Gatwick Airport Independent Arrivals Review

Report and Recommendations

About the Review Team

The Review is led by Bo Redeborn who brings extensive experience and understanding of air traffic control as well as global provisions for aviation, having previously served as Principal Director of Air Traffic Management for EUROCONTROL.

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Graham Lake is the second member of the Review team. Graham, who previously served as Director General of CANSO, also brings extensive experience and understanding of air traffic control, aviation policy and aviation environmental developments.

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Foreword

Aircraft noise is an issue for almost all major airports around the world, Gatwick is no different. There have been particular issues related to noise from aircraft arriving at Gatwick. Following complaints from some local community groups and elected officials that Gatwick Airport is generating excessive noise disturbance and affecting more people, in August 2015 Gatwick Airport Limited (GAL) appointed Bo Redeborn to lead an independent arrivals review.

The review team comprised of Bo Redeborn and Graham Lake is independent of GAL and has been tasked to provide wholly independent professional analysis and report. The review has been asked to determine whether:

a) Everything that can reasonably be done to alleviate the problems which local communities are raising is in fact being done, whether this involves action by the airport or by other parties most closely involved – National Air Traffic Services (NATS), UK Civil Aviation Authority (UKCAA), the Department for Transport (DfT) or the airlines; and

b) The mechanisms which Gatwick has adopted for providing information to the local community and for handling of complaints have been fully adequate for the task.

The review has included an analysis of documentation and correspondence, the development of a comprehensive understanding of the principal perspectives identified and expressed and the identification of and engagement with key stakeholders, including residents and community groups.

Additional evidence was gathered through site and familiarisation visits. The identification of potential options to improve the present reported situation has included suggestions from all the established stakeholders and community groups and individuals, together with a review of the relevant techniques and policies used elsewhere in the UK and overseas.

The Independent Review has stemmed from Gatwick's assessment that more could be done to meet the concerns of local communities about noise from arrivals. That assessment has been borne out by the findings of the Review. It is clear to us that there is scope for significant improvement of the present situation through the utilisation of a number of established techniques, and through a closer collaboration on noise issues between the stakeholders. More can and should be done.

Full cooperation has been provided to the review team by the Department for Transport, the Civil Aviation Authority, National Air Traffic Services and Gatwick Airport Limited, and both easyJet and British Airways, for which we express our sincere appreciation and thanks.

Foreword

Gatwick has demonstrated a clear commitment to building strong and constructive relationships with its stakeholders and with local residents, in particular indicating its commitment to improved community engagement and to seeking sustainability in its operations.

The review team has been struck by the positive and constructive inputs to the study by all those involved, and it is our strong hope and belief that this report will provide a basis on which all concerned can move forward in that spirit to deliver a significantly better situation for the residents living close to the Airport's flight paths.

Finally, we wish to record our sincere thanks to the many individuals and organisations that have contributed their views to permit the development of these findings and recommendations.

Bo Redeborn Graham Lake

28th January 2016

Executive Summary

The Independent Review of Arrivals has stemmed from Gatwick's assessment that more could be done to meet the concerns of local communities about noise from aircraft arriving at the airport. That assessment has been borne out by the findings of this Review, it is clear that there is scope for the improvement of the present situation through the greater utilisation of a number of established techniques, and through a closer collaboration on noise planning, noise mitigation and noise communication issues between the stakeholders.

The review work has included an analysis of documentation and correspondence, the development of a comprehensive understanding of the principal perspectives identified and expressed and the identification of and engagement with key stakeholders, including residents.

In relation to noise planning, management and coordination matters, the complex structure of air transport policy, regulation, operation and oversight creates a naturally fragmented environment within which misunderstandings and even organisational conflict can develop. This situation can be exacerbated when the institutions and residents involved find themselves in an adversarial position, which on the basis of the findings of the review, appears to have been the case on occasion for Gatwick arrivals.

It is important to recognise that people's reaction to and perception of arrivals aircraft noise is a complex matter for any airport. Gatwick is no different. The routes and heights flown by aircraft have a direct impact on the effects of aircraft noise. They are also the result of airspace design and its operational management. For a physically small country with a large demand for aviation activity, the UK airspace infrastructure is a scarce resource. Since England has one of the highest population densities in the EU, it is therefore inevitable that aircraft noise will be a particular issue here compared with other countries.

Civil Aviation operates within a highly structured regime throughout the world. In the UK as elsewhere, this comprises, Government Policies and Strategies, Regulations and the Governance of airports, aircraft operations and airspace management. To ensure a consistent, safe and harmonised implementation, changes proposed for the UK air transport system at a national level are required to respect and reflect the policies and guidance developed and agreed by states (including the UK) at the global level through the International Civil Aviation Organisation (ICAO). Increasingly, European Regulation through the EC and the European Aviation Safety Agency (EASA) is adding to that complexity.

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Gatwick is located in South East England, one of the busiest locations for air transport in the world, an area served by airports which combined generate more than 1 million flights, processing in excess 150 million passengers. About half of these flights are operated at Heathrow, a quarter at Gatwick and the remainder by the other four London airports. Together these flights create one of the world's most complex areas of terminal airspace. The airspace used by aircraft arriving at all London airports including Gatwick, is managed by the UK National Air Traffic Services (NATS) from the UK National en-route Air Traffic Control Centre, located at Swanwick, Hampshire.

The routings established for Gatwick Arrivals and Departures reflect good practice as defined by the CAA and reflect the greater demand for airspace for the busier airport at Heathrow which also, because of its location, constrains the airspace options available to Gatwick.

Community Feedback

The review team, in the course of undertaking the arrivals task, has engaged with an extensive range of organisations, individuals, Parish, Town, District and County Councils, and Members of Parliament at Westminster, and has conducted three interactive public meetings with local Members of Parliament which were each attended by several hundred individuals. A large volume of e-mailed opinion has also been received.

The analysis of this feedback has led to the conclusion that community sensitivity to, perception of, and reaction to, the noise from aircraft using Gatwick, has increased. This is apparently for several reasons, which, in no particular order, include:

- The public consultation of Airspace Change Proposals in 2013 (subsequently withdrawn) for Gatwick, related to the CAA UK Future Airspace Strategy and NATS London Airspace Management Programme, their associated proposed P-RNAV arrival and departure routes, and the concentration of arrivals implied by the proposal of a Point Merge procedure.
- The 2013 Approach Stabilisation Initiative by GAL and NATS, changing the radar vectoring methodology used by NATS air traffic controllers at Swanwick, who manage Gatwick arrival manoeuvring and sequencing, which created an arrival swathe concentration of aircraft, both further east and further west of the airport.
- The work of the Airports Commission and the associated campaign by GAL to win approval for a second runway at Gatwick.

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- Airframe noise, generated by the Airbus A320 family of aircraft. The use of these aircraft at Gatwick is progressively increasing; by 2014 they represented more than 60% of all aircraft movements at the airport.
- The 2014 ADNID trial of potential new departure routes west of the airport.
- The introduction of RNAV-1 departure routes and the subsequent Post Implementation Review by the CAA.
- The perceived inability of communities to influence noise factors through the normal community engagement process provided by the airport, including the Gatwick noise complaints procedure (which is also reported by some residents to be inadequate) and the Gatwick Airport Consultative Committee (GATCOM).
- Insufficiently coordinated and sometimes inconsistent communications regarding arrivals procedures and noise mitigation from GAL, CAA, NATS and the DfT.
- The ubiquitous use of social media and of flight following Apps that has enabled the rapid dissemination of information and sometimes misinformation, which the institutions involved have often had neither the resource, coordination mechanisms, nor experience to manage effectively.

A Balanced Approach

For the management of aircraft noise, ICAO has adopted a balance approach. This uses a mixture of improvements in airframe and engine technology, and a range of operational measures. Land use planning policies, also a part of the balanced approach adopted by Governments, have been designed to reduce the numbers of people affected. This balanced approach is also used by the EU and UK Government for policy making and, has informed the structure of this review and its report.

Noise mitigation options reviewed and recommended by the review team are based on a wide range of policy, best practice and technical material. Aviation safety is of paramount and overriding concern in the consideration of any options by the review team who have taken the view that safety should be maintained and whenever possible should be enhanced by the recommendations made in the report.

Reducing aircraft noise at source has delivered the most significant noise reduction benefits, through enhancements in airframe and engine design and manufacture. By creating quieter aircraft in this way, the significant benefits in aviation noise reduction have been driven since the 1950s. These important measures, always a focus of aircraft manufacturers and noise certification authorities, have enabled the progressive and continuing reduction of noise at source.

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Airbus 320 Series Whine

Of particular relevance to Gatwick arrivals is the known noise issue (a whine) associated with the Airbus A320 family of single aisle narrow bodied aircraft, for which an approved noise modification is available. This family of aircraft is the most frequently used aircraft type at Gatwick.

Based on responses from easyJet and British Airways, the two largest operators of A320 series at Gatwick, the review has concluded that it is reasonable to expect by June 2016 a significant decrease in the occurrence of Airbus 320 family aircraft arrival whine events at Gatwick, with the majority of flights operated by modified or new (unaffected) aircraft by the end of 2017. Even so, more action is needed; the review accordingly makes the following recommendations:

- That as an indication of GAL commitment to noise reduction, as a further tangible indication to local communities that the noise impact of the airport is taken seriously and to incentivise an accelerated noise modification by all airlines using A320 family aircraft at Gatwick, GAL should establish an earlier sunset date for unmodified Airbus 320 family aircraft using the airport of December 31st 2017. With an appropriate noise penalty applied for non-compliant aircraft immediately thereafter.
- That GAL to engage with DfT, consider proposing to the European Commission the establishment of a sunset date of December 31st 2020 for the operation in Europe of Airbus 320 series aircraft without the Fuel Over Pressure Protector (FOPP) cavity vortex generator noise modification.

Land Use Planning

It is important to ensure that inappropriate new building development is discouraged or prohibited around airports. A holistic approach to planning and land management would see attempts to limit aviation noise at source and adapted operational procedures combined with a strategy to over time reduce the number of people living in areas where noise mitigation will always be challenging. If this were implemented by Government and strictly controlled, first through the National Planning Framework, and then adopted by local authorities, there is the potential over time to significantly reduce the population affected by annoying levels of noise at many airports.

