will probably be sold on to another airline, rather than scrapped, so that they could theoretically still be operating for many more years, although their high utilisation rates under LCC usage may make them less economical to operate and maintain at that age.

**4.7** While LCCs can be more efficient on a per passenger basis than more traditional business models, when looking at the wider environmental context, the situation is more complex. There is a case to suggest that the entrance of an LCC into a market stimulates new demand rather than simply replace the demand served by less efficient airlines and whilst high asset utilisation shortens the aircraft life-cycle, it is simply producing a life-time of emissions over a shorter period of time. In the wider context it could be suggested that LCCs have created a net increase in emissions over what would otherwise have been generated by the more expensive business models.

## Network Carriers

**4.8** Despite the rise in LCCs, the majority of the world's air traffic is still carried by network carriers. Traditionally these airlines were supported by and/or represented their national governments and identity, but are increasingly becoming more independent, privatised and international. Ultimately, complete relaxation of foreign ownership restrictions is one way the industry can cut out 'vanity capacity' and exercise true free-market discipline.

**4.9** A key differentiator is that a network carrier aims to provide a level of service for its passengers that goes above and beyond simply "flying from A to B", consequently they often have several classes of carriage, with varying levels of service and associated cost. In broad terms, network carriers can be seen as the opposite of LCCs. They operate longer flights using larger aircraft (with the exception of regional hub feed) and often at a lower density seat configuration. As demonstrated in the LCC section, their fleets tend to be older, although this may be just as much to do with long-term fleet investment (and therefore not "asset-squeezing" their aircraft) as it is to do with greater focus on cost efficiency by LCCs

**4.10** One particular aspect of network operations that is important in sustainability terms is the use of hubs. These hubs allow fast and smooth connections to be made between flights, vastly increasing the number of possible city pairs that the airline can offer. This in turn makes the flights more profitable and therefore a greater number of cities can be successfully linked to the hub. This is an ideal situation for the city in which the hub is based, since it opens up more connections around the world, however it does also have some sustainability impacts.

**4.11** Compared to a simple point-to-point model of airline operations (either from network carriers or LCCs), a hub can be expected to increase the number of flights – and connectivity – in the region which means at a local level may lead to greater noise and emissions. Extreme examples can be seen around the world in places such as Amsterdam and Dubai, where the level of aeronautical activity is exceedingly high compared to the demand for travel to and from the city itself. Hubs are most sustainable where there is strong local demand in place, such as New York, Shanghai or London. This is because the extra demand created is less likely to require new flights, and more likely to require a transition to larger (more efficient) aircraft on existing flights.

**4.12** The beneficial effect on sustainability of operating a hub can be demonstrated with a simple model. Using London as a central hub, 10 popular short-haul cities and 10 popular North American cities have been modelled for operation with and without the hub.

**4.13** In the *without hub scenario*, it is assumed that a point-to-point network serves all combinations of airports with the smallest modern wide-body aircraft available (in this instance, the state of the art Boeing 787-8) at a 75% load factor on a single daily frequency. In a real life situation, some routes (such as Paris-New York) could be operated at a good level of service without the need for an intermediary hub; and the reverse is also true that there will be some city pairs that cannot justify a long-haul service at all, but the combined demand would be enough to justify a link with a hub.

Figure 24: Network Map - Direct Services


*RDC analysis*

**4.14** The hub scenario then assumes that all passengers re-route via the London hub. The passenger numbers are divided by the capacity of a sensible aircraft for the route to give a 5x daily 777-300ER service on the North American sectors and a 10x daily Airbus A320 service on the European sectors. The short-haul frequency may appear excessive, but in reality these flights would be spread among more regional airports within the catchment, rather than 10x daily at one central hub.

Figure 25: Network Map - Hub Services


*RDC analysis*

**4.15** The net effect has been to reduce the number of daily long haul flights from 100 to 50. Economies of scale are gained by the use of larger aircraft and therefore the emissions on the long haul flights are considerably lower. The short haul flights are performed on efficient aircraft designed to move large numbers of people at minimal cost/maximum efficiency. By offering a greater daily frequency, the hub service can safely compete with the point-to-point services while offering considerably improved connectivity for its home market.

Table 1: Simplified Hub Model Outcome

| | City Pairs | Short-haul Flights | Long-haul Flights | Short-haul Seats | Long-haul Seats | kT of $CO_2$ | $CO_2$/Seat (Tonnes) |
|---|---|---|---|---|---|---|---|
| Point-to-Point | 100 | 0 | 100 | 0 | 21,400 | 12.84 | 0.60 |
| Hub | 100 | 100 | 50 | 17,200 | 23,450 | 11.36 | 0.48 |

*RDC analysis*

**4.16** This example has been built to show only the effect of carrying the same number of passengers between the same cities using two different airline models. Extrapolated over a wider air transport system, such as that to and from Europe, the environmental efficiency benefits are magnified whilst delivering a substantial connectivity improvement to the country hosting the hub.

**4.17** Using fuel burn data from RDCApex.com, the overall reduction in $CO_2$ produced is 12%, based on a very efficient aircraft on the without hub model and a moderately efficient aircraft flying the with hub model. This is without considering that the hub services could accommodate additional local traffic or use a more efficient large aircraft. For a city such as London, the non-hub traffic could account for as much as 50%, further increasing the economies of scale and reducing the overall $CO_2$ produced compared with a pure point-to-point model – potentially by as much as 24%. This analysis suggests that a hub model produces less $CO_2$ on both a per-passenger and overall $CO_2$ burn basis, while increasing connectivity for the hub airport.

**4.18** The downside of this approach is that the hub airport becomes the focal point for all flights and therefore accrues the noise and local air quality issues surrounding a larger airport. It also means the host-country counts all carbon emissions on its national inventory.

## Charter

**4.19** This business model has been popular with many independent carriers (i.e. not state owned or influenced) since the 1960s. Its core market is leisure, and particularly the transportation of passengers to and from holiday destinations. As such, the model is designed for maximum flexibility – the route network changes and adapts through the season and capacity is leased in and out as required. As most of the passengers are low yielding, a lot of the principles of the low cost airlines such as high-density seat configurations were first used and advanced by these charter airlines. However, low cost airlines have found that their own models are just as efficient at serving these markets, and the influence of their competition has driven the charter market down to an exceedingly small scale. These days the main charter carriers (in the UK: Monarch, Thomson, Thomas Cook and Jet2) operate hybrid models that have more in common with LCCs. Though they and some of the smaller airlines may still operate ad-hoc charter work, the proportion of traffic of which this accounts for is now very slim.

## Regional Services

**4.20** The regional sector of aviation consumes a lot less fuel, and therefore is much less of an issue for emissions, as the aircraft are significantly smaller and the distances travelled are relatively short. They are also quieter, being smaller and requiring less thrust. The 1990s and early 2000s saw the rise in popularity of regional jets, at the expense of turboprops. Overall this would have a negative impact for the sustainability of air transport as these regional jets are comparatively inefficient on a per-passenger basis. However the most recent capacity data suggests that this trend has flat-lined as fuel prices have become more volatile and turboprops more economically viable. The trend was also less applicable to the UK market, where rail travel is a viable substitute on many short distance routes, and other routes to Europe have a large enough demand to support larger aircraft.

## Freight

**4.21** The transportation of freight is a part of the industry that has always been considered integral to its function. However recently this side of business is becoming increasingly polarised. LCCs, in an effort to reduce turnaround times and reliance on external suppliers, rarely accept freight on their flights, and with their fast increasing share of the market, this means the choices for transporting freight by scheduled air services are becoming few and far between.

**4.22** At the other end of the spectrum, the industry has seen a large rise in the use of freight forwarding conglomerates, such as DHL, UPS and FedEx. These companies have globe-spanning networks with dozens of local bases and regional subsidiaries.

They provide a seamless service from pick-up to delivery which is highly attractive to their customers. The air network forms the link between major hubs of these freight forwarders, sometimes using other airlines' aircraft (such as Aerologic for DHL) or increasingly using their own fleet of aircraft – most importantly these aircraft are dedicated freighters, which do not and cannot carry revenue passengers on the same flight.

**4.23** Traditionally, freight has been carried in the bellies of large passenger aircraft, particularly those operating in and out of hub airports (as these offer opportunities for onward connections and therefore economies of scale). This is a highly efficient means of transporting freight, as it is on-board flights that are already carrying revenue passengers and therefore the marginal cost of transporting the freight is extremely low. The use of dedicated freighters is not necessarily inefficient in itself if the loads are high for both the outbound and return legs (demand for freight can often be mono-directional), however these aircraft are usually either conversions of older passenger aircraft or the last aircraft from a given aircraft production line. This means that the rates of technology implementation for dedicated freighter airlines are among the lowest in the industry. Popular aircraft types for these airlines continue to include the McDonnell Douglas DC-10 (first flight 1970) and Airbus A300 (1974). Furthermore, dedicated freighter aircraft frequently operate at unsociable hours, due to the desire to guarantee overnight deliveries and the availability of cheap slots – this can be a primary cause of noise complaints for local residents, especially at airports without night curfews.

**4.24** Sustainability for air freight is most likely to be achieved through the use of existing passenger airline hub networks supplemented by large-scale freight aggregators with dedicated aircraft fleets linking logistics hubs. This will minimise the need for extra flights, ensure economies of scale from larger aircraft, and utilise the most modern and efficient technologies available.

## Conclusions and Future Direction

**4.25** Overall it is clear that the way in which the aviation industry develops with respect to the various business models will have a significant impact on its sustainability. The rise of low cost airlines can be seen as a net benefit in this respect, transforming short-haul travel into an efficient and fuel-lean means of connecting across relatively short distances and making flying more affordable. However, the long-haul market will continue to be orientated towards service levels as well as cost, requires the aggregation of freight alongside passengers, and therefore is unlikely to be as successful for low cost airlines in the future. With this in mind the industry needs to focus on finding an efficient means of connecting thousands of possible city-pairs across the world with the smallest amount of infrastructure, and the solutions to this are hubs. Hubs provide the economies of scale from a wide selection of possible routes, combined with the movement of high volume freight through belly-hold space, which can reduce emissions of $CO_2$ and other harmful gases by at least 12% even in a simplified 20-city model.

# 5. Operations

**5.1** The air transport system is already relatively efficient (in terms of fuel burn and therefore emissions as well as noise) as it exists in a situation where mostly-private companies are motivated to operate at maximum efficiency to minimise costs, particularly with regards to fuel burn as this is frequently the airline's most significant cost. However there are some bottle-necks in the system caused by regulation or congestion which may provide opportunities or further improvements in the coming years.