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However, in the course of consultation with institutions and local authorities for this Gatwick Arrivals Review, it has become equally clear that other unrelated obligations from Government, for example to increase housing stock or to identify land for a new school or hospital, mean that effective use of Land Use Planning tools in this context is extremely difficult to achieve. This report therefore includes the following recommendations intended to improve the effectiveness of such policies:

- That planning authorities for communities impacted by aircraft noise from Gatwick, coordinate to conduct their own joint review of the application of land use policy in context of Gatwick aircraft noise, with the objective of identifying steps that will enable the increase of its effective use and the improvement of the aircraft noise awareness for existing and potential land users.
- That Gatwick develop, publish and maintain with annual updates an information booklet intended for planning authorities, home buyers, estate agents and conveyancing solicitors, to provide reference information on flight routes, terminology and other aspects of the airport operation relevant to communities. NATS and the CAA should also be encouraged to participate, and to verify those elements of the content that reflect their own areas of activity.

Operational Measures

Noise abatement operational procedures embrace a wide range of steps which can be taken by the CAA, airspace planners, pilots and air traffic controllers to minimise the noise nuisance from overflights, for example the use where feasible of continuous descent approach procedures with aircraft using low power and low drag configurations. The potential for increased (or improved) use of a number of noise abatement techniques for Gatwick has been analysed and recommendations identified where real potential for improvements was seen.

Many residents reported to the review that they have asked both GAL and NATS to reverse the change of vectoring methodology, which led to a chain of events that ultimately resulted in an application for a Judicial Review. These requests for a restoration of the pre-2013 situation were also widely made to the review team. The arrivals review has carefully considered the factors driving the original change and the options now available. This has confirmed that increasing the size of the arrival swathe, by locating closer to the airport the minimum distance from touch down for an arriving aircraft to be established on final approach, can be expected to deliver significant overall noise improvements for those currently most effected on the ground and should enable a fairer and more equitable dispersal.

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Accordingly a recommendation has been developed:

- That GAL explore with NATS the potential for aircraft be vectored to be established on the ILS at a minimum of 8nm from touchdown outside of night hours, rather than the current 10nm. This adaptation to vectoring methodology should extend the arrival swathe 2nm closer to the airport and increase the arrivals dispersal to more closely emulate the operations prior to the 2013 change. Hence the arrival swathe would normally extend from a minimum of 8nm to 14nm, with aircraft joining on a straight in approach when traffic permits.

Holding Stacks and Defined Arrival Routes

There are currently no defined fixed routes or heights for aircraft to follow from the arrival stacks to the final approach at Gatwick in normal operations, but well defined routes are planned in the UK Future Airspace Strategy to make use of modern navigation technologies and techniques. This will enable the creation of consistent mechanisms for fair and equitable dispersal of noise with defined respite procedures. The timing of such new arrival routes for Gatwick is subject to the airspace design and a formal consultation process. However, even though there are clear opportunities to disturb fewer people, any implementation is likely to be after 2022. Examples of potential new routes are illustrated as an Annex of the report. Meanwhile the review recommends:

- The adoption of carefully designed routes from the approach holding fixes used for Gatwick, to the ILS final approach tracks, provides real opportunity to reduce noise, to disturb fewer people, to deliver fair and equitable dispersal of noise, and, to deliver well defined respite measures. The London Airspace Management Programme should be developed by NATS and GAL to incorporate alternative proposals, to those published in 2013, as soon as reasonably possible, for consultation, agreement and implementation for Gatwick arrivals.

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Continuous Descent Arrivals (CDA)

The CDA concept is widely discussed in noise policy and in best practice guides. CDA is intended to keep aircraft higher for as long as possible, and is acknowledged as a leading technique for reducing arrivals noise. All aircraft arriving at Gatwick are already required by the CAA and GAL whenever practicable to follow CDA or *'low power, low drag'* procedures to reduce noise.

The actual achievement of CDA is measured and reported by Gatwick and is a key performance indicator for NATS at Gatwick and number of UK airports. This is an important measure and should be used as a metric to assess progress to more ambitious CDA goals.

An increase of the altitude from which the CDA are commenced, by aircraft arriving at Gatwick at all times, must be a priority. Equally for noise reasons, holding should be higher, or the position of the Gatwick Arrivals Fixes (the site of the Gatwick airborne holding areas) should be relocated over the sea, eliminating airborne holding dwell time over Sussex, while permitting a longer continuous descent arrival tracks.

Residents have reported a focus on aircraft height, suggesting to the review team that arriving aircraft today are lower than they used to be. Investigation has revealed no firm basis for this perception, which is a common phenomenon reported elsewhere, including Heathrow and a number of airports overseas. It is more likely a consequence of the progressive increase in size of aircraft of similar types, independent research is needed to fully understand the reasons and to properly inform all stakeholders.

A number of additional measures have been identified to improve the noise impact of CDA and are reflected in the recommendations:

- That as soon as possible, the altitude for commencement of CDA at Gatwick should be increased from the current 6000 feet to 7000 feet (FL070).
- That GAL collaborates with NATS, CAA and airlines within 12 months to agree incremental improvements, to the application of CDA procedures for Gatwick.
- That GAL work with NATS and CAA to raise the Gatwick CDA commencement altitude to 8000 feet when feasible.
- That the Gatwick holding areas should be higher, or should be relocated to enable holding aircraft to dwell over water, rather than over Sussex.

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- That GAL propose a subsidiary CDA taxonomy which includes the commencement altitude of the procedure, e.g. CDA 6000, be established by the CAA to improve lay understanding and to better benchmark later improvements.
- To better inform stakeholders, independent academic research should be undertaken to validate the reasons why arriving aircraft are often perceived by residents to be lower than in the past and to identify measures to establish the actual facts in a controlled analysis with community involvement.

Landing Direction

At Gatwick, as in the rest of the UK, the prevailing wind is westerly and therefore the long term average allocation of runway in use is reported as 70:30 in favour of westerly operations (landing towards the west). It is not unusual to experience periods of prolonged operation in either one direction or another, providing little respite to residents.

A characteristic of surface wind, subject to the wider meteorological situation, is that it tends to erode or disappear in the late evening. There will be occasions, normally, but not exclusively at night, when low wind conditions would permit a change of landing direction, thereby potentially delivering respite for residents experiencing both arriving and departure noise. The review has recommended:

- The development, publication and implementation by GAL of an operating protocol to define the occasions when a change of landing direction will be implemented at Gatwick for noise reasons, if weather, safety requirements and other conditions permit. The objective of the protocol being to achieve a more even split of arrivals, and to fragment the otherwise continuous use of one runway direction or another because of long term weather patterns. The impact should be monitored by GAL and the results regularly reviewed by the Noise Management Board (NMB). The target implementation of the protocol should be during 2016 following engagement with airlines, air traffic control and communities.

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Operational Efficiency

Good schedule planning is essential at airports such as Gatwick with constrained runway capacity. Flight delays are exacerbated by the bunching of arrival runway demand caused in part by peaks within the schedule, but also by airline processes and performance which do not consistently deliver aircraft movements on plan (recognising that there are very often network factors outside of airline control, such as weather, industrial action or unplanned equipment outages). Even so, reducing airborne delay will reduce noise impact. This is particularly important late in the day, but at an airport such as Gatwick, airline punctuality is essential throughout the day. Increased focus by airlines for on-time departures throughout the day is vital. GAL is already doing a good job of improving airport performance and should consider further incentivising airlines adherence to schedule.

The majority of residents who expressed a view on night operations at Gatwick sought to reduce the numbers of flights if possible. The review has identified and proposed efficiency measures related to airline scheduling and the introduction by NATS and GAL of improved capacity management tools for Gatwick, which if implemented in full cooperation with airlines and neighbouring air traffic control providers in Europe, can be expected to reduce the numbers of aircraft operations delayed into the night hours at Gatwick, especially during peak period and summer months.

These measures include:

- That the Gatwick Flight Performance Team introduce a KPI, enabling the monitoring and reporting of the number of flights delayed from planned daytime arrival into a night movement (after 23:30 local) and that GAL initiate measures to identify and agree steps, including enhanced use of time based operations, with airlines and with the airport's scheduling committee for implementation within 12 months, to effectively and progressively reduce unplanned night arrivals at Gatwick.
- That within 6 months, GAL and NATS conduct a joint investigation to establish and agree whether the XMAN extended arrivals manager is an effective tool to reduce arrival holding at Gatwick and if so; to agree and publish within 9 months when XMAN can be deployed for Gatwick and what results can be expected.
- GAL and NATS should evaluate the potential efficiency benefits of an earlier implementation of advanced TBS technology (timescale for completion of evaluation within 12 months).

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Noise Complaints Management

As regards the noise complaints policy and procedures employed at Gatwick, the review findings indicate that an overhaul of the airport's noise complaints policy and procedure is an essential step to restore trust in the system for residents sensitive to aircraft noise. The review recommends:

- That Gatwick should establish an enhanced complaints policy and fully transparent procedure, as soon as possible, using an on-line form as the primary medium, requiring sufficient detail to allow the location (postcode) of the complainant, the date and time of day of the incident, such that the aircraft in question can be identified and established with the location, to allow empirical data to be developed and analysed so that noise mitigation action can be taken. There should be no limit to the number of complaints per household. For residents not possessing computer access, postal submissions should be accepted, but should be required to contain the basic information outlined above.

Noise Management Board

It will be evident to any reader of this report that the policies, procedures and imperatives related to the management of aircraft noise disturbance are extremely complex. The complicated multi-layered interaction between the organisations able to effect any change in the impact of aircraft noise is equally complex. Ensuring a consistent combined change management process for noise is essential.

The review has therefore proposed the establishment of a Noise Management Board (NMB) for Gatwick by summer 2016, to be operated under independent chairmanship and comprising representatives from each of the institutions able to effect change for Gatwick arrivals, as well as the chair of the Airport Consultative Committee (GATCOM), and both elected council members and residents' representatives.

The objective of the NMB should be to develop, agree and oversee coordinated noise management strategies for all stakeholder organisations, intended to improve the situation for arrivals at Gatwick and, their implementation and to enhance their understanding by residents, through consistent communication, and both verifiable data and transparent policies.

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Issues that the NMB should consider, as well as from the key airspace and aircraft methodologies and airport efficiencies discussed in this report, should also include topics such as any unintended or unexpected consequences of noise mitigation initiatives and the noise awareness training of operational staff, including air traffic control and pilots. The NMB should also seek resolution of any areas for which leadership and accountability between the institutions is interpreted inconsistently for Gatwick. The Approach Stabilisation Initiative for instance highlighted issues in this area. For airspace design and change planning it is also important to note that NATS has significantly greater influence than GAL on how traffic is managed above 4000 feet.