## Taxiing and Ground Delays

**5.2** With a finite amount of runway capacity, peak times can cause a build-up of delays at many airports. The effect that this has on the local environment in terms of noise and emissions is almost totally dependent on how the airport and airline choose to handle the situation.

**5.3** The Aircraft on Ground Reduction (AGR) Programme developed by Sustainable Aviation found that at Heathrow airport, emissions from ground aircraft accounted for 30% of $CO_2$ emissions (not including emissions created in the "en-route" phase of flight), and is therefore an identifiable area for future improvement.

**5.4** Taxiing is a relatively inefficient process, as it uses the aircraft's engines, designed to propel the aircraft to over 600mph, at speeds closer to 20-30mph. There are a number of initiatives both proposed and in use around the world that aim to reduce the fuel burn during taxiing, thereby reducing noise and emissions on the ground. The simplest of these initiatives is single-engine taxiing, where one engine is not started until as late as possible (around 2-5 minutes before departure). A study by Deonadan and Balakrishnan of MIT[7] found that at busy US airports such as New York JFK, NOx emissions from taxiing could be reduced by as much as 40% by employing this method.

**5.5** Alternatively, aircraft can be towed to the runway by a tug or similar vehicle, and the same study found that this could reduce the $CO_2$ emissions from taxiing by around 70%. However it also noted that the use of these vehicles could also increase NOx by around 60% depending on the age and type used. There is potential in the future for aircraft tugs to be electrically powered, and therefore effectively eliminate emissions; however, these are not widely used and the appetite for universal uptake is dependent on the airport handling agents.

**5.6** A perfectly managed situation would see an aircraft never leave the gate until it was able to taxi to an available runway without delay. This way the aircraft would not have to start up its engines or APU (a small engine usually located in the tail of the aircraft that powers the aircraft while on the ground) and instead could rely on the GPU or FEGP[8] until the exact moment it is required. The GPU is both quieter and less pollutant than the aircraft's on-board power systems. However this procedure requires a high level of coordination between the airport and airlines, and for airports

7 Deonadan and Balakrishnan (2010) "Evaluation of Strategies for Reducing Taxi-out Emissions at Airports"

8 Ground Power Unit and Fixed Electical Ground Power

such as Heathrow and Gatwick, could be a very inefficient way to make the most of its scarce gate and runway capacity. Deonadan and Balakrishnan found that using this system of "advanced queue management" taxi emissions could be reduced by around 50%. However, this system would not be practical in a situation of very limited runway capacity, as the act of maximising the limited available capacity would require aircraft to queue at the entrance to the runway.

**5.7** Sustainable Aviation estimate that around 50% of the emissions from APUs can be cut through increased use of GPUs and other systems, and a 0.6% reduction in UK aviation's overall $CO_2$ emissions. A study at Zurich airport found that the NOx reduction from use of GPUs would be around 4.3% per flight.

## Delays from Airborne Holding

**5.8** While delays on the ground may be costly, aircraft naturally burn more fuel in the air, and so delays that occur to aircraft awaiting a slot to land can be far more devastating to both the airline and the local environment. A study by researchers from Aviation Economics and Loughborough University (2015) found that an aircraft in a holding pattern burns around 1kg of $CO_2$ per seat per minute (varying greatly depending on the aircraft used).

**5.9** The researchers also discovered that the particular situation at London Heathrow leads to a 0.6% increase in the overall fuel and $CO_2$ burn of all flights arriving at the airport. There may also be an added impact of noise, since each arrival spends an average of 4-5 minutes extra holding at a height of between 8,000 and 12,000ft over mostly built-up areas. However, the noise impact of aircraft at this altitude has not been quantified.

**5.10** The paper finds that these delay impacts are all directly the result of poor access to runway capacity, since an airport system with appropriate runway capacity would not have the need for holding patterns or long ground waiting times. It concludes that expansion of capacity should not always be viewed as a net cost to the surrounding environment, as it has benefits from reducing delays.

## Single European Skies and Global Navigation

**5.11** The "invisible infrastructure" that makes up the airways crossing our skies has remained largely unchanged for several decades. This means that many flights are directed on paths that are not as direct as they could be, leading to unnecessary fuel burn and emissions. The industry is working on a solution known as Performance Based Navigation (PBN) that would allow flights to travel on more direct flightpaths without the risk of collision. This system requires the cooperation of nations controlling the airspace, so is likely to be gradually implemented rather than a sudden 'big bang'. PBN is expected to be operating in Europe in the early 2020s.

**5.12** NATS, the UK's primary air traffic service provider, monitors every flight that travels through UK airspace and gives it a *3D inefficiency* (3Di) score. This considers the difference between the track travelled by the aircraft and the optimal track to reduce fuel burn and emissions. NATS has several targets written into its UK license to improve the average 3Di score of aircraft under its control.

**5.13** One critical issue to consider in the choice of flightpaths is that it is often not possible to reconcile both reducing emissions and reducing noise impacts at the same time. For example under a PBN system, all departures to the Middle East and Asia (usually large aircraft heavily laden with passengers, freight and fuel) would fly an almost identical departure track – concentrating the impacts on particular communities and not offering respite. However, fanning or splitting departures to offer respite causes longer routings which burn more fuel and emissions. Handling these separate issues is one of the challenges that needs the combined effort of regulators, airlines, airports, navigation service providers and local communities to resolve.

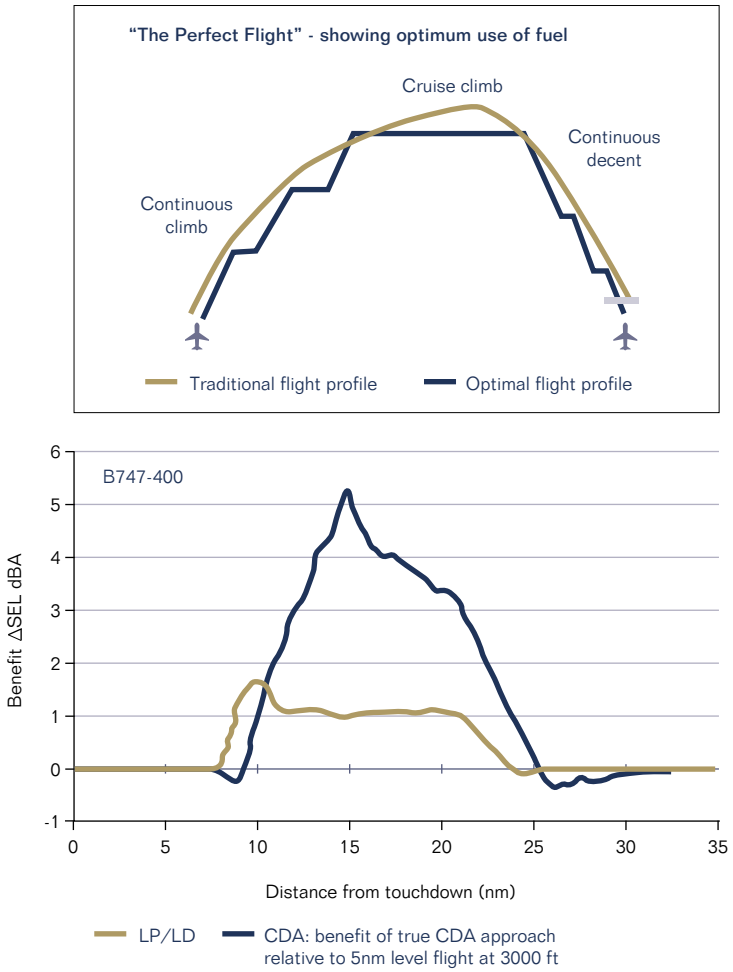
**5.14** One of the largest sources of noise complaints from aviation is on the approach phase of flight. Although quieter than the departure phase, the approach offers less flexibility in planning because aircraft have to be approaching in line with the runway from around 10 miles out, whereas on departure can be vectored out to different departure paths comparatively quickly. This is a particular problem for Heathrow where the runways are East-West aligned such that aircraft approach over West and Central London when the wind is in the prevailing Westerly direction. This accounts for about 70% of Heathrow's flights.

**5.15** There are a number of potential ways in which the operation of airport approaches can be optimised to reduce the impact on local residents. One of the most beneficial and simple to operate is referred to as "low power, low drag", or LP/LD approaches. This means reducing thrust to a low level early in the approach and maintaining this until landing, whilst also operating in a "clean" configuration with minimal application of flaps and no landing gear deployed for as long as safely possible. Pilots that are familiar with the airport are likely to fly in a style similar to this, however unfamiliar pilots may be anxious to complete their pre-landing checklists and establish the landing configuration as soon as possible. Establishing an airport-wide practice for LP/LD would provide benefits in these instances of around 1-2dB for most of the approach (see figure 26). Indeed, simply sharing best practice from each airlines' standard operating procedures at an airport can bring substantial benefits in noise above local communities.

**5.16** Greater gains can be made with the use of continuous descent approaches (CDA). These are performed by aircraft flying a single constant descent from its cruising altitude, as opposed to the more common stepped approach. This means the aircraft can stay at a lower, quieter thrust level for longer on the approach, without the short bursts of increased thrust seen on stepped approaches. The difficulties in implementation of this system are that it often requires airspace to be redesigned, high levels of coordination to ensure aircraft begin their descent at the correct distance from the airport and sufficient capacity to not delay aircraft in holding stacks. However when this is correctly performed the expected benefits can be as high as a 5dB reduction in noise for residents under the approach path, as well as associated emissions benefits from reduced thrust.

**5.17** The figure below from the DfT's code of practice for arrivals shows the relative benefits of the two systems. Continuous descent approaches provide the greatest benefit, but this can be complimented with LP/LD operations for optimal noise reduction.

Figure 26: NATS Optimal Flight Profile and Continuous Descent Profile




*Source: NATS*

## Comparative Benefits of LP/LD and CDA Approaches

**5.18** Continuous Descent Approaches fit into NATS' "perfect flight" initiative (shown above). Sustainable Aviation forecasts that improvements from this and other navigational techniques can lead to a 6.5% decrease in $CO_2$ emissions, while analysis by IEA indicated that a CDA could save between 5% and 11% of fuel on the final 300km of a flight.

**5.19** For some aircraft operations, the impact of aircraft noise can be further mitigated through the use of displaced thresholds. These change the position of touchdown for aircraft to further down the runway, thereby increasing the relative height at which the aircraft pass overhead local communities, and limiting the lowest part of the approach to within the airport perimeter. In order to perform these operations, the

aircraft must have a sufficient length of runway to land with no safety implications. A 1 nautical mile displaced threshold can mean aircraft are 300ft higher when flying over local communities. In Heathrow Airport's submission to the Airports Commission, it claimed that it could operate one or more runways like this with a three-runway configuration, alternating usage to give residents periods of respite – an activity which Heathrow has calculated to provide a net benefit in terms of reduced sleep disturbance and annoyance over the current operations at a two-runway Heathrow. A study by Jacobs UK Ltd. on behalf of the Airports Commission found that the use of displaced thresholds on Heathrow's runways would reduce the population within the 90dB SEL noise contour by around 78% (although it must be noted that not all flights could perform this operation). Some of the schemes analysed by the Airports Commission promoted the use of displaced thresholds. Of particular note is the Heathrow Hub scheme, which involved extending the Northern runway out to the West. This would mean that at off-peak times (such as the first arrivals of the morning) aircraft could land further down the runway and that the last 2 nautical miles of flight would be over the airport site itself.

Table 2: Summary of Potential Improvements

| | $CO_2$ benefit (global) | NOx benefit (local) | Flightpath noise benefit | Notes |
|---|---|---|---|---|
| **APU reduction** | 0.6% | 4.3% | - | |
| **Single-engine taxi** | 0.5% | 10% | - | Using SA estimate of 30% $CO_2$ emissions from ground |
| **Advanced Queue Management** | 2.0% | 20% | - | |
| **No Holding** | 0.6% | 2.5% | - | Some noise benefit under holding patterns |
| **Performance Based Navigation** | 1.7% | - | - | |
| **LP/LD Approach** | 0.3% | - | 1db | |
| **Continuous Descent Approach** | 0.5% | - | 4db | |
| **Displaced Thresholds** | - | - | 4db | 300ft higher but not for all aircraft |
| **Estimated Total*** | **6.20%** | **36.8%** | **6-9db** | |

Using various sources supplemented with RDC data and assumptions.

*Assumes that all measures are independent and not currently being employed.

**5.20** The table above shows a summary of the methods described in this chapter and the gains that could hypothetically be made with all measures in place. It should be noted that some of these measures may already be partially in place or not fully realisable in combination with other measures, but that with the use of as many of these measures as is realistically possible, the impacts from aviation could still be reduced substantially. The opportunities for the greatest environmental benefits from operational changes are for local air quality and noise. $CO_2$ remains a global issue that needs to be dealt with in all phases of flight.

# 6. Policy and Implementation Options

## Surface Access

**6.1** When considering the sustainability of aviation, it is important consider it as part of a wider transport network, creating demand for traffic on modes such as road and rail, and it exists in a system in which much of the traffic bypasses the airport as if it were not there.

**6.2** A Heathrow Airport study of its surrounding area found that NOx emissions from aviation were only 13%, while other airport impacts including surface access accounted for a further 10% (19% and 28% respectively on the airport site itself). Measurements taken at nearby Hillingdon and Hayes were found to be higher than at the airport or its immediate surroundings and in excess of legal limits despite the airport and its associated impacts only accounting for 6% of these emissions at Hayes. The road network around Heathrow includes the UKs busiest stretch of motorway – the M25 between J13 and 14, which combined with the M4 carries over 350,000 vehicles per day[9], while the airport handles around 1,300 flights per day, forecast to peak at 2,000 with a new runway.

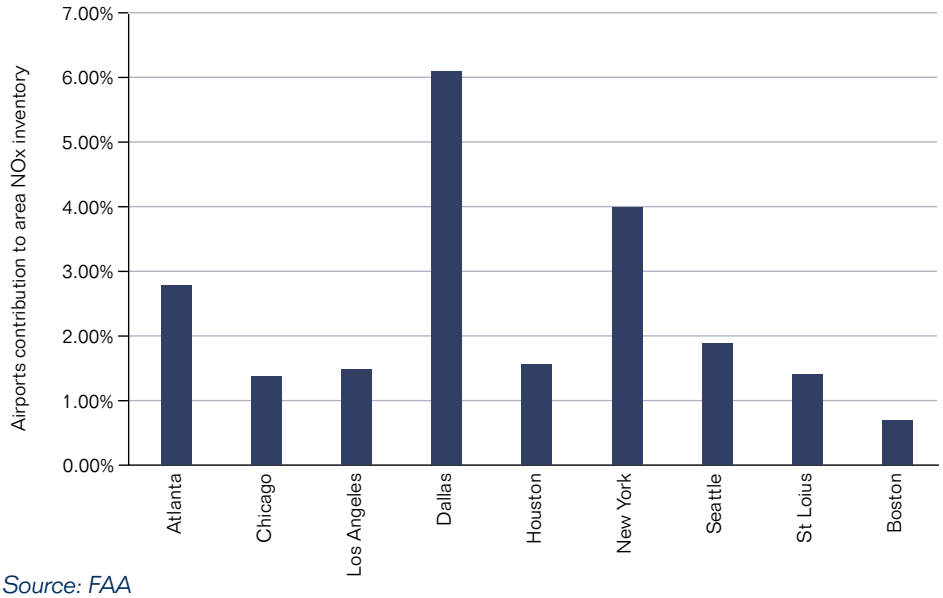
**6.3** An academic study by Farias and ApSimon[10] reinforces this assertion, as they found that the impact from traffic on local emissions was found to be significantly larger than that from aircraft. This evidence shows that while aviation can have an impact on local air quality, it is often polluting indirectly through other modes – and in some cases the other modes are far greater sources of emissions, regardless of airport traffic. Therefore it is important to consider both the effect of an airport on other modes and also its impacts in context with these other modes.

**6.4** Similar analysis by the USA's FAA can be seen in the Figure 27 opposite. This study features 9 cities with at least one airport in the top 20 in the country. The airports' contribution to the area NOx inventories vary from 0.7% to 6.1%, with the greatest contributor being Dallas which has two very large urban-located airports and is obviously an extreme case.

9 Department for Transport – Annual road traffic census counts

10 Farias and ApSimon (2004), "Relative contributions from traffic and aircraft NOx emissions to exposure in West London", Envrionmental Modelling & Software 21

Figure 27: Airport Contribution to Local NOx at Selected US Airports




*Source: FAA*

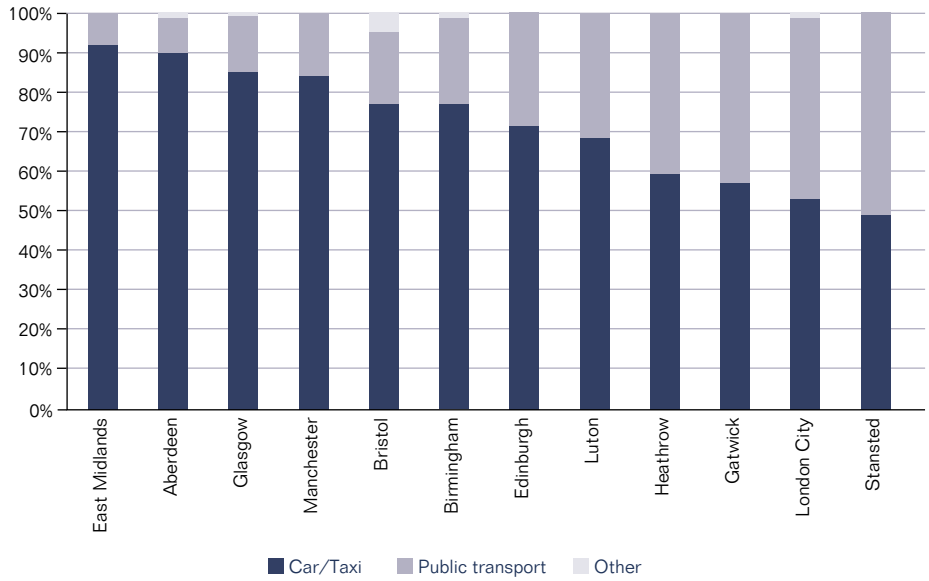
**6.5** Road vehicles have seen substantial improvements in emissions such as NOx and PM10 since the introduction of catalytic converters in the 1990s, however their overall emissions represent the greatest challenge to the wider transport network and were still recording year-on-year increases until the economic recession of 2008 caused reductions in road traffic.

**6.6** The automotive sector already has a mandated quota of biodiesel in circulation, and is able to embrace electric and electric-hybrid powered vehicles in a way that aviation cannot until battery technology vastly improves. The Department for Transport have taken this improvement in automotive technology into account in their road emissions forecasts, estimating that NOx will fall by 62% and $CO_2$ by 15% from 2015 to 2040.

**6.7** As aviation is a part of this collective system, improvements in emissions from road vehicles and a continuing shift away from private cars use for staff and passengers will see benefits flow through to the areas around our airports, resulting in lower levels of particulate and NOx emissions within those areas.

**6.8** Surface access to UK airports is currently made predominantly by road, though it varies greatly depending on the airport (e.g. public transport share at London City is 46% but at East Midlands is 7%). However the UK government is supporting the creation and improvement of alternative modes, such as Crossrail to Heathrow and improving capacity on the line to Gatwick Airport. The diagram 28 overleaf shows the public transport mode share of the top 12 UK airports. As a general rule, larger airports can support greater infrastructure investments and therefore have a larger share of public transport usage. The two notable exceptions to this are London City, which is small but has a high public transport share, and Manchester, which is large but with a much lower public transport share.

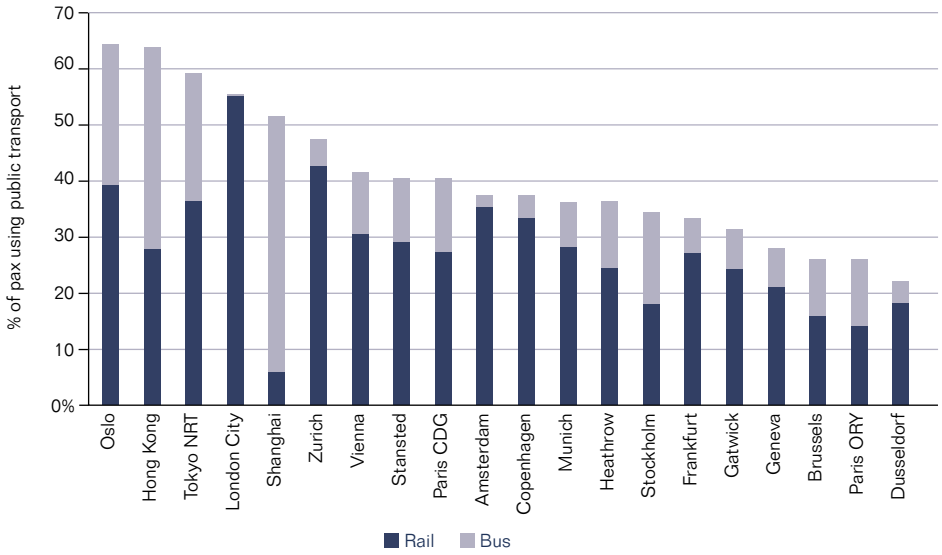
Figure 28: UK Airport Modal Split




*Source: CAA (2011)*

**6.9** The chart below shows how four of London's airports perform among a worldwide selection in terms of public transport usage. The data shows that the London airports have a reasonable share of public transport (approx 30-40%) but there remains room for improvement compared to leading-class airports such as Oslo and some of the largest Asian airports.