The review therefore recommends:

- The establishment of a Noise Management Board (NMB) by summer 2016, to be operated under independent chairmanship and comprising representatives from each of the institutions able to effect change for Gatwick arrivals, as well as the chair of the Airport Consultative Committee (GATCOM), and both elected council members and residents' representatives.

Finally the review makes a number of other observations and proposals intended to benefit the development of noise mitigation strategies for Gatwick. In addition to the steps implied within the recommendations, a specific recommendation is included in the report that proposes in the interests of improved community relations, that GAL publish not later than January 31st 2017, a progress report, including relevant status updates from CAA and NATS of the issues and recommendations identified in the Independent Arrivals Review report.

Conclusion

The review has led us to conclude that there are real opportunities to alleviate significantly the noise issues from Gatwick arrivals which have given rise to so many complaints and concerns. These opportunities can be realised to the full only if all of the parties involved work together in new and more effective means of cooperation. We urge everyone involved to agree a programme of action as a matter of urgency and to implement those actions in the same spirit.

Context

1.1 Gatwick Independent Arrivals Review - Scope and Purpose

Following complaints from some local community groups and elected officials that Gatwick Airport arrivals are generating excessive noise disturbance and affecting more people, in August 2015 Gatwick Airport Limited (GAL) appointed Bo Redeborn to lead an independent review of flight routes used for aircraft on arrivals to Gatwick.

While the cost of this review is met by GAL, the review team, comprised of Bo Redeborn and Graham Lake, is independent of GAL and has been tasked to provide wholly independent professional analysis and report.

The purpose of the Independent Review is to consider, in relation to Gatwick Arrivals, whether:

a) Everything that can reasonably be done to alleviate the problems which local communities are raising is in fact being done, whether this involves action by the airport or by other parties most closely involved – National Air Traffic Services (NATS), UK Civil Aviation Authority (UKCAA), the Department for Transport (DfT) or the airlines; and

b) The mechanisms which Gatwick has adopted for providing information to the local community and for handling of complaints have been fully adequate for the task.

The full Terms of Reference of the Arrivals Review, governing the work of the review team are provided at Annex 1.

1.2 Community Feedback

The review team, in the course of undertaking the arrivals task, has engaged with an extensive range of organisations and individuals, Parish, Town, District and County Councils, and Members of Parliament at Westminster and has conducted three interactive public meetings with local Members of Parliament which were each attended by several hundred individuals. A large volume of e-mailed opinion has also been received.

A summary of communities' feedback and specific requests is included at Annex 2, with a detailed list of those organisations and individuals providing input at Annex 3.

The analysis of this feedback has led to the conclusion that; community sensitivity to, perception of, and reaction to the noise from aircraft using Gatwick, has increased since 2012.

Context

1.2 Community Feedback

This is apparently for several reasons, which in no particular order are:

- The statutory public consultation of Airspace Change Proposals for Gatwick in 2013 (subsequently withdrawn), related to the UK Future Airspace Strategy and London Airspace Management Programme, their associated proposed P-RNAV arrival and departure routes, and the concentration of arrivals implied by the proposal of a Point Merge[1] procedure.
- The 2013 Approach Stabilisation Initiative by GAL and NATS, changing the radar vectoring methodology used by NATS air traffic controllers at Swanwick who manage Gatwick arrivals maneuvering and sequencing, which created an arrival swathe concentration of aircraft, both further east and further west of the airport[2].
- The work of the Airports Commission[3] and the associated campaign by GAL to win approval for a second Runway at Gatwick.
- Airframe noise, generated by the Airbus A320 family of aircraft. The use of these aircraft at Gatwick is progressively increasing; by 2014 they represented more than 60% of all aircraft movements at the airport[4].
- The 2014 ADNID[5] trial of potential new departure routes west of the airport.
- The introduction of RNAV-1 departure routes and the subsequent Post Implementation Review by the CAA.
- The perceived inability of communities to influence noise factors through the normal community engagement process provided by the airport, including the Gatwick noise complaints procedure[6] (which is also reported by some residents to be inadequate) and the Gatwick Airport Consultative Committee[7] (GATCOM).
- Insufficiently coordinated and sometimes inconsistent communications regarding arrivals procedures and noise mitigation from GAL, CAA[8], NATS and the DfT.

[1] http://www.londonairspaceconsultation.co.uk/wp-content/uploads/2013/10/LAC_Part_A_Intro_SQ.pdf

[2] http://www.nats.aero/wp-content/uploads/2015/06/NATS-Customer-Report-2014.pdf page 28
and
http://www.gatwickairport.com/globalassets/publicationfiles/business_and_community/all_public_publications/aircraft_noise/natmag/natmag-minutes---november-2014-final.pdf

[3] https://www.gov.uk/government/collections/airports-commission-final-report-and-supporting-documents

[4] https://www.gatwickairport.com/globalassets/publicationfiles/business_and_community/all_public_publications/aircraft_noise/fpt_quarterly_reports/fpt-report-april-june-2015.pdf

[5] http://www.gatwickairport.com/business-community/aircraft-noise/airspace-strategy/airspace-consultation/

[6] http://gatwickairport.com/globalassets/business--community/b_7_aircraft-noise/yla-complaints-handling-policy2015.pdf

[7] http://www.ukaccs.info/gatwick/

[8] Also referenced in the Independent Review of Airspace Change Process by Helios: http://publicapps.caa.co.uk/docs/33/AirspaceChangeProcessIndependentReviewFinal.pdf

Context

1.2 Community Feedback

- The ubiquitous use of social media and of flight following Apps that has enabled the rapid dissemination of information and sometimes misinformation, which the institutions involved have often had neither the resource, coordination mechanisms, nor experience to manage effectively.

Where appropriate for the Review, these observations are addressed and options for resolution are discussed, later in this report.

1.3 Air Transport in a Global Context

The regulatory provisions of the International Civil Aviation Organisation (ICAO) are the prerequisites for all international civil aviation. There are almost 1400 airlines operating worldwide flying over 25,000 commercial aircraft, large and small, that move 3.3 billion passengers annually through airspace managed by 173 air navigation service providers between 3900 airports. While aviation delivers positive global social and economic benefits, aviation noise has an impact on local communities which negatively colours public perceptions of the air transport industry.

The UK has the third largest aviation network in the world after the USA and China. Any changes proposed for the UK air transport system at a national level are required to respect and reflect the policies and guidance developed and agreed by states (including the UK) at the global level to ensure a consistent, safe and harmonised implementation.

Context

1.4 Aircraft Noise in a Global Context

The United Kingdom is one of the near 200 nations that are members of ICAO. For the management of aircraft noise, ICAO has adopted a balanced approach. This uses a mixture of airframe and engine technology and a range of operational measures. Land use planning policies, also part of the balanced approach adopted by governments, have been designed to reduce the numbers of people affected.

The UK government, through the Department for Transport has adopted the ICAO balanced approach for the management of aircraft noise.

The Independent Arrivals Review has therefore also reflected the structure and principles of the balanced approach, the elements of which are:

- **Reducing noise at source;** regulated through ICAO, by means of progressive tightening of aircraft noise certification standards[9]. The current Chapter 4 standard for new aircraft took effect in 2006; the next 'Chapter 14' standard applies to new aircraft from 2017.
- **Land-use planning and management;** to ensure that inappropriate new development is discouraged or prohibited around airports.
- **Noise abatement operational procedures;** steps taken by pilots and air traffic controllers to minimise the noise nuisance from overflights, for example the use where feasible of continuous descent approach; and
- **Operating restrictions** - measures that limit the access of aircraft to airports, such as night movement caps and noise quotas or the phased withdrawal of noisier aircraft types.

[9]http://www.icao.int/environmental-protection/Pages/technology-standards.aspx.

Context

1.5 Aircraft Noise in a UK Context

The UK's Aviation Policy Framework supports the ICAO balanced approach and makes it clear that the UK Government recognises that noise is the primary concern of local communities near airports. It also recognises that the extent to which noise is a source of tension between airports and local communities will vary depending on factors such as the location of an airport in relation to centres of population, rural aspects of tranquility, and of the quality of its relations and communications with its local communities.

The Policy Framework indicates that the Governments' overall objective on noise is to limit and where possible reduce the number of people in the UK significantly affected by aircraft noise. The document makes clear that the acceptability of growth in aviation depends to a large extent on the industry continuing to tackle its noise impact and confirms that the Government expects the industry at all levels to continue to address noise.

The Government further indicates that since England has one of the highest population densities in the EU, it is inevitable that aircraft noise will be a particular issue here compared with other countries. The Government therefore expects the UK aviation industry at all levels (manufacturers, airlines, airports and air traffic service providers) to lead the way in best practice and to drive forward international standards. The Noise Roadmap[10] is one tool being developed by Sustainable Aviation, which sets the UK aviation industry's blueprint for managing noise from aviation sources to 2050.

The Government also has the powers under the Civil Aviation Act 1982 to set noise controls at specific airports which it designates for noise management purposes. They are Heathrow, Gatwick and Stansted Airports which are strategically important to the UK economy; any decisions made by the Government will balance between noise controls and economic benefits, and seek to reconcile the local and national strategic interests.

A wide range of the Policies, Regulations, Techniques, Methodologies and Guidance materials applicable to the management of aircraft noise in the UK is noted in Annex 5 or referenced through this report. Specific noise measures for Gatwick are described by the CAA[11]. The noise exposure contours for London Airports including Gatwick are measured and reported by Government[12].

[10]http://www.sustainableaviation.co.uk/wp-content/uploads/2015/09/SA-Noise-Road-Map-Report.pdf

[11]http://www.caa.co.uk/Environment/Environmental-information/Information-by-environmental-impact/Noise/Aviation-noise-information/#legalobligations

[12]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/458528/lgw_2014_report_final.pdf

Context

1.6 Airspace Management

The routes and heights flown by aircraft can have a direct impact on the effects of aircraft noise. They are also the result of airspace design and its operational management. ICAO has defined and adopted a globally harmonised airspace upgrade programme as a part of the wider Global Air Navigation Plan[13]. The European Union has consequently also defined and adopted a more detailed and harmonised airspace upgrade programme for all European nations as a part of the Single European Sky (SES)[14].

The UK Government in its Aviation Policy Framework supports the SES, which has the potential to deliver real benefits by minimising air traffic delays, reducing aircraft fuel consumption and lowering the amount of emissions (including noise) produced by the aviation sector.