Figure 29: Modal Splits at a Selection of Large Airports

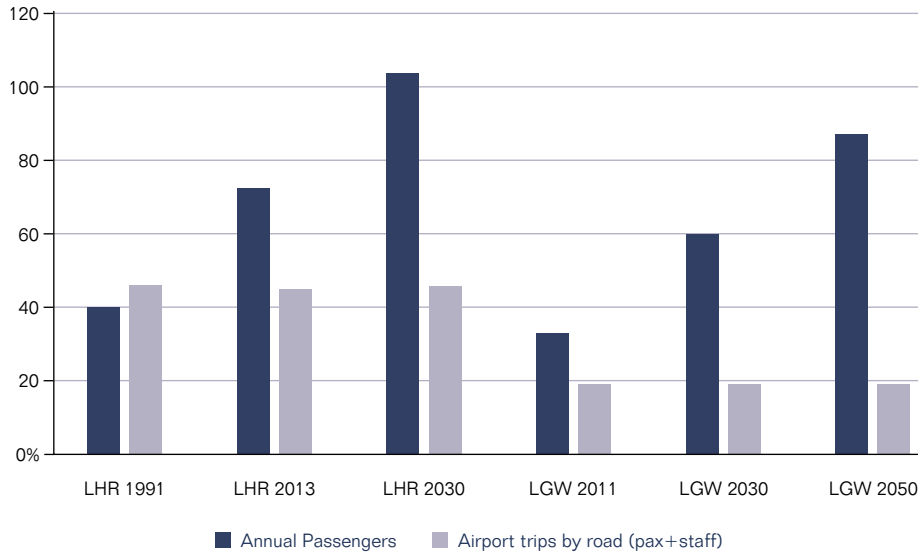



*Source: FAA NB. The FAA definition of public transport (bus and rail only) is slightly less comprehensive than that used by the CAA in Figure 28 above.*

**6.10** Emissions from surface access are primarily from road travel and can be reduced through increased use of public transport and other less-pollutant means. In order to ensure that this happens, new airport capacity should be delivered as part of a wider integrated intermodal transport plan. The relative geographic and temporal proximities of any Heathrow expansion and High Speed 2 plans have made them obvious candidates for being integrated together (and it is disappointing that they have not been) but the approach should be wider than that and consider modes of transport from all directions. The proposals for Southern and Western rail access to Heathrow are steps in the right direction.[11]

**6.11** The assumption is often made that airports increasing in size will increase the amount of road traffic, however where investment in infrastructure is made to meet the demand, then this effect can actually be reversed. Heathrow Airport presents a key case study of this phenomenon, with road trips not increasing between 1991 and 2013, despite an increase in passengers of 80% over the same period. This has been due to investment in public transport such as the Heathrow Express alongside improvements to the Piccadilly line as well as Heathrow's comprehensive commuter programme to reduce travel to work by car.

Figure 30: Surface Transport Mix – Heathrow and Gatwick Forecasts from Airports Commission Submissions




*Source: Heathrow Airport and Gatwick Airport*

**6.12** Gatwick Airport's own forecast of surface access usage paints a very similar picture of substantial growth not leading to an increase in car usage, and its position on the London to Brighton rail line is core to this.

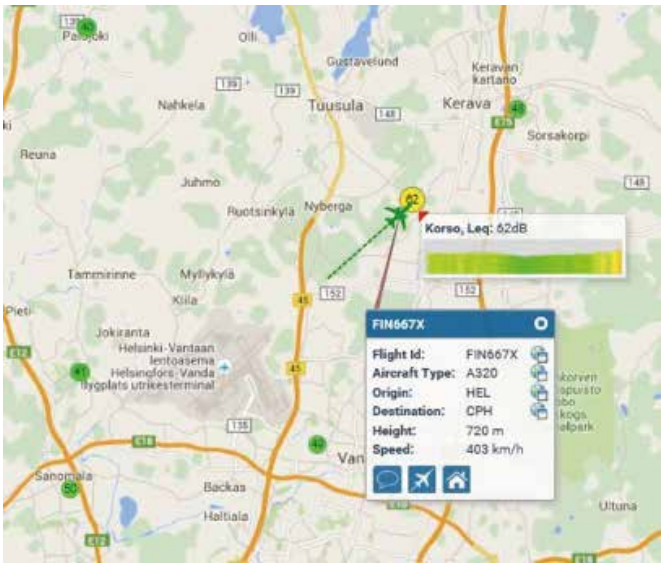
11 http://your.heathrow.com/takingbritainfurther/wp-content/uploads/2014/09/Transport-Fact-Sheet_FINAL2.pdf 102

## Community Engagement

**6.13** Emissions and noise impacts go far beyond simple numbers and charts in their effect on local residents. Commercial airports in the UK are already engaging with their local community to ensure that information is available on noise, how it might affect them and what is being done about it to improve the situation for the future. Many airports currently offer grants for additional noise insulation to local communities, understanding that it is important that they engage in this way to improve the understanding of the airport and wider aviation industry.

**6.14** The UK's national air traffic service provider, NATS, engages with the communities whenever changes are made to airspace or flightpaths. It has found that proposed changes are often met with a cautious response. For instance the aim of a flightpath change might be to provide periods of respite to those most overflown, but if it brings new households under the flightpaths then there will be a negative reaction from these residents, even though as a whole the community might be better off. However, through this process of engagement, it has been able to conclude that predictable periods of respite are critical to enable those affected to plan their activities around known 'quiet' periods.

Figure 31: Helsinki Airport WebTrak




*Helsinki Airport WebTrak*

**6.15** Finland is a global leader in dealing with the environmental impact of Vantaa airport in Helsinki, which handles around 80% of the country's flights and 99% of long-haul services. Through a range of local and national environmental policies, Vantaa Airport is able to meet the objectives of providing greater connectivity for Finland within its goal to minimise impact on the environment.

**6.16** The air transport landscape in Finland is more joined-up than other parts of Europe with one entity, Finavia, operating the airports and navigation services for the country. This provides the opportunity for a joined-up national policy and implementation framework. As part of its noise commitment around Vantaa, the airport publishes flight tracking and noise monitoring in real time, enabling communities to monitor the performance of particular airlines, aircraft and routings at a number of points around the airport. Heathrow uses a similar system but with less transparency. Until recently, data were delayed by 24 hours before being shown, and the system currently has no real time noise monitoring, but is being enhanced with new noise monitoring terminals being added that will bring the ability to conduct self-service analysis.

**6.17** We believe the industry in the UK can go further, however there is an important trade-off to be made. Systems employed by NATS and other organisations in the past have looked to optimise flight paths to reduce fuel burn and $CO_2$ production, but this can be vastly different from the optimal flightpath for reducing noise impacts. RDC proposes that a system similar to NATS "3Di" (see section 5) could be introduced in the UK, whereby airlines are monitored and scored for their fuel and $CO_2$ efficiency during the cruise phase (above a height of around 10,000ft) but on approach and landing at UK airports they are monitored and scored by their noise impact. The noise impact would be a combination of the intensity of the sound measured from ground stations and the population size that is affected by it. Airlines would then be incentivised to fly noise-friendlier approach paths and controllers incentivised to facilitate them. The key to making this system work would be making it publicly available and usable, similar to the WebTrak system at Helsinki Airport, allowing residents to see how current flights are performing as well as being able to access historical data showing which flights consistently perform poorly.

## Policy Measures

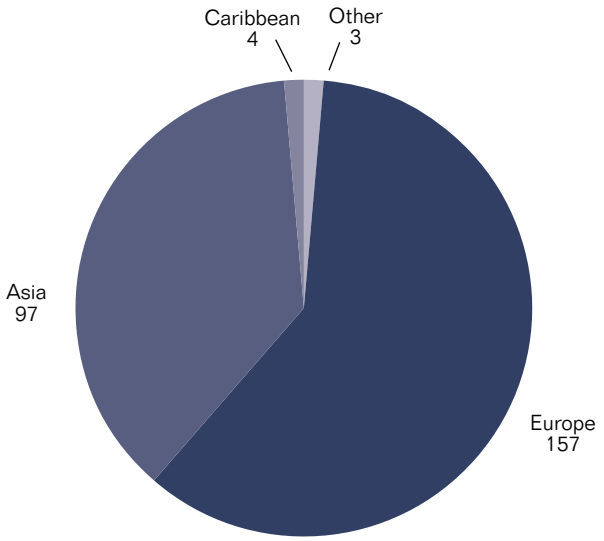
**6.18** There are a number of ways an airport can look to reduce emissions from the operation of its own facilities and by encouraging users to reduce their own. Airports Council International (ACI) in Europe has produced a carbon accreditation scheme which offers a roadmap for airports to become carbon neutral from their own operations. So called "kiss and fly" visits, where a person is dropped off or picked up by a relative (creating double the necessary car trips), are particularly undesirable and airports can introduce charges for drop-offs to limit these and encourage passengers to use alternative modes of transport. A large number of trips to airports are made by staff, so most major airports have schemes in place to reduce these, including staff shuttle buses and incentive schemes to use public transport.

**6.19** At a government policy level, the UK Air Passenger Duty (APD) is charged to departing passengers at UK airports. Depending on the distance and the class of travel, this is charged at between £13 and £142 per passenger, and is one of the most expensive taxes of its type worldwide. It has in the past been referred to as an environmental or "green" tax, however it has no clear direct link to reducing emissions other than discouraging low-income travel and potentially has the effect of shifting inbound tourism to neighbouring countries such as France, Germany and Ireland where air passenger taxes are either significantly lower or non-existent.

Ireland, Netherlands and Belgium are examples of countries that have successfully abolished their tax and benefited as a result. Any economic policy measure to reduce emissions must be significantly more direct (i.e. charged on a per emission or fuel burn basis) and applied as universally as possible to avoid harmful market distortion. Revenues gained through such measures or, indeed, incremental revenues from APD, could be hypothecated for use in supporting communities around the airport or wider environmental measures.