For a physically small country with a large demand for aviation activity, the UK airspace infrastructure is a scarce resource. The CAA, working together with the airspace operators, and NATS has defined the Future Airspace Strategy (FAS), which sets out the long-term framework on how the UK should change its airspace within the overall aim of modernising the UK's airspace system in the context of the ICAO and SES objectives. This includes a specific programme for the London airports including Gatwick. The Government also supports the implementation of the FAS. The industry has set out a deployment plan to deliver the measures that support the strategy.

The Airspace used by aircraft arriving at all London airports including Gatwick, is managed by NATS from the UK National en-route Air Traffic Control Centre, located at Swanwick, Hampshire.

[13]http://www.icao.int/publications/Documents/9750_cons_en.pdf

[14]http://ec.europa.eu/transport/modes/air/single_european_sky/index_en.htm

Context

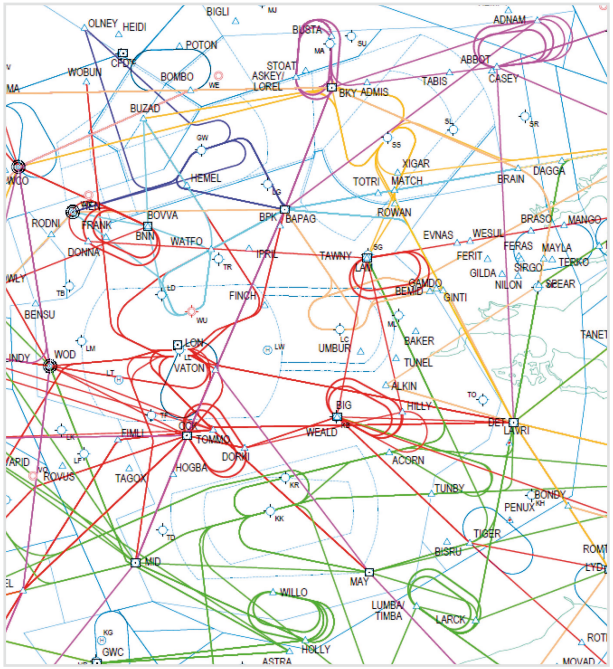


Figure 1 London Terminal Control Area routes 3/2015 Gatwick green, Heathrow red

1.7 London Airspace

South East England is one of the busiest locations for air transport in the world. London is served by six principal airports; Heathrow, Gatwick, Stansted, Luton, City and Southend. Each year, these airports combined generate more than 1 million flights, processing in excess of 150 million passengers. About half of the flights using London's airports are operated at Heathrow, a quarter at Gatwick and the remainder by the other four London airports combined. Together these flights create one of the world's most complex areas of terminal airspace.

In broad terms, the airspace must be managed in a way that aims to minimise the environmental impact but which also seeks to make the most effective and efficient use of potential airspace capacity. Within these arrangements, each airport in the UK is asked to work with its airspace provider with regard to the management of airspace concerning noise monitoring, noise mitigation, improving flight and air traffic management efficiency and, any proposed changes to airspace use. The basis of today's airspace structure over London and the South East was established several decades ago when there were fewer aircraft in the skies and they each had relatively basic navigation capability.

Aircraft are now able to use very accurate Performance Based Navigation (PBN) technology, making use of satellite navigation, which has also established the direction of the ICAO Air Navigation Plan and the EU Single European Sky. All EU member States, including the UK, have agreed to revise their airspace to make best use of these new technologies to improve safety and efficiency. PBN routes will therefore be used to improve capacity and efficiency as a part of the UK Future Airspace Strategy.

The arrival and departure flight routes flown by aircraft using the London airports and others serving the London area, such as the business airports at Farnborough and Biggin Hill, are designed to provide a safe and expeditious flow of air traffic. Because of the proximity of these airports to each other – it takes a jet aircraft only a few minutes to travel across London - the flight routes are interdependent. Changes cannot usually be made to arrival (or departure) routings serving any one airport, without a consequent impact to another.

NATS has introduced the London Airspace Management Programme (LAMP) to plan the design and implementation of optimum arrival and departure routes for all London airports, in context of wider technology based changes including Performance Based Navigation. Routings for Gatwick Arrivals and Departures are in particular adapted to reflect the greater demand for airspace from flights using Heathrow, effectively constraining the airspace options available to flights using Gatwick.

To illustrate the complexity of London airspace, a simplified chart of arrival departure routings is included at **Figure 1**.

Context

1.8 The London Airspace Management Programme (LAMP)

The LAMP defines in a ten year programme of airspace changes beginning in 2012 to determine how the airspace and route upgrades required for FAS, are designed, consulted, adapted and implemented for the London airports.

For Gatwick, which was scheduled to be in the first phase of FAS due for implementation in early 2016, the LAMP airspace change consultation that took place from October 2013 until January 2014 generated, a significant feedback from the community to Gatwick, NATS and other industry bodies.

As a result, in September 2014 GAL withdrew the proposals for Gatwick from the first phased LAMP of implementation, agreeing that it was necessary to undertake further work first, before decisions can be taken on the best way to design and implement any changes.

The consequence of this decision is that the likely timeframe for implementation of any LAMP related airspace changes for Gatwick is now post 2022. Any future proposed airspace changes will be subject to the required airspace change process, including a period of consultation.

1.9 Gatwick Airport Arrivals Management

Gatwick is the world's busiest single runway airport. The runway handles more aircraft each day than either of the two runways at Heathrow. Gatwick is also the UK's second busiest airport by passenger traffic - in 2015, more than 40 million passengers passed through the airport. More than 60 airlines operate regularly from Gatwick serving over 200 destinations and together generating about a quarter of the flights arriving at all London Airports.

Context

1.9 Gatwick Airport Arrivals Management

Runway in Use

Like all airports the landing runway direction at Gatwick is determined according to the weather conditions, principally the wind direction. In order to ensure safe take-off and landing, aircraft normally fly in to the wind at the airport. The prevailing wind direction in the UK is westerly, so normally arriving aircraft will approach the Gatwick runway from the east.

During periods of easterly winds, the runway direction and flight patterns are reversed, with aircraft arriving from the west. Wind direction and speed is measured both on the ground and at higher levels. Aircraft normally establish on their final approach between 3,000 and 4,000 feet above runway level. The wind velocity at these levels may determine the runway selection.

During conditions of little or no wind, which occur particularly at night, the airport may have the option to vary the direction of the runway in use so as to deliver arrivals noise respite.

Holding Stacks

Aircraft inbound to Gatwick leaving the UK airway system will plan their route to a Holding position. If an approach delay is expected, which will normally be due to traffic congestion or weather, instructions may be given by the NATS controller for the aircraft to enter a holding pattern or *'Stack'*. In routine traffic conditions, Gatwick uses two stacks, located over land, to the south and southeast of the airport[15]. Aircraft in the holding pattern circle at different altitudes at the fix until the airspace capacity is ready for them to be directed into the arrival sequence for landing. Aircraft in the hold are separated vertically by 1,000 feet. Aircraft normally leave the stack at 6000 feet.

Holding stacks are more likely to be used in poor weather, or during Low Visibility Procedures when the movement rate is reduced at the airport for safety reasons.

During periods of low traffic, aircraft may be routed direct from the airway system for a more direct approach, without the need to route via the holding fix.

[15]http://www.nats-uk.ead-it.com/public/index.php%3Foption=com_content&task=blogcategory&id=93&Itemid=142.html

Context

Final approach to Gatwick (Present)

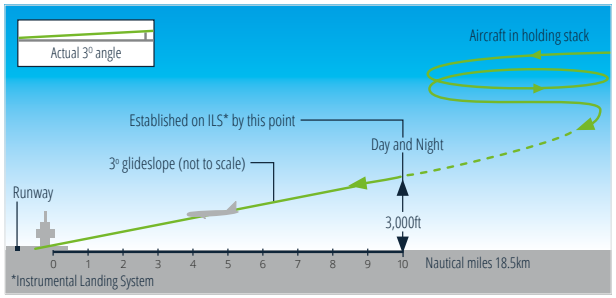


Figure 2 Aircraft Arrival Profile

1.9 Gatwick Airport Arrivals Management

Radar Vectoring

When inbound traffic is being sequenced by a controller using radar, that part of the approach between the holding fix and the Final Approach Track (FAT) will be flown under directions from the Radar Controller. Once the aircraft is under Radar Control, changes of heading or flight level/altitude will normally be made only on instructions from the Approach Radar.

Headings and flight levels at which to leave the holding facility will be passed by ATC to the pilot. Radar directions will be given, and descent clearance will include an estimate of track distance to touchdown to facilitate a continuous descent approach. Further distance information will be given between initial descent clearance and intercept heading to the ILS. On receipt of descent clearance the pilot will descend at the rate judged to be best suited to the achievement of continuous descent, the object being to join the glide-path at the appropriate height for the distance. CDA permits a period of level flight to enable aircraft to reduce speed[16].

Hence for aircraft approaching Gatwick, the precise track and height over the ground is determined by the runway in use and; the tactical decisions of the approach controller and pilot, based on the traffic conditions at the time and the particular aircraft characteristics, in order to enable the aircraft to become established on the final approach track safely separated from other aircraft. The target ILS joining point and minimum radar vectoring height will also affect these tactical vectoring decisions.

[16]UK Air Pilot, procedures for Gatwick

Context

Comprison of Go-Around Non Trial (2011) Vs. Trial Period (2013)

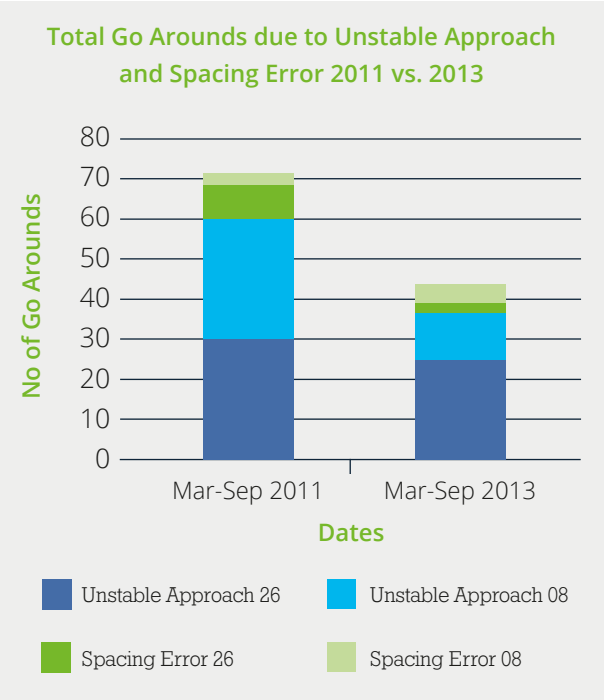


Figure 3 - Example of go around causes 2011 & 2013 (NATS)

1.9 Gatwick Airport Arrivals Management

Final Approach

Aircraft flying into Gatwick use the Instrument Landing System[17] to provide precision horizontal and vertical guidance along the extended runway centerline to the runway.