**6.20** Around the world, Europe is leading the way in terms of establishing noise and environment-related charges on airlines. 60% of all airports with such charging structures are in Europe, whereas there are none in North America. At an airport level, industry has taken to incentivising quieter and less polluting travel through the use of differentiated charging structures, with the number of airports using these systems increasing over recent years. These charges typically take the form of either a noise charge or a NOx charge, as these are the impacts that are most relevant to the airport and its local community.

Figure 32: Airports with Environmental Charge Elements Split by Continent




*Source: Airportcharges.com*

**6.21** Within Europe, the UK is one of the front-runners in implementing environmental charges. The nine largest airports all have noise charges, and three of those also charge for NOx.

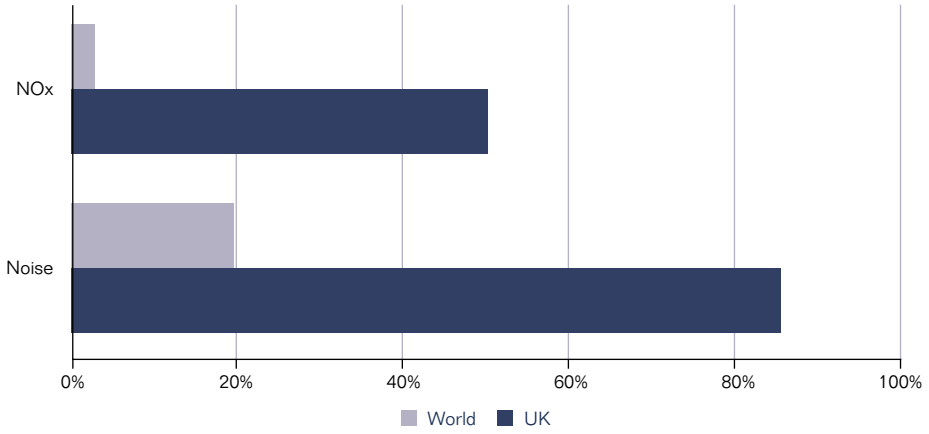
Table 3: UK Airports with Environmental Charging Elements

| Airport | Noise charges | Nox charges |
|---|---|---|
| London - Heathrow Airport | Yes | Yes |
| London - Gatwick Airport | Yes | Yes |
| Manchester International Airport | Yes | |
| London - Stansted Airport | Yes | |
| London - Luton Airport | Yes | Yes |
| Edinburgh Airport | Yes | |
| Birmingham International Airport | Yes | |
| Glasgow International Airport | Yes | |
| Bristol Airport | Yes | |
| London City Airport | | |
| Newcastle Airport | | |
| Liverpool John Lennon Airport | | |
| Belfast International Airport | | |
| East Midlands Airport | Yes | |
| Aberdeen Airport | Yes | |
| Leeds/Bradford Airport | | |
| Belfast City Airport | | |
| Southampton Airport | Yes | |
| Jersey Airport | | |
| Guernsey Airport | | |

*Source: airportcharges.com and RDC analysis. Note that London City and Belfast City airports have local planning agreements that restrict movements*

**6.22** Although there remain a number of airports in the UK without environmental charges, the high coverage of the largest airports means that 86% of the UK departing seats are covered by noise charges and 51% by NOx charges.

Figure 33: Proportion of UK Airport seats Covered by Environment Charges




*Source: Airportcharges.com*

## Noise Management

**6.23** Before construction of any new capacity at either Heathrow or Gatwick, the government should introduce new noise abatement policies, limits or quotas to ensure that the capacity is delivered whilst limiting the impact on local residents. It could also mandate the use of certain routing pathways to ensure airline flight plans are optimised for the needs of communities rather than to simply reduce fuel burn. However on their own, bilateral actions by government or the airport operators may be treated with extreme scepticism by those living under flight paths. Building the trust of communities is a vital part of the planning and delivery process, with community participation essential to delivering effective noise management. The chances of meaningful engagement with community groups will be greatly improved if there are independent redress and control measures that oversee all short and long term agreements, with direct powers of intervention for breach of agreed limits.

**6.24** For this reason we support the creation of an independent regulator responsible for highly sensitive issues such as noise. Ideally this body would have a wider ranging remit than simply flight-path noise and would objectively consider how best to manage noise from aircraft and other forms of transport around the airport in conjunction with those most affected. An authority independent from government and the other aviation regulatory bodies would be able to advise on a range of critical issues, from the location of monitoring stations to consulting on proposed solutions and advising government on best practise.

**6.25** With the Airports Commission having published a revised set of long-term growth projections for the UK, a noise authority should look to create a long-term noise road-map that links current and future flight paths to demand projections, showing how noise is expected to develop in terms of intensity and frequency. It would be in a position to work with local stakeholders and NATS on developing a range of environmentally optimised approach and departure paths that balance reducing fuel burn with carbon emissions and minimising local noise.

**6.26** Planning permission, or even the airport operating licence, should include new regulatory limits or noise quotas, backed up with ongoing publication of results by airline, aircraft type and route across a range of monitoring stations. Add to this real-time noise monitoring and a noise authority with the power to approve, suspend or fine operators for failure to use agreed flight paths or hit targets for aircraft operations, it should be possible to gain the trust of local communities.

**6.27** It is increasingly common for such restrictions to be included in the planning permission at major airports across Europe, and there are a number of key examples to learn from:

- Frankfurt – In 2011 the airport opened its fourth runway, which came with a ban on night flights – a total ban for 6 hours during the night, and a tight restriction on the number of flights in the borderline times.
- Berlin Brandenburg – Marketed as a new airport but essentially a major expansion of the current Schönefeld Airport, including the construction of a second runway. Flights will be banned between midnight and 5am, with "strict quota limitations" from 10pm and between 5-6am.
- Amsterdam Schiphol – Constructed sixth runway in 2003. Night operating procedures were tightened to include shoulder periods of one runway used for arrivals and one runway for departures.

# 7. Radical Technologies

**7.1** So far we have looked at the efficiencies that should be achievable within the aviation sector through the implementation of 'known' or relatively low-risk technologies. These tend to be improvements in equipment, techniques or procedures that are either in use today or that are very likely to be introduced before 2030.

**7.2** Looking beyond the 2030 time period, which is the point beyond which we expect the current and planned global fleet starting to be replaced by aircraft that are yet-to-be developed, there are likely to be further enhancements across the environmental spectrum that could have a material impact on $CO_2$ emissions, NOx and noise. However the levels of uncertainty are such that they should be considered as 'unknown' in the context of a study such as this. Nonetheless, there is scope for radical future technologies to make a step-change in emissions and/or noise from aircraft.

## Biofuels

**7.3** At present biofuels (also known as Sustainable Aviation Fuels) are seen as an important part of the long-term sustainability solution for aviation. Depending on the projections, anywhere between 5% and 20% of future emission savings could come about from use of biofuels as a replacement for the jet kerosene that is currently used to power the global fleet.

**7.4** For production, distribution and logistical reasons, biofuels must be compatible with conventional jet fuel so that aircraft can be flown safely irrespective of the type of fuel available at an airport, which means any alternative fuel must have 'drop-in' properties whereby it can be mixed with regular fuel and behave in the same way. Unlike road transport, for which there are relatively few risks in achieving a stable mix of bio- and regular fuels, replicating the properties of jet kerosene comes with significant challenges. Any 'drop-in' fuel must share similar properties to that with which it is being mixed, including having the same freeze- and flash-points; density and energy content; and being able to share the same on-site infrastructure in order to propel an aircraft safely through the extreme range of operational conditions, be that at high altitude over the Polar Regions or taking-off at sea level in the desert.

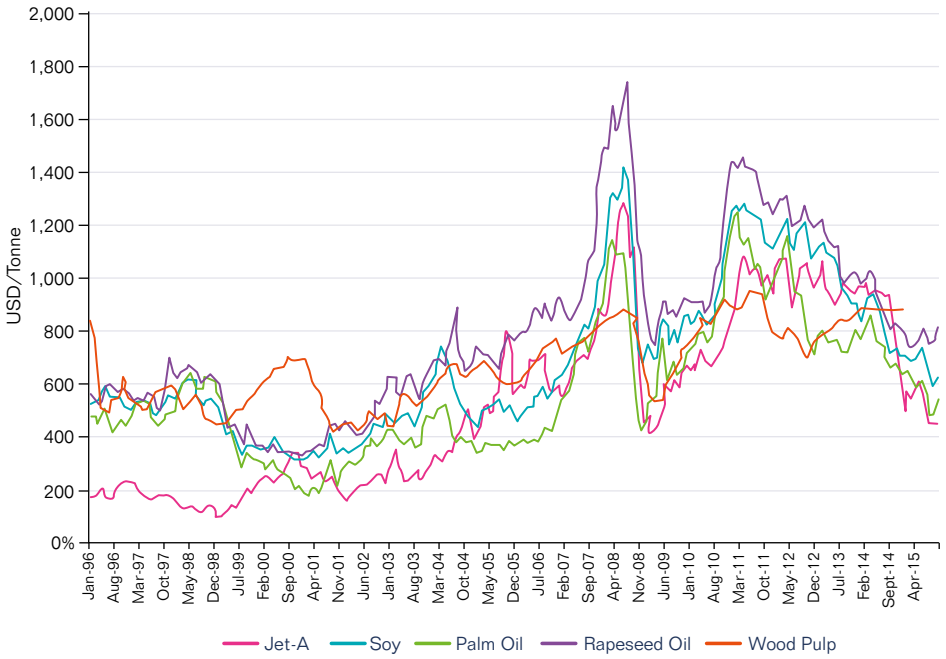
**7.5** Given the potential value of achieving a breakthrough in developing sustainable biofuels it is no surprise that there are a considerable number of processes, techniques and fuel sources under investigation. In the US alone, an estimated 2,700 biofuel patents have been issued since 2002 and there are now several alternative fuels that have been certified for use and tested in real-life flight conditions. In its 2014 report into alternative fuels, IATA details 3 already-approved pathways to producing biofuels and highlights 21 agreements between airlines and producers to develop and test these alternative fuels. Over the last decade, in excess of 1,500 flights have been undertaken using a blend of regular and biofuel and the world's

largest airlines – who are also the heaviest consumers of jet fuel – have conducted test flights using mixes of up to 50% biofuel developed using various techniques and fuel sources. To date, there have been a range of raw materials used to synthesise aviation fuel, including agricultural waste, used cooking oil, various plant and switchgrass sources such as jatropha and camelina, and fermented hydro-processed sugar.