Gatwick, in line with most other airports globally, has a glideslope of 3 degrees, which provides a descent of about 310 feet per nautical mile. The closer to the runway that an aircraft joins the ILS, the lower it will need to be to intercept the glideslope.

The system is designed to safely maximize arrival capacity at London Gatwick and to minimize noise disturbance in the areas overflown during the approach and aircraft commanders are requested to conform to low-power, low-drag procedures[18].

The spacing provided between aircraft will be designed to achieve maximum runway utilization within the parameters of safe separation minima (including vortex effect) and runway occupancy.

Go Arounds

Occasionally an aircraft may not be able to land on its first approach and will go around for another. Go arounds occur for a variety of reasons but are always executed because it is safer to abandon the approach, rather than to continue. Gatwick, like all airports, has published procedures enabling go arounds for aircraft to make another approach or to land elsewhere.

While go-arounds when initiated are always the safest option at the time, they are neither fuel efficient for the airline, nor capacity efficient for either the runway or for the airspace managers. Section 1.10 deals with an initiative that was intended in part to reduce the number of go arounds at Gatwick. **Figure 3** shows a comparison of the numbers go arounds at Gatwick for related periods and their associated causes.

[17]http://www.skybrary.aero/index.php/Instrument_Landing_System_(ILS)

[18]http://www.ead.eurocontrol.int/eadbasic/pamslight-5684CA481604D139BD19D382E723DDD9/7FE5QZZF3FXUS/EN/AIP/AD/EG_AD_2_EGKK_en_2015-12-10.pdf

Context

1.10 Approach Stabilisation Initiative

Information provided to this Review has included a significant level of feedback from the west, but especially from residents east of Gatwick, to the impact of the 2013 Approach Stabilisation Initiative. The most consistent message of many to the review team from residents has been a plea for a return to the dispersion of flights that existed prior to 2013, noise impacts then being acceptable and entirely preferable in their indicated view.

The 2013 initiative by NATS and GAL relocated the minimum ILS joining points on the final approach track both east and west of Gatwick from 7nm to 10nm from touchdown, effectively narrowing and concentrating the final approach swathe on base leg[19] further from the airport. This had the effect of increasing the number of flights passing over some areas, while reducing the number of flights in other areas closer to the runway.

Research has confirmed that NATS and GAL instigated an Approach Stabilisation Initiative at Gatwick on the 25th March 2013 following a preliminary assessment begun in autumn 2012. The aim was expressed in the associated briefing material provided to this review, as an intention to reduce potential of high workload, rushed approaches and to improve energy management on the intercept and final approach segments for flight crew.

These Gatwick objectives are not unusual. The reduction of unstable approaches has been a priority globally for aviation safety managers for several years[20]. An aircraft must meet certain criteria on approach to be able to land safely. This is because an aircraft in flight, and in particular a large aircraft, possesses a great deal of energy that must be dissipated appropriately during descent, landing and rollout. Managing an aircraft during the descent and approach phases essentially becomes a task of managing energy, which is achieved by adjusting aircraft speed and level. Controllers are briefed to be aware that the Flight Management Computer and Instrument Landing System are designed so that the horizontal path is captured first, then the vertical path.

[19]http://lib.skybrary.aero/index.php/APR

[20]http://www.skybrary.aero/index.php/Toolkit:Stabilised_Approach_Awareness_Toolkit_for_ATC

Context

1.10 Approach Stabilisation Initiative

For GAL and NATS, an ancillary purpose for the 2013 initiative was discussed and agreed with NATS[21] and reported publicly, related to the implementation at Gatwick of the Airport Collaborative Decision Making (A-CDM) programme - a Europe wide airport/ATM harmonisation programme. NATS has been working in partnership with Gatwick Airport and airlines to fully implement Gatwick's A-CDM55 project where information is more effectively shared right across the airport's operation to improve safety and efficiency. The principle of A-CDM is that everyone involved in airport operations is in the right place at the right time, with the right information, working precisely to plan, in unison and sharing information. A-CDM55 had two main aims in terms of air traffic control:

- Helping to enhance runway capacity by reducing spacing variations, and thus assist in reaching declared capacity level of 55 aircraft movements an hour.
- Introducing a system to monitor how well the entire operation is performing on a real time basis.

It appears from the analysis undertaken in 2015 for this arrivals review, that the noise consequences of this 2013 programme, as regards the increased concentration of flights into a narrower swathe on base leg, further to the east and to the west of Gatwick were not adequately considered or understood by either NATS or GAL at the time. As a result, neither the CAA nor DfT were fully aware or briefed of the arrival concentration consequences of the initiative until later, an increased level of mistrust developed between the institutional stakeholders and the residents affected.

The aircraft concentration consequences of the stabilization initiative have significantly increased the number of aircraft noise complaints at Gatwick. The Review team has been reminded many times of the impact in terms of increase of flights for the large number of residents that this change affected adversely.

[21] http://www.nats.aero/wp-content/uploads/2015/06/NATS-Customer-Report-2014.pdf section 3

Context

1.11 Gatwick Arrivals - The Institutional Stakeholders

As explained earlier, Civil Aviation operates within a highly structured regime throughout the world. In the UK as elsewhere, this comprises Government Policies and Strategies, Regulations, and the Governance of airport and aircraft operations and airspace management. This complex set of relationships can be confusing to anyone not involved in the day to day operation of air transport. This section therefore sets out to explain at a high level some of the roles and responsibilities of the many organisations involved in the governance and management of aircraft noise mitigation as related to Gatwick arrivals.

Department for Transport (DfT)

The Department for Transport's role is to develop policies and long-term strategies for UK aviation; to facilitate their implementation; and to lead international negotiations in the aviation sector. To do this the DfT works with a number of different organisations including; airlines, airports, regulators, other Government departments, international Governments, trade associations, embassies and consumer and community representatives. The Secretary of State for Transport has in addition specific responsibility for noise control at Heathrow, Gatwick and Stansted.

Civil Aviation Authority (CAA)

As the UK's independent aviation regulator, many of the CAA's functions cut across the aviation noise and aviation capacity spheres. The CAA houses the UK's expert noise monitoring and noise contour modelling function within its Environmental Research and Consultancy Department (ERCD) and undertakes research into the health effects of noise.

As the airspace regulator, the CAA has a statutory duty to consider the environmental impact of aviation when taking decisions in relation to proposed changes. In addition, in December 2012, the CAA was given a duty to publish environmental information on the effects of aviation on the environment. With this new duty, the CAA is intending to consolidate existing aircraft noise information and implement new tools to improve the public understanding of the effects of aircraft noise. In addition, the CAA advises the Government on aviation issues, represents consumer interests, conducts economic and scientific research and produces statistical data.

The CAA is responsible for the oversight and regulation of all UK airspace including the navigation and communications infrastructure to support safe and efficient operations.

Context

1.11 Gatwick Arrivals - The Institutional Stakeholders

National Air Traffic Services (NATS)

NATS provide en-route air traffic control services for aircraft flying throughout UK airspace. The NATS en-route activity is regulated and is operated under licence from the Civil Aviation Authority. Under the terms of its licence, NATS is required to make the most efficient overall use of airspace, and to be capable of meeting reasonable levels of overall demand.

Approach Control Services are provided by NATS for all London Airports, including Gatwick, from a Centralised Terminal Control Centre located at Swanwick in Hampshire. This facility is normally responsible for all arriving aircraft bound for London airports over south east England, until they have descended to an altitude of 3000 feet on final approach.

NATS also provides Aerodrome Control Services at some UK airports. Aerodrome Control manages aircraft and vehicles on the ground and aircraft on the final approach, normally below 3000 feet. At Gatwick this Aerodrome Control service will transition from NATS to a new provider in March 2016.

The Airport Operator (GAL)

The airport operator in this case Gatwick Airport Limited (GAL), is responsible for the day to day operation of Gatwick airport, including implementation of the Government's noise policy for the airport. In particular this includes facilitating the monitoring and reporting of noise, track-keeping on noise preferential routes (departures) and, in the final approach phase, Continuous Descent Arrivals (CDA) performance. GAL is also responsible for responding to noise complaints and enquiries. State of the art noise and track keeping equipment is used by the airport to monitor all aspects of the noise abatement procedures and report regularly to the Department the Airport Consultative Committee, NATS aircraft operators and the general public, on performance against these procedures.

Context

1.11 Gatwick Arrivals - The Institutional Stakeholders

Aircraft Operators

Aircraft operators play an integral role in the implementation of the procedures set out in the UK Aeronautical Information Publication (AIP), liaising with appropriate authorities on operational and equipment matters and are encouraged to use appropriate procedures to minimize noise wherever possible. They play a key role in advising of both actual and potential impact of any change in procedures or aircraft characteristic.

Airport Consultative Committees (ACC)

Gatwick Airport operates an airport consultative committee (GATCOM)[22] in accordance with the Civil Aviation Act. The UK Airport Consultative Committee website includes Government guidelines for the establishment, constitution, governance and operation of an ACC[23]. While the exact size and constitution of the committee will depend upon local circumstances, the guidelines suggest that the committee should be of a manageable size. ACC members normally include users of the aerodrome, Local Authorities and others with an interest. This last category will vary according to local circumstances but will generally consist of community organisations such as local environmental groups and residents associations, local business and enterprise groups as well as tourism and consumer bodies.

The guidelines note that there should be fair and equitable treatment of the different categories with no one interest dominating the committee. Subject to ensuring adequate representation for each group, each committee has discretion to decide on the scope and level of representation based on local circumstances and practice.