**7.6** However, although it is now proven that aircraft can be safely powered by various mixes and types of biofuel there is yet to be clarity over how to achieve future large-scale production at commercially viable prices. There are a number of reasons behind this. Firstly, crop-based biofuels must come from sustainable sources, meaning they cannot be derived from food-crops, nor can they compete with land or other resources, such as water, that could be used to grow such crops. Second, fuel sources must be able to generate a predictable and stable yield, which is not the case with some of the plants used to date. Finally, production and retail costs must be similar to the cost of the fuel they are replacing, or at least the cost of the fuel plus any environmental mitigation costs such as associated carbon trading or emissions charges.

**7.7** Looking at the cost of a sample of raw materials that could be used to produce bio-jet, including soy and palm oil or wood-pulp, we can see that the commodity cost-per-tonne tracks a similar line to that of jet fuel over a 20-year period. In this example, the chart compares the cost of raw materials for the crop-based commodities versus refined jet fuel. In the case of rapeseed oil, about 2.5 tonnes is required to produce one tonne of biofuel[12], making the rapeseed around three-times more expensive per tonne than jet fuel – before production costs are factored.

Figure 34: Cost per Tonne of Jet Fuel and Selected Biomass Raw Materials




*Source: US EIA, Index Mundi, RDC*

12 European Biomass Industry Association

**7.8** The second major challenge for crop-based biofuels is the land-mass required for large scale production. Using a simplistic illustration, UK airlines consume an estimated 8m tonnes of fuel per year. A mid-yield biofuel crop such as rapeseed has a yield of around 1,000 litres of fuel per hectare, which equates to over 9m hectares of land required to generate enough fuel to power the UK airline fleet for a year – an equivalent land mass to Portugal.

**7.9** Other resources such as municipal or agricultural waste, or used cooking oil, offer 'win-win' potential as source materials for biofuel but are difficult to aggregate and transfer to production sites in large volumes without adding carbon.

**7.10** In a recent MIT study into the use of advanced biofuels in aviation[13], Winchester et al conclude that there are significant challenges to scaling-up production of biofuels for commercial use in aviation, which include *"high production costs and lack of integration of aviation biofuels into regulatory frameworks, limits in scale-up due to feedstock availability, environmental and socio-economic consequences of large-scale land-use change and competition with food and feed needs, water consumption associated with biomass cultivation and time required for scaling up biomass cultivation and conversion facilities."*

**7.11** Biofuels have a role in the mitigation of carbon emissions and are part of a range of measures that we believe can help the wider transportation industry reduce its environmental impacts. However, given the challenges currently facing large-scale production, they are unlikely to produce a step-change in emission levels for any mode of transport, and in terms of air transport it is safer to assume that for the next two-decades there will be a slow and steady introduction of such fuels in modest quantities rather than a radical shift.

## Other Alternative Power Sources

**7.12** As with road, rail and other transport, the long-term future for the propulsion of air transport is likely to be with electrical power. Unfortunately for an aircraft the technology required to make this feasible needs to be considerably more advanced than other modes, as the power output is high and the distances between possible opportunities for charging are huge.

**7.13** Airbus is one of several manufacturers to carry out research into this field. In 2015 they successfully flew the Airbus "e-fan" for the first time – a twin seat electrically powered aircraft aimed at the flight training market.

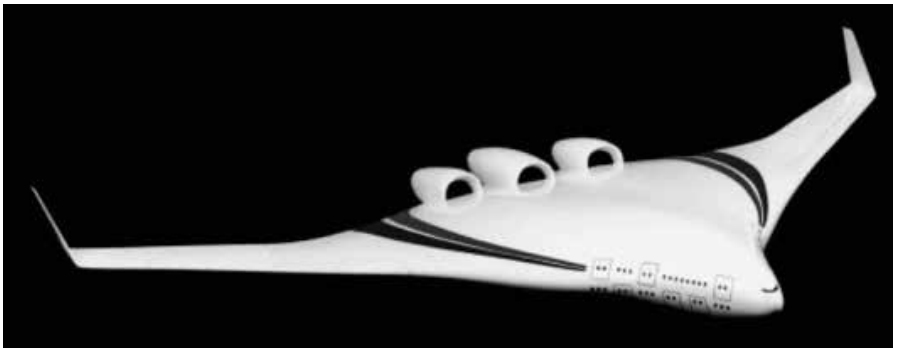
**7.14** Airbus has also developed a concept, known as the "e-thrust", which would essentially be a hybrid-powered aircraft for commercial use. One jet turbofan engine would charge a battery, which provides the power to six large fans. This would increase the effective bypass ratio and significantly increase the efficiency of the aircraft. However the technology required is currently well beyond that of the e-fan, as each of the e-thrust's engines are required to deliver 670kW of power, while the entire e-fan aircraft runs off just 60kW of power.

13 Niven Winchester et al, The Impact of Advanced Biofuels on Aviation Emissions and Operations in the US, Feb 2015

## Non-powerplant Changes

**7.15** A number of opportunities exist for commercial aircraft design to develop away from what has become "the norm" in aircraft design. One idea that has been discussed on a number of occasions – albeit often as too radical – is known as the blended wing body, and an even more radical change is known as the flying wing.

Figure 35: Concept of a Blended Wing Body Airliner



Source: Wikimedia Commons

**7.16** Both designs are significantly more fuel efficient and quieter than traditional commercial aircraft designs, although estimates vary greatly. The greatest challenges in their implementation will be a redesign of existing infrastructure (as the designs require long wingspans/shorter fuselages) and acceptance from passengers of the new configurations, such as less windows.

## Summary

**7.17** With some of these technology options, key challenges including financial viability of research and development may not be resolved from the private sector alone. As we have seen very recently, projects that appeared commercially attractive with oil at $150/barrel no longer appear viable when it falls below $50/barrel. Low oil prices in the short term affects the development of long-term market-based environmental solutions, including the UN's Clean Development Mechanism which underpins global carbon trading, that are currently struggling to attract investment while oil remains cheap. Governments have a role to play here in supporting R&D or requiring its own departments to use or develop clean technologies that will filter through into the commercial world over time.

**7.18** The military plays a part here, particularly in terms of aviation. The US Department of Defence has mandated itself to reduce reliance on fossil fuels, targeting 50% from renewable sources by 2020. The US Air Force alone uses an estimated 2.4 billion gallons of jet fuel annually, and its investment in support of the US biofuel industry to generate over 1bn gallons of biofuel for its consumption can only bring forward production solutions. The same goes for airframe technology, where radical designs may be tested and developed for military use many years before entering commercial service.

**7.19** We conclude that the aircraft of the future is likely to be very different to that of today, but is unlikely to be taking to the skies any time before the mid-2030s at the earliest, and more likely post-2040. Until then, working on incremental efficiency gains and a combination of policy intervention, development of international standards and research pathways coupled with market forces, will drive change at a sufficient rate to ensure radical technologies are not essential to enable short-term growth.

# 8 Conclusions

**8.1** The UK aviation industry clearly has to show responsibility for its environmental and social impacts. For many years the wider industry has avoided $CO_2$ targets, and this is something that must be rectified swiftly in order to bring the global industry into line and make it as answerable as other sectors. However, in the UK this process is already underway, and EU regulations have made possible the stringent measurement of NOx and other gases which can harm air quality around the airport perimeter. The outcomes of the UK's Airports Commission have shown that there is an urgent need to build more airport capacity, but this cannot come at the detriment of sustainability.

**8.2** Local air quality is a problem that is rightly high on the public agenda but it is difficult to unravel the full impact of aircraft from NOx emissions from the wider transport network, of which London is the worst performing capital city in Europe[14]. Firstly, the impact is limited to the immediate surroundings of the airport itself, as emissions from altitude are sufficiently dispersed so as not to be a problem for residents on the ground. The impacts from aircraft themselves are relatively modest, with research suggesting airport vehicles and surface access add an equivalent amount. Surface access is difficult to split out from with non-airport traffic – for instance at the air quality monitoring stations around Heathrow, the highest NOx emissions are seen at areas where less than 5% of the NOx comes from airport traffic. Where emissions such as NOx are a problem, there are a number of opportunities for reducing these impacts with more efficient airport operations – and new technology will have an impact as well. With surface access forming a substantial portion of these emissions, the continuous improvement in automotive technology should significantly reduce the impact from the airport, for instance the DfT forecast a 62% reduction in NOx from road vehicles by 2040.

**8.3** From a noise perspective the industry has been driving gains since the height of the jet-age in the 1960s and 70s, however it is apparent that residents local to airports are still affected by noise nuisance. We consider the means to address this are three-fold. Firstly, continued technology improvement through new aircraft and retro-fitting upgrades to older aircraft – we forecast that the average aircraft will be at least 9dB quieter by 2050, without any radical new technology. Secondly, the tweaking of airport operations to minimise noise to local communities, such as the use of continuous descent approaches and displaced runway thresholds, could save up to 9dB. Use of PBN in conjunction with a legally binding flight paths with guaranteed periods respite can offset the impact of continual and concentrated noise. Airports need to continue and further develop engagement with their local communities in order to disseminate information and increase awareness of the airports operation, providing the knowledge and prior warning of flightpath usage that should make living under a flightpath a less stressful experience, with guaranteed periods of respite wherever possible. This should be enhanced by giving communities access to an independent arbiter in the form of a noise authority with powers to monitor and report on performance against agreed limits and penalise where necessary.

14 Clean Air in London - http://cleanair.london/sources/guide-to-sources-london-has-the-highest-levels-of-nitrogen-dioxide-of-any-capital-city-in-europe/

**8.4** $CO_2$ is a global issue that must be tackled with global measures. The fuel efficiency of new technology will see the industry becoming more fuel efficient by around 1.6% per year, however this will almost certainly be outstripped by increasing demand from developing economies. Carbon trading and greater multinational coordination are the potential long-term solutions to this, along with a continued drive to deliver improving technology. In the meantime, the UK should avoid attempting to address its own problem with unilateral action. By stifling the country's air transport industry, the UK would only succeed in pushing its portion of emissions to other countries, in what is undoubtedly a global problem, whilst allowing delays and severe inefficiencies to become commonplace. Furthermore, the evidence laid out in this report suggests that the hub model is a more efficient means of transporting passengers over long distances than the point-to-point alternative, and therefore capping airport growth as an environmental measure is likely to be flawed if it inhibits a hub model from functioning effectively.

**8.5** Sustainability is undoubtedly one of the greatest challenges facing the aviation industry in the 21st Century, and we have explored various impacts and mitigation measures available. Aviation can meet almost all of its targets for sustainability by following the current trend, helped by pragmatic engagement with communities and some regulatory intervention. Noise and local air quality impacts have been improving greatly as new technology becomes greener and more efficient. $CO_2$ is also falling on a per passenger basis, however high rates of growth in developing regions of the world are likely to lead to an overall increase in $CO_2$ without further action. The aviation industry requires greater coordination on a global scale in order to contain this problem, including encouraging greater streamlining through the use of hubs and a global approach to carbon trading and other measures.

# Notes

## Author Profile

**Peter Hind** is Managing Director of RDC Aviation and has over 20 years' experience in the aviation sector, including senior roles in the strategy and network planning team at bmi. He has also authored the ITC's reports on 'The Optimal Size of a UK Hub Airport' and 'Delivering improved airport capacity' which were submitted to the Airports Commission. Peter also teaches Sustainable aviation on the Air Transport Management MSc at City University.

## The Brief

This Report was commissioned by the Independent Transport Commission (ITC) to review and assess advancements in the sustainability of air travel over recent decades, as well as to determine whether or not progress can be expected to continue. The report is intended to give an independent assessment of how technology and operations have contributed towards improving the sustainability of air travel, particularly in the areas of emissions and noise, and seeks to determine the scale of progress made so far and whether or not this is likely to continue over the next 30-50 years.

## Disclaimer

Any statements made in the Report that are not historical fact are based on data and information provided by others. RDC has not verified the accuracy of any such data and information unless otherwise specified. Any conclusions, recommendations, forecasts, projections or estimates contained within the Report constitute forward-looking statements that, by their very nature, involve risks and uncertainties that are beyond our control. No allowance has been made for changes in government policy or regulation; economic performance; price; taxation; company failure; strategic change; ownership change; business failure; or other external factors that could cause actual results to differ materially from those shown in the Report. RDC specifically does not guarantee or warrant any estimate, forecast or projected outcome contained in this Report.

The information contained in the Report was produced between October 2015 and January 2016 and is based on the conditions encountered and information available at that time.

RDC Aviation
The Hub
40 Friar Lane
Nottingham NG1 6DQ

t: +44 (0) 115 852 3043
f: +44 (0) 115 924 0361
www.rdcaviation.com
info@rdcaviation.com

Independent Transport Commission

March 2016

For further information and electronic copies please visit:

www.theitc.org.uk

or write to:

The Independent Transport Commission

70 Cowcross Street

London

EC1M 6EJ

INDEPENDENT
**TRANSPORT**
COMMISSION

## Published by the Independent Transport Commission

The **Independent Transport Commission (ITC)** is one of Britain's leading research charities with a mission to explore all aspects of transport and land use policy. Through our independent research work and educational events we aim to improve and better inform public policy making. For more information on our current research and activities please see our website: **www.theitc.org.uk**

Independent Transport Commission
70 Cowcross Street
London
EC1M 6EJ

Tel No: **0207 253 5510**
**www.theitc.org.uk**

Registered Charity No. 1080134

£15



reachmarketing.co.uk 24245 03/16

# ISHR-004

## Department of Transport
## Circular 01/2010 - Control of development in Airport Public Safety Zones

DEPARTMENT FOR TRANSPORT

*DfT Circular 01/2010*
***Department for Transport***
***Great Minster House, 76 Marsham Street, London SW1P 4DR***

5 March 2010

# CONTROL OF DEVELOPMENT IN AIRPORT PUBLIC SAFETY ZONES

1. This Circular updates DfT Circular 1/2002 to take account of the shift of day-to-day administrative responsibilities for implementing Public Safety Zone (PSZ) policy from the Department for Transport to the Civil Aviation Authority (CAA). The PSZ policy itself and the guidance to local planning authorities contained in the Annex to this Circular remain the same.

2. Following an internal DfT review, it has been concluded that the administration of PSZ policy will be carried out by the CAA. The CAA has, therefore, taken over responsibility for the implementation of new PSZs and the review and update of existing PSZs, as instructed by DfT.

3. DfT Circular 1/2002 is hereby withdrawn.

4. Enquiries about this Circular should be addressed to:

   Airports Policy Division
   Department for Transport
   1/24 Great Minster House
   76 Marsham Street
   London SW1P 4DR

   or to psz@dft.gsi.gov.uk.

Enquiries regarding existing PSZs, including requests for paper copies of Public Safety Zone maps and, where applicable, the 1 in 10,000 individual risk contours in digital format, should be addressed to:

Aerodrome Standards
Civil Aviation Authority
Aviation House 2W
Gatwick Airport South
West Sussex RH6 0YR

or to psz@caa.co.uk.

John Parkinson, Divisional Manager

Addressed to:

The Chief Planning Officers in England

# ANNEX

## CONTROL OF DEVELOPMENT IN AIRPORT PUBLIC SAFETY ZONES

## THE BASIC POLICY OBJECTIVE

1. Public Safety Zones are areas of land at the ends of the runways at the busiest airports, within which development is restricted in order to control the number of people on the ground at risk of death or injury in the event of an aircraft accident on takeoff or landing. The basic policy objective governing the restriction on development near civil airports is that there should be no increase in the number of people living, working or congregating in Public Safety Zones and that, over time, the number should be reduced as circumstances allow.

## INDIVIDUAL RISK CONTOUR MODELLLNG

2. The implementation of Public Safety Zone policy at civil airports is based on modelling work carried out using appropriate aircraft accident data to determine the level of risk to people on the ground around airports. This work determines the extent of individual risk contours, upon which a person remaining in the same location for a period of a year would be subjected to a particular level of risk of being killed as a result of an aircraft accident. Public Safety Zone policy is based predominantly on individual risk, while extending beyond it in relation to particular types of development such as transport infrastructure and to temporary uses. The areas of the Public Safety Zones correspond essentially to the 1 in 100,000 individual risk contours as calculated for each airport, based on forecasts about the numbers and types of aircraft movements fifteen years ahead. The Public Safety Zones represent a simplified form of the risk contours, in order to make the Zones easier to understand and represent on maps, and also in recognition of the necessarily imprecise nature of the forecasting and modelling work. In some cases the resultant shape of the Public Safety Zones is that of an elongated isosceles triangle. In others the triangle is slightly modified to form an elongated five-sided shape. In all cases the Public Safety Zones are based on the landing threshold for each end of the runway and taper away from the runway.

3. The Public Safety Zones are based upon risk contours modelled looking fifteen years ahead, in order to allow a reasonable period of stability after their introduction. The Public Safety Zones should be of sufficient size to allow for possible future growth in the number of aircraft movements, without affecting unnecessarily large areas of land. Third party individual risk contours around airports will be remodelled at intervals of about seven years, based on forecasts about the numbers and types of aircraft movements fifteen years ahead. It is likely that this will lead to the redefinition of the Public Safety Zones, though the changes will not necessarily be significant. In the meantime, the contours will be remodelled in the event that a significant expansion of an airport is approved which has not already been assumed in the modelled risk contours. In addition, the Public Safety Zones will need to be redefined if a runway is extended or if a landing threshold is moved.

## RISK APPRAISAL

4. The basis of the policy of restricting new development within Public Safety Zones is constrained cost–benefit analysis. This is a risk appraisal principle under which individual risk is reduced to a tolerable level irrespective of cost, and then further reduced only if the benefits of doing so exceed the costs. Within the Public Safety Zones there are safety benefits from preventing any new or replacement development, or change of use, which would result in an increase in the numbers of people within the Zones. The economic costs of removing existing development throughout the Zones would, however, outweigh the safety benefits of doing so, and the Secretary of State is therefore not proposing that course.

5. Although the boundaries of the Public Safety Zones correspond essentially to the 1 in 100,000 individual risk contours, the level of risk in some areas within the Zones may be much higher. The Secretary of State regards the maximum tolerable level of individual third party risk of being killed as a result of an aircraft accident as 1 in 10,000 per year. At some airports, the 1 in 10,000 individual risk contour extends beyond the airport boundary and includes occupied property. In other cases there is no occupied development within the areas concerned, or the areas concerned are contained wholly within airport boundaries.

## PURCHASE OF PROPERTY BY AIRPORT OPERATORS

6. The Secretary of State wishes to see the emptying of all occupied residential properties, and of all commercial and industrial properties occupied as normal all-day workplaces, within the 1 in 10,000 individual risk contour. In cases where any part of a residential property falls within this contour he will expect the operator of an airport for which new Public Safety Zones have already been established to make an offer to purchase the property or, at the option of the owner, such part of its garden as falls within this contour. In addition he will expect such operators to make an offer to purchase, in whole or in part, a commercial or industrial property if that property, or the relevant part of it, is occupied as a normal all-day workplace and falls within this contour. If the part of the property in question is discrete or self-contained, and its loss would not materially affect the business concerned, only that part need be the subject of such an offer. Otherwise the airport operator should offer to purchase the entire property. In the case of airports for which Public Safety Zones are established or redefined after the date of this Circular, the Secretary of State will expect the operators to make such an offer, where applicable, within twelve months of the notification of the Public Safety Zones and the 1 in 10,000 individual risk contours.

7. The Secretary of State will expect all such offers to be kept open indefinitely. If an owner wishes to sell a property, the airport operator should apply the Compensation Code. Airport operators will be expected to demolish any buildings purchased and to clear the land. The Secretary of State will be prepared to consider applications for compulsory purchase orders by airport operators with powers under section 59 of the Airports Act 1986.

## ESTABLISHMENT OF PUBLIC SAFETY ZONES

8. Public Safety Zones have been established at all the airports for which modelling work produced 1 in 100,000 individual risk contours of a sufficient size to justify doing so. PSZs may from time to time be established at other airports if the modelled level of individual third party risk in their vicinity fifteen years ahead justifies this.

## ROLE OF LOCAL PLANNING AUTHORITIES

9. This Circular contains guidance to local planning authorities to enable them to decide planning applications and consider road proposals affecting land within Public Safety Zones. Local planning authorities need not carry out risk assessments in considering individual planning applications for sites within Public Safety Zones: the principle of constrained cost–benefit analysis underlies the specific guidance contained in paragraphs 10 to 12 below. Nor will it normally be necessary for them to consider whether the granting of an individual planning application would lead to an increase in the number of people living, working or congregating in the Public Safety Zone: the specific guidance contained in paragraphs 10 to 12 indicates whether or not particular types of development are acceptable.

## GENERAL PRESUMPTION AGAINST DEVELOPMENT WITHIN PUBLIC SAFETY ZONES

10. There should be a general presumption against new or replacement development, or changes of use of existing buildings, within Public Safety Zones. In particular, no new or replacement dwellinghouses, mobile homes, caravan sites or other residential buildings should be permitted. Nor should new or replacement non-residential development be permitted. Exceptions to this general presumption are set out in paragraphs 11 and 12.