[22]http://www.ukaccs.info/statutory.htm

[23]http://www.ukaccs.info/guidelines.htm

Context

1.12 Issues not considered by the Arrivals Review

Departures

Consideration of the routing and noise impact of aircraft departing from Gatwick is not a part of the scope of this Independent Arrivals Review. The review has nevertheless recognised that, in particular, flights departing from Gatwick, and aircraft both departing from and arriving at Heathrow, constrain the lateral and vertical scope for arrival routing options for Gatwick. Many of these routings occupy the airspace above that used for Gatwick arrivals. For this reason the wider planning and schedule considerations of those aspects of the London Airspace Management Programme, part of the UK Future Airspace Strategy will inform some aspects of this report.

The Airports Commission – a New Gatwick Runway

The potential impact to Gatwick arrivals routings of a Government decision on the findings and recommendations of the Airports Commission Report analysing options for a new runway for London, which was published in July 2015 and awaits a Government decision, are beyond the scope of this arrivals review and are therefore not considered. Hence this Arrivals Review has scrutinised only the arrivals practices for the existing runway infrastructure at Gatwick.

Operational Restrictions

The remit of the Review does not include measures such as night restrictions or the phased withdrawal of noisier aircraft types. The Review does however recommend operational efficiency and other improvements that are expected to reduce the numbers of arriving flights delayed into the night period.

The Effects of Aircraft Noise

A number of residents engaging with the review team expressed a desire that the review take into account information on the health effects of prolonged exposure to aircraft noise disturbance. This issue along with the other effects of air transport, such as the reduction of emissions, is discussed and taken into account in the Aviation Policy Framework published by the UK Government. Government Policy has been used to inform the work of the review. The analysis of advice given to Government by Health Authorities in context of aircraft noise is beyond the remit of the review task.

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.1 Introduction

It is important to recognise that individuals' reaction to and perceptions of arrivals aircraft noise are a complex matter for any airport. Gatwick is no different. Based purely on 57 Leq noise contour data[24], the reduction in aircraft noise achieved by the aviation industry over the last half century has resulted in many fewer people being significantly affected by noise[25]. However based on regular stakeholder feedback received by the industry and reinforced in the UK Aviation Policy Framework, it is equally apparent that noise from aircraft operations remains a real source of tension between airports and local communities.

This review has confirmed in relation to residents affected by arriving aircraft noise at Gatwick a conclusion already acknowledged by UK Government and reflected globally i.e.; that many local communities, especially those in rural areas, believe that current noise metrics, including the use of average noise contours, do not fully reflect their particular experience of aircraft noise. This underlines the need for the on-going Government and international research to identify improved methods and metrics for assessing noise over tranquil and rural areas.

The balanced approach to controlling noise at airports, developed by ICAO and incorporated in both EU and UK Legislation provides the structure for the arrivals analysis of this report:

- Reducing noise at source; regulated through ICAO, by means of progressive tightening of aircraft noise certification standards.
- Land-use planning and management; to ensure that inappropriate new development is discouraged or prohibited around airports.
- Noise abatement operational procedures; steps taken by pilots and air traffic controllers to minimise the noise nuisance from overflights.
- Operating restrictions - measures that limit the access of aircraft to airports, such as night noise quotas, restrictions, or the phased withdrawal of noisier aircraft types.

[24]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/458528/lgw_2014_report_final.pdf

[25]See Annex 5 for CAA figures for Gatwick

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.1 Introduction

The guidance and policy material used by the Review team to develop the philosophy and rationale for identifying the noise mitigation options for Gatwick has included a wide range of material, for instance:

- ICAO, Global Air Navigation Plan
- ICAO, Annex 16
- CANSO/ACI, Managing the Impacts of Aircraft Noise
- SESAR, European ATM Master Plan
- DfT, Policy Guidance to the Civil Aviation Authority on Environmental Objectives
- CAA Managing Aviation Noise - CAP1165
- Future Airspace Strategy, CAA Deployment Plan
- Sustainable Aviation Roadmap

This guidance and policy material is applied through several different levels of regulation as illustrated in **figure 4**.

Figure 4 Hierarchy of regulation relating to aircraft noise

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.2 Reducing Noise at Source

The most significant potential noise reduction benefits in terms of reducing noise can be produced through enhancement in airframe and engine manufacture. It is through creating quieter aircraft that the significant benefits in noise reduction have been driven since the 1950s[26].

Aircraft are required to operate to a certified noise standard – currently ICAO Annex 16, Chapter 4[27]. This relates to the actual noise generated by aircraft engines, which is a function of design and power setting and; the airframe noise created as the aircraft passes through the air, a function of the aircraft design and its aerodynamic configuration at the time. Flaps, slats and undercarriage each when deployed, create drag and hence aerodynamic noise. For aircraft arrivals therefore, the longer an aircraft can remain in a clean configuration (low drag) and a low power setting in the approach phase, the less noise disturbance it will cause.

The Committee on Aviation Environmental Protection (CAEP) within ICAO has agreed a Chapter 14 noise standard, which requires new types of large civil aircraft, from 2017, to be at least 7dB quieter on average in total, across the three test points, than the current Chapter 4 standard. Standards for smaller aircraft will be similarly reduced in 2020. Further reduced noise goals for aircraft due to enter service from 2030 are currently being discussed.

Airbus A320 Family Aircraft Airframe Noise

Of particular relevance to Gatwick arrivals is the known noise issue associated with the Airbus A320 family of single aisle narrow bodied aircraft. Often described as a high pitched whine, generated by the Fuel Over Pressure Protector (FOPP) cavities under the wings[28], this phenomenon was first identified to the CAA in 2005. The whine is clearly audible under the approach of these aircraft, normally between 7 and 15 nm from touchdown and is hence directly pertinent to the Gatwick arrivals review. About 60 percent of all arrivals at Gatwick are made by A320 family aircraft. The characteristic has been recognised by a large number of residents and organisations reporting to the review, who also report that they do not understand why this characteristic has been allowed to persist for so long by the relevant authorities.

[26]http://mag-umbraco-media-live.s3.amazonaws.com/1004/airlinesplusandplusaircraftplusfleetsplusdatasheet.pdf

[27]http://www.icao.int/SAM/Documents/2014-ENV/3.2.Noise%20TechnologyV3_notes.pdf

[28]See Annex 7

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

Airline	Pre-fitting Schedule	Retrofitting Schedule
easyJet	All new aircraft have been fitted with vortex generators since June 2014	Commitment: All 197 aircraft without vortex generators to be retrofitted by March 2018
	Interim: 37 recieved by June 2016	Interim: 88 retrofitted aircraft by June 2016
British Airways	All new aircraft fitted with modification as standard	Commitment: All 130 aircraft to be retrofitted by end of 2017

Figure 5 A320 Series noise modification schedule

[29]See Annex 8

[30]FlightGlobal

2.2 Reducing Noise at Source

Airbus A320 Family Aircraft Airframe Noise

Airbus, the aircraft manufacturer, has developed a modification to address this noise phenomenon and estimate that it will deliver an improvement of up to 9 dB on a standard Continuous Descent Approach[29].

easyJet is the largest operator of Airbus A320 series aircraft at Gatwick, with 60 based aircraft. British Airways is the second largest operator of the type at Gatwick. Airbus 320 series aircraft are also regularly operated at Gatwick by, Aer Lingus, Monarch Airlines, TAP Air Portugal, Thomas Cook, Titan, Turkish Airlines, Vueling and others.

Airline Operators Schedule for Retrofitting and Pre-fitting A320 Series Aircraft with Noise Modification

easyJet reported to the Review team in December 2015 that through a combination of new deliveries and the retrofit programme, it expects to have 125 aircraft fitted with noise reducing vortex generators by end of June, 2016. The airline noted that they have front-loaded the programme to focus on the aircraft at Gatwick, their largest base, and anticipates that the majority of aircraft operating in and out of Gatwick will have vortex generators by summer peak period (2016). In addition, from 2017, easyJet will start to take delivery of 130 new generation A320neo aircraft that have overall noise levels lower than today's aircraft and up to 15dB below the ICAO Chapter 4 noise standards. The majority of these new aircraft will replace their existing fleet.

British Airways reported that all new aircraft now have the vortex generator modification fitted as standard and that it has begun retrofitting this modification to its entire fleet of 130 Airbus aircraft. These aircraft are currently based at Heathrow, Gatwick and London City airports. The first British Airways aircraft was modified in October 2015 and the operator estimates that it will take approximately 2 years to complete the entire programme.

Monarch Airlines, a smaller operator at Gatwick, will begin replacing its entire fleet of Airbus aircraft in 2018 with Boeing 737Max, planning to phase out all Airbus by 2020[30].

On this basis, the review has concluded that it is reasonable to expect by June 2016 a significant decrease in the occurrence of Airbus 320 family aircraft arrival whine events at Gatwick, with the majority of flights operated by modified or new (unaffected) aircraft by the end of 2017.

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.2 Reducing Noise at Source

Airline Operators Schedule for Retrofitting and Pre-fitting A320 Series Aircraft with Noise Modification

Despite the progress being made, and while this Airbus noise performance issue was identified by CAA as a problem in 2005 and is recognised as such internationally[31], it is not yet eliminated - for example by, operating restriction.

Any operating restriction of these aircraft based on noise performance is likely to comprise an operating restriction as defined under EU law (Directive 2002/30, and from June 2016 Regulation 598/2014). The law states that *"Decisions on noise-related operating restrictions shall be based on the noise performance of the aircraft as determined by the certification procedure conducted in accordance with Volume 1 of Annex 16 to the Chicago Convention, sixth edition of March 2011"* (article 7.1 of the 2014 Regulation). For the purposes of this ICAO certification, both the aircraft with and those without the noise modification devices are the same.

The Review therefore recommends:

- That as an indication of GAL commitment to noise reduction, as a further tangible indication to local communities that the noise impact of the airport is taken seriously and to incentivise an accelerated noise modification by all airlines using A320 family aircraft at Gatwick, GAL should establish an earlier sunset date for unmodified Airbus 320 family aircraft using the airport of December 31st 2017. With an appropriate noise penalty applied for non-compliant aircraft immediately thereafter.
- That GAL to engage with DfT, consider proposing to the European Commission the establishment of a sunset date of December 31st 2020 for the operation in Europe of Airbus 320 series aircraft without the Fuel Over Pressure Protector (FOPP) cavity vortex generator noise modification.

*Noise penalties levied by airports are used for charitable activities agreed with local communities

[31] https://www.lawa.org/uploadedFiles/lax/noise/presentation/noiseRT_141112_Noise%20from%20A320%20Family%20of%20Aircraft.pdf

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.3 Land-use Planning and Management

It is important to ensure that inappropriate new development is discouraged or prohibited around airports. A holistic approach to planning and land management would see attempts to limit aviation noise at source and adapted operational procedures combined with a strategy to over time reduce the number of people living in areas where noise mitigation will always be challenging. If this were implemented by Government and strictly controlled, there is the potential to reduce over time the population affected by significantly annoying levels of noise to close to zero at many airports.

However in the course of consultation with institutions and local authorities for this Gatwick Arrivals Review, it has become equally clear that other unrelated obligations from Government, for example to increase housing stock or to identify land for a new school or hospital, mean that effective use of Land Use Planning tools in this context is extremely difficult to achieve. Even then, obtaining reliable information on current and likely planned flight routes is difficult for planners, further compromising their ability to inform those decisions that they are able to influence.

Feedback from community groups and many individuals revealed a degree of surprise that their homes are located in areas likely to be subject to aircraft noise. This is in part due to the variable nature of final approach tracks and changes in concentration that occurred in 2013, but is due also to the lack of relevant synthesized information which could to improve public understanding of airport and aircraft operating characteristics. Home-buyers, estate agents and conveyancing solicitors have also reported either directly to the review team, or indirectly through other representatives, a lack of easy to access, credible and easy to understand information to inform their decisions and advice.

When investigating how other airports have dealt with these challenges, the review team found that Manchester Airport has developed a comprehensive guide[32] intended to address these and related questions and which contains more concise information intended for this purpose, than is currently produced for Gatwick.

[32]http://www.manchesterairport.co.uk/community/living-near-the-airport/runway-data-sheet/

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.3 Land-use Planning and Management

The Review therefore recommends:

- That planning authorities for communities impacted by aircraft noise from Gatwick, coordinate to conduct their own joint review of the application of land use policy in context of Gatwick aircraft noise, with the objective of identifying steps that will enable the increase of its effective use and the improvement of the aircraft noise awareness for existing and potential land users.
- That Gatwick develop, publish and maintain with annual updates an information booklet intended for planning authorities, home buyers, estate agents and conveyancing solicitors, to provide reference information on flight routes, terminology and other aspects of the airport operation relevant to communities. NATS and the CAA should also be encouraged to participate, and to verify those elements of the content that reflect their own areas of activity.

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

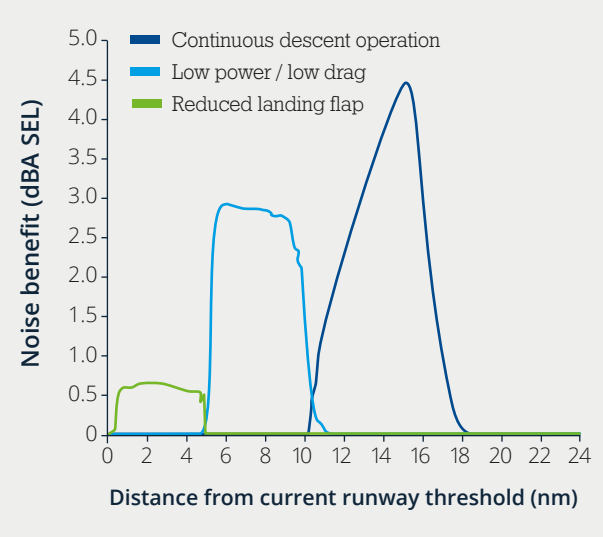


Figure 6 Noise benefits of aircraft operational techniques (CAA

2.4 Noise Abatement Operational Procedures

Noise abatement procedures include a wide range of steps which can be taken by pilots and air traffic controllers to minimise the noise nuisance from overflights, for example the use where feasible of continuous descent approach procedures.

The potential noise benefit from of a selection of final approach noise abatement measures has been assessed by the CAA and is illustrated in **Figure 6**.

The potential for improved use of a number of noise abatement techniques for Gatwick is analysed below, and recommendations identified where real opportunity for improvement was identified.

Perceptions of Aircraft Height

Many residents have reported to the review team that arriving aircraft today are lower than they used to be. This *"aircraft are lower"* perception is a common phenomenon reported at many airports, including Heathrow and a number overseas. This is in part more likely a consequence of the progressive increase in size of aircraft of similar types. It is also in part because aircraft height and position relative to the observer is highly variable.

For illustration, the Airbus A319 is commonly used at Gatwick, it carries about 150 passengers. The almost identical Airbus A321, also commonly used at Gatwick, is 50% larger carrying about 230 passengers. The Boeing 777 variants, again commonly seen at Gatwick, also vary widely in size dependent on the exact variant, carrying between 250 and 400 passengers. Smaller versions of the Boeing 737 using Gatwick carry about 110 passengers, while the larger versions used by Norwegian, Ryanair and others at the airport, are half as large again as 189 seat aircraft. Yet each of these larger variants is outwardly very similar to their smaller version. Size matters.

Residents are also referring to position and height information supplied by Flight Following Apps to validate the low flying perceptions.

It is important to understand the role of the atmospheric pressure reference on which the vertical position of an aircraft is reported by the Flight Following App. Flight Level uses a standard pressure normally used to indicate the vertical position of one aircraft relative to another, but with only a notional reference to distance from the surface. Altitude is a distance above mean sea level or; Height, a distance above aerodrome level[33].

[33]See Eurocontrol Skybrary for more detailed altimetry considerations

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Perceptions of Aircraft Height

Apps are most likely to use the Flight Level standard reference basis while aircraft are in flight, providing only a notional indication of height above sea level (not the observer), reverting to an on ground indication (zero feet) when the aircraft has slowed to less than flying speed. This is now confirmed by Flight Radar 24 on Twitter.

Conversely, the Casper facility used at Gatwick provides a reliable indication of aircraft height above aerodrome level at Gatwick[34]. The CAA have verified the reporting accuracy and published their findings[35]. However, information derived from Flight Following Apps as noted above uses standard pressure references for aircraft in flight, which because of normal atmospheric variations can be significantly misleading at a local level (up to +/- 900 feet) and hence are not a reliable source of aircraft height information for arriving aircraft near the ground. Commercially produced Flight Following Apps are unintentionally misleading some users as a source of aircraft height information.

There is nevertheless no information identified by the review to suggest that Gatwick arrivals are managed today significantly differently in vertical profile than they have been in the past, or differently to those for instance at Manchester, Stansted, Edinburgh, the Paris or the New York airports. Moreover, no evidence has emerged during the review that indicates that aircraft arriving at Gatwick are being operated at lower altitudes than those prescribed in the associated arrivals charts for Gatwick.

Independent research is needed to fully understand the reasons for these height perceptions and to inform all stakeholders.

The Review therefore recommends:

- To better inform stakeholders, independent academic research should be undertaken to validate the reasons why arriving aircraft are often perceived by residents to be lower than in the past and to identify measures to establish the actual facts in a controlled analysis with community involvement.

[34]Source CAA

[35]http://publicapps.caa.co.uk/docs/33/CAP1246_Gatwick_Noise_and_Track_Keeping_System.pdf

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Continuous Descent Approaches (CDA)

The CDA concept is widely discussed in noise policy and in best practice guides. CDA is intended to keep aircraft higher for as long as possible, and is acknowledged as a leading technique for reduction of aircraft noise during the approach to an airport.

CDA is a noise abatement technique for aircraft in which the pilot, when given descent clearance by ATC in preparation for landing, will descend at the rate judged to be best suited to the achievement of continuous descent, based upon the track distance to run to touchdown provided by the controller, at the same time as meeting ATC speed control requirements. The objective of the CDA profile is to join the glide-path at the appropriate height for the distance, in order for an aircraft to reduce speed on approach, a short period of level flight may sometimes be necessary, this is a noise efficient CDA practice.

Continuous descent from cruise level to final approach has also been set as an aspirational objective by ICAO in the Global Air Navigation Plan and appears as part of the 4D trajectory management concept of operation for the Single European Sky and is a long term objective in the UK FAS. This is more related to fuel efficiency than noise performance. In practice the CDA compliance today reported by NATS and Gatwick, when compared to the aspirational objectives set by ICAO, reflects much less ambitious criteria, covering the descent from the arrival holding fix, normally 6000 feet to the runway, about the last 10 minutes of the flight.

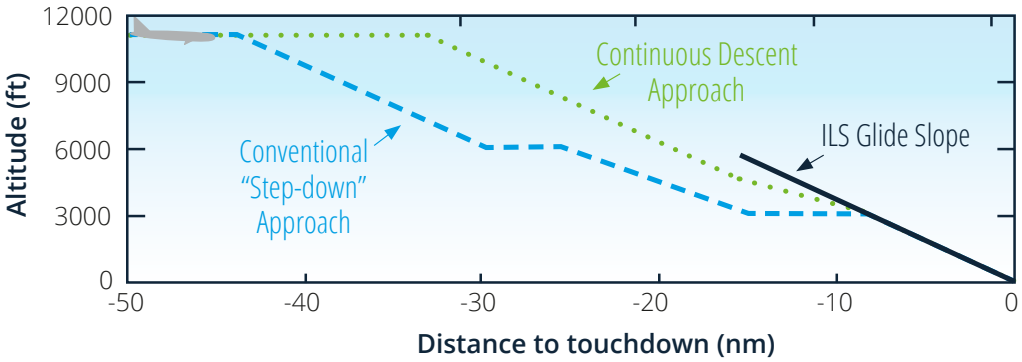


Figure 7 The principle of a Continuous Descent Approach

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Continuous Descent Approaches (CDA)

Continuous descent from cruise level to final approach has also been set as an aspirational objective by ICAO in the Global Air Navigation Plan and appears as part of the 4D trajectory management concept of operation for the Single European Sky and is a long term objective in the UK FAS. This is more related to fuel efficiency than noise performance. In practice the CDA compliance today reported by NATS and Gatwick, when compared to the aspirational objectives set by ICAO, reflects much less ambitious criteria, covering the descent from the arrival holding fix, normally 6000 feet to the runway, about the last 10 minutes of the flight.

The aspirational continuous descent from the cruise level to touchdown at Gatwick will require a number of substantial airspace and traffic management techniques not yet deployed for the London Terminal Airspace during peak hours. The governing considerations are described in the Guide to Implementing Continuous Descent. Even so, while these changes may be aspirational, significant near term improvements to noise performance should be possible.

All aircraft arriving at Gatwick are already required by the CAA and GAL whenever practicable to follow CDA or *'low power, low drag'* procedures to reduce noise. The actual achievement of CDA is measured and reported by Gatwick and is a key performance indicator for NATS at Gatwick and number of UK airports. This important measure should be used as a metric to assess progress to more ambitious CDA goals.