## DEVELOPMENT PERMISSIBLE WITHIN PUBLIC SAFETY ZONES

11. Two types of exception to the general presumption may be permitted within those parts of Public Safety Zones outside any 1 in 10,000 individual risk contours. First, it is not considered necessary to refuse permission on Public Safety Zone grounds for the following forms of extension or change of use:

    (i) an extension or alteration to a dwellinghouse which is for the purpose of enlarging or improving the living accommodation for the benefit of the people living in it, such people forming a single household, or which is for the purpose of a 'granny annex';

    (ii) an extension or alteration to a property (not being a single dwellinghouse or other residential building) which could not reasonably be expected to increase the number of people working or congregating in or at the property beyond the current level or, if greater, the number authorised by any extant planning permission; or

    (iii) a change of use of a building or of land which could not reasonably be expected to increase the number of people living, working or congregating in or at the property or land beyond the current level or, if greater, the number authorised by any extant planning permission.

Second, certain forms of new or replacement development which involve a low density of people living, working or congregating may be acceptable within a Public Safety Zone. Examples of these might include:

(iv) long stay and employee car parking (where the minimum stay is expected to be in excess of six hours);

(v) open storage and certain types of warehouse development. 'Traditional' warehousing and storage use, in which a very small number of people are likely to be present within a sizeable site, is acceptable. But more intensive uses, such as distribution centres, sorting depots and retail warehouses, which would be likely to entail significant numbers of people being present on a site, should not be permitted. In granting planning permission for a warehouse, a local planning authority should seek to attach conditions which would prevent the future intensification of the use of the site and limit the number of employees present;

(vi) development of a kind likely to introduce very few or no people on to a site on a regular basis. Examples might include unmanned structures, engineering operations, buildings housing plant or machinery, agricultural buildings and operations, buildings and structures in domestic curtilege incidental to dwellinghouse use, and buildings for storage purposes ancillary to existing industrial development;

(vii) public open space, in cases where there is a reasonable expectation of low intensity use. Attractions such as children's playgrounds should not be established in such locations. Nor should playing fields or sports grounds be established within Public Safety Zones, as these are likely to attract significant numbers of people on a regular basis;

(viii) golf courses, but not clubhouses; and

(ix) allotments.

12. Paragraphs 5 to 7 set out the general policy in relation to buildings and land within any 1 in 10,000 individual risk contours. The principal feature of that policy is that people should not be expected to live or have their workplaces within such areas. Consequently very few uses will be acceptable within this risk contour. But certain forms of development which involve a very low density of people coming and going may be acceptable within it. Examples of these might include:

(i) long stay and employee car parking (where the minimum stay is expected to be in excess of six hours);

(ii) built development for the purpose of housing plant or machinery, and which would entail no people on site on a regular basis. Examples might include boiler houses, electricity switching stations or installations associated with the supply or treatment of water; and

(iii) golf courses, but not clubhouses.

## REFERENCE TO THE DEPARTMENT

13. A local planning authority may exceptionally receive applications for other forms of development on sites within Public Safety Zones for which it may consider that there is a reasonable expectation of low-density occupation and may therefore be minded to grant planning permission. The authority may wish to refer such applications to Airports Policy Division in the Department for Transport, which may be able to advise on whether the proposed development is consistent with the general thrust of Public Safety Zone policy.

## CONDITIONS

14. Local planning authorities should consider the use of suitably-worded conditions in appropriate cases in order to limit the number of people who might be expected to be present on site at any time.

## TRANSITIONAL ARRANGEMENTS

15. Planning permissions are valid for five years or for a specified alternative period, and local planning authorities may have granted planning permission in relation to sites which were not within Public Safety Zones at the time when the permissions were granted. Similarly, local planning authorities may have granted outline planning permission in relation to such sites but not yet considered applications for permission for the details. The Secretary of State is not seeking the revocation or modification of an unimplemented planning permission during its lifetime. Nor is he seeking the refusal of planning permission on Public Safety Zone policy grounds when an application for the approval of details comes to be considered, provided that the approval of such an application does not result in a greater number of people on the site than would have been appropriate for the type of use for which the outline permission was granted. On the other hand, if a planning permission has not been implemented by the time it expires, any application for an extension of the permission should be considered in the light of the specific guidance contained in paragraphs 10 to 12 above.

## DEVELOPMENT NOT REQUIRING PLANNING PERMISSION

16. Public Safety Zone policy has full effect only when an application for planning permission is made. But local planning authorities should also have regard to Public Safety Zone policy when considering and commenting on proposed development for which they are not the determining authority, such as Crown development, overhead lines, some forms of permitted development and orders made under the Transport and Works Act 1992.

17. Where the exercise of permitted development rights would encourage more people on to land within a Public Safety Zone, the local planning authority should consider whether an Article 4 direction, made under the Town and Country Planning (General Permitted Development) Order 1995 in order to require a planning application, would be appropriate. Relevant circumstances might include the temporary use of land within a Public Safety Zone for the holding of a market or its proposed use as a caravan site.

## TRANSPORT INFRASTRUCTURE

18. Although transport infrastructure within Public Safety Zones is typically used by any one person for only a short period at a time, a large number of people can be using a particular facility at any particular time. The density of occupation of a six-lane motorway or a mainline railway, averaged over a day, is similar to that of a housing development. Transport infrastructure is therefore considered for Public Safety Zone policy purposes as if it is residential, commercial or industrial development. As with those forms of development, the Secretary of State does not consider it necessary to remove existing transport infrastructure from within Public Safety Zones. But new transport infrastructure such as railway stations, bus stations and park and ride schemes should not be permitted within Public Safety Zones, as they would result in a concentration of people for long periods of the day. The planning of new transport links requires careful consideration. Although people passing along a transport route are likely to be within the Public Safety Zone for only a very small part of the day, the average density of occupation within the Zone may be significant, and as high as that for fixed development. Individual schemes should therefore be considered on their merits. Proposals for major roads and motorways should be carefully assessed in terms of the average density of people that might be expected to be exposed to risk. Careful attention should also be given to the location of major road junctions and to related features such as traffic lights and roundabouts which may lead to an increase in the number of stationary vehicles within a Zone. Low-intensity transport infrastructure, such as minor or local roads, can be permitted within Public Safety Zones.

## OFFICIAL SEARCHES

19. Local planning authorities whose areas include a Public Safety Zone or part of a Zone should ensure that the associated restrictions on development are entered in the Register of Local Land Charges.

## PURCHASE NOTICES AND COMPENSATION PAYABLE BY LOCAL PLANNING AUTHORITIES

20. The refusal of planning permission on Public Safety Zone policy grounds does not carry with it an automatic entitlement to compensation. But there may be a right to compensation under a purchase notice if a site or property is incapable of being put to any alternative beneficial use as a result of it being within a Public Safety Zone. Where permission for development is refused, or conditions are imposed, a local planning authority may have to acquire the site under the purchase notice provisions in sections 137–144 of the Town and Country Planning Act 1990, or pay compensation under section 144 (2) of that Act. Similarly, if planning permission is revoked or modified, or if permitted development rights are withdrawn by a direction under Article 4 of the Town and Country (General Permitted Development) Order 1995 and planning permission is refused or granted subject to conditions, a local planning authority may incur expenditure under sections 107, 108 or 279 of the 1990 Act. In these circumstances, if the action which gives rise to a compensation claim has been taken solely on Public Safety Zone policy grounds, the following arrangements apply:

    (a) local authority or privately owned airports subject to Part V of the Airports Act 1986

Any airport in respect of which a permission to levy charges is in force under Part IV of the Airports Act 1986, or in respect of which there is a pending application for such permission (subject to certain exclusions), is subject to Part V of the Act. Section 61 of the 1986 Act provides for the local planning authority to recover from the airport operator compensation which the authority has become liable to pay. This provision applies if the compensation liability results from a planning decision which would not have been taken, or from an order under section 97 of the Town and Country Planning Act 1990 which would not have been made, other than to prevent persons or buildings from being struck by aircraft using the airport. Section 61 of the 1986 Act also provides for the purchase of land by the operators of airports subject to Part V of that Act where a purchase notice is served.

(b) local authority or privately owned airports not subject to Part V of the Airports Act 1986

Where a local authority or privately owned airport is not subject to Part V of the Airports Act 1986, section 61 does not apply. Local planning authorities may wish to seek specific deeds of indemnity from the owners of any such airports against liability under the purchase notice and compensation provisions of the Town and Country Planning Act 1990, so that the airport owners will be the bodies to whom any land acquired under a purchase notice will normally be conveyed.

## PUBLIC SAFETY ZONE MAPS

21. Printed copies of maps showing the Public Safety Zones and, where applicable, the 1 in 10,000 individual risk contours, will be sent to the local planning authorities whose areas are affected by them. Additional copies will be available for sale from the CAA. The boundaries of the Public Safety Zones and any 1 in 10,000 individual risk contours are available from the CAA, free of charge, in digital format.

## INCORPORATION OF PUBLIC SAFETY ZONES INTO DEVELOPMENT PLANS

22. Regional Spatial Strategies and Local Development Frameworks should include a policy stating that Public Safety Zones have been established for a particular airport and that there is a general presumption against most kinds of new development and against certain changes of use and extensions to existing properties within the Zones, as described in DfT Circular 1/2010. The extent of Public Safety Zones and any 1 in 10,000 individual risk contours should be indicated on proposals maps accompanying regional spatial strategies and local development frameworks.

## MILITARY AERODROMES

23. The Ministry of Defence is responsible for Public Safety Zone matters at military aerodromes, although there are no such Zones currently in use at these sites.

Published by TSO (The Stationery Office) and available from:

**Online**
**www.tsoshop.co.uk**

**Mail, Telephone, Fax & E-mail**
TSO
PO Box 29, Norwich, NR3 1GN
Telephone orders/General enquiries: 0870 600 5522
Fax orders: 0870 600 5533
E-mail: customer.services@tso.co.uk
Textphone 0870 240 3701

**TSO@Blackwell and other Accredited Agents**

**Customers can also order publications from:**
TSO Ireland
16 Arthur Street, Belfast BT1 4GD
Tel: 028 9023 8451
Fax: 028 9023 5401



*Printed by The Stationery Office Ltd under the authority and superintendence of the Controller of Her Majesty's Stationery Office and Queen's Printer of Acts of Parliament.*

ISBN 978 0 11 553140 8

£6.50

TSO
information & publishing solutions

**www.tso.co.uk**

ISBN 978-0-11-553140-8
9 780115 531408 >