For monitoring purposes[36], due to system constraints and airfield elevations, CDA are measured from 5500 feet above aerodrome level at Gatwick. Level flight is interpreted as any segment of flight having a change of altitude 50 feet or less over a distance of 2nm or more. For practical purposes, a working definition of a successful CDA as an arrivals noise technique at Gatwick is a measured descent, from an altitude of 6000 feet, in which any period of level flight does not exceed 2.5nm.

Overall the findings of the Review tend to suggest that the current CDA procedures for noise abatement used by NATS in the UK (and their measurement and reporting by GAL and NATS) reflect the codifying of an existing arrivals efficiency practice, rather than the delivery of the aspirational improvements in noise performance identified by planners. However in order to achieve even the limited CDA objectives that are recognised today, the proactive contribution of air traffic controllers and pilots is essential and is achieved most of the time.

[36]NATS

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

An increase of the altitude from which the CDA are commenced for noise purposes by aircraft arriving at Gatwick at all times, must be a priority. Equally for noise reasons, holding aircraft should be kept higher and the position of the Gatwick Arrivals Fixes (the site of the Gatwick airborne holding areas), should be relocated over the sea, eliminating airborne holding dwell time over Sussex, while permitting a longer continuous descent arrival tracks. Because this will also require widespread airspace and procedural change, part of FAS, it is likely to be still some years away. Clear steps to remove these barriers should be identified by NATS, CAA and GAL with incremental improvements proposed as interim measures to deliver enhanced CDA.

The acronym CDA can be interpreted to mean different things, which is not helpful when discussing noise mitigation. CDA is used to describe a wide range of fuel and noise efficiency procedures that commence at various altitudes and which legitimately, may or may not contain periods of level flight. It is therefore recommended that GAL propose to CAA, the establishment of a revised CDA taxonomy for the CDA procedure, which includes the altitude from which the continuous descent is planned to commence; e.g. CDA 6000. The delivery of future CDA improvements will then be more clearly defined, easier to categorise and to measure; CDA 8000 for instance would signal an improvement over CDA 6000.

The Review therefore recommends:

- That as soon as possible, the altitude for commencement of CDA at Gatwick should be increased from the current 6000 feet to 7000 feet (FL070).
- That GAL collaborates with NATS, CAA and airlines, within 12 months, to agree incremental improvements, to the application of CDA procedures at Gatwick.
- That GAL work with NATS and CAA to raise the Gatwick CDA commencement altitude to 8000 feet when feasible.
- That the Gatwick holding areas should be higher or should be relocated to enable holding aircraft to dwell over water, rather than over Sussex.
- That GAL propose a subsidiary CDA taxonomy which includes the commencement altitude of the procedure, e.g. CDA 6000, be established by the CAA to improve lay understanding and to better benchmark later improvements.

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Slightly Steeper Approach

Aircraft Operational Noise Mitigation Opportunities

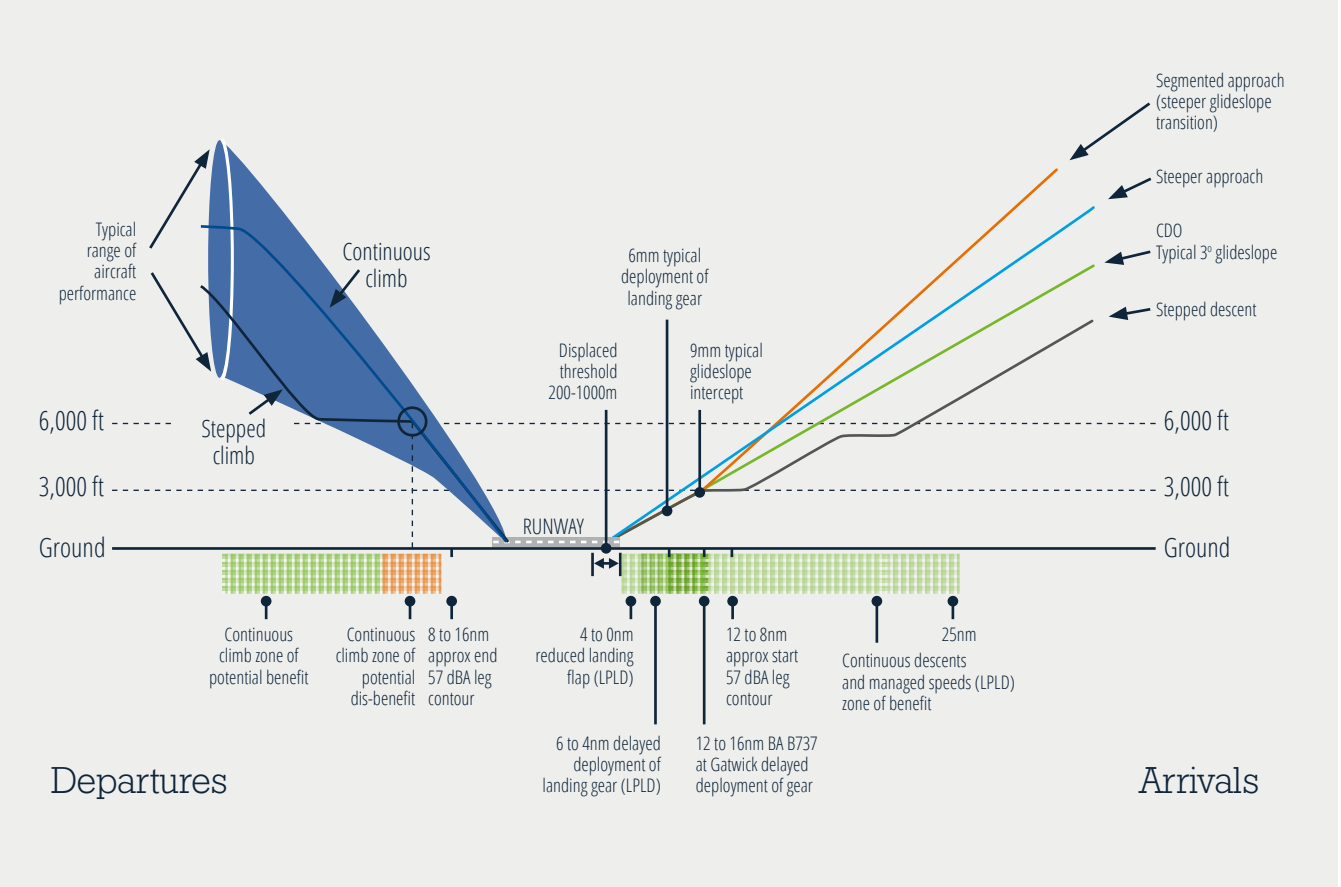


Figure 8 Noise Mitigation Operational Techniques

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

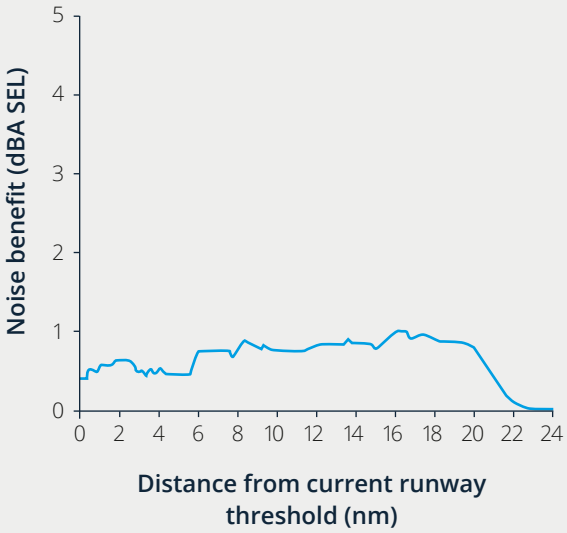


Figure 9 Noise impact of increasing Glide-path Angle from 3 degrees to 3.2 degrees (CAA)

2.4 Noise Abatement Operational Procedures

Slightly Steeper Approach

The international standard Instrument Landing System (ILS) glide-path angle is 3 degrees. Increasing an aircraft's glide-path reduces noise in two ways. Firstly, it marginally increases the height of the aircraft over the ground, thereby increasing the distance over which sound travels before it reaches a population. Secondly, it increases an aircraft's rate of descent, reducing the amount of engine power required, and thus reducing the amount of noise emitted[37].

The noise impacts of an increase in aircraft glide-path angle to 3.2 degrees are illustrated in Figure 9. The increase in glide-path angle of 0.2 degrees delivers an increase to aircraft height of 20 feet per nautical mile from touchdown. Even at 10nm from touchdown, the height increase will be 200 feet. The resultant 1db improvement in noise is insufficient to be normally perceptible to the human ear.

While such approach angle initiatives elsewhere have been welcomed[38] by campaign groups as an indication of positive noise endeavour by airports, the actual noise benefit is not a significant contributor to noise reduction for residents. Hence an increase of glide-path angle at Gatwick is not recommended by the arrivals review team.

Displaced Landing Threshold

One method of potentially mitigating the impact of aircraft noise is the displacement of airport runway thresholds from the extremity of the runway surface end, to a location further down the runway. Displacing the runway threshold also moves the glide-path meaning that the aircraft will fly at slightly greater heights as they pass over communities located near the airport, thereby increasing the distance between aircraft producing noise and the community. Runway thresholds have been routinely displaced to increase the clearance between approaching aircraft and obstacles located near the airport. But the corresponding reduction to the landing distance available to the aircraft limits the extent to which the threshold can be displaced. A 400 metre displacement by way of example will provide an increase in aircraft height above specific final approach points, of about 75 feet throughout the approach. Any resultant improvement in noise is insufficient to be normally perceptible to the human ear.

At Gatwick, the thresholds serving both runway 26 and 08 are already displaced, thus negating the option as a further noise measure.

[37]CAP1165

[38]Frankfurt and Heathrow

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Point Merge

Point Merge is a form of linear holding that can be designed into a Standard Arrival Route (STAR). It allows ATC to delay, sequence, and integrate aircraft arrivals by giving routings along predetermined variable legs to specific points, instead of providing radar headings. It can also entirely replace or significantly reduce the need for traditional holding stacks.

'Point Merge', illustrated at **figure 10**, is already in operational use at some airports including Dublin and soon, London City. ATC arrival clearance is given for the complete longest linear hold route. As soon as the correct spacing is achieved, the aircraft is instructed to route to the 'merge point' from where a single arrival path is resumed.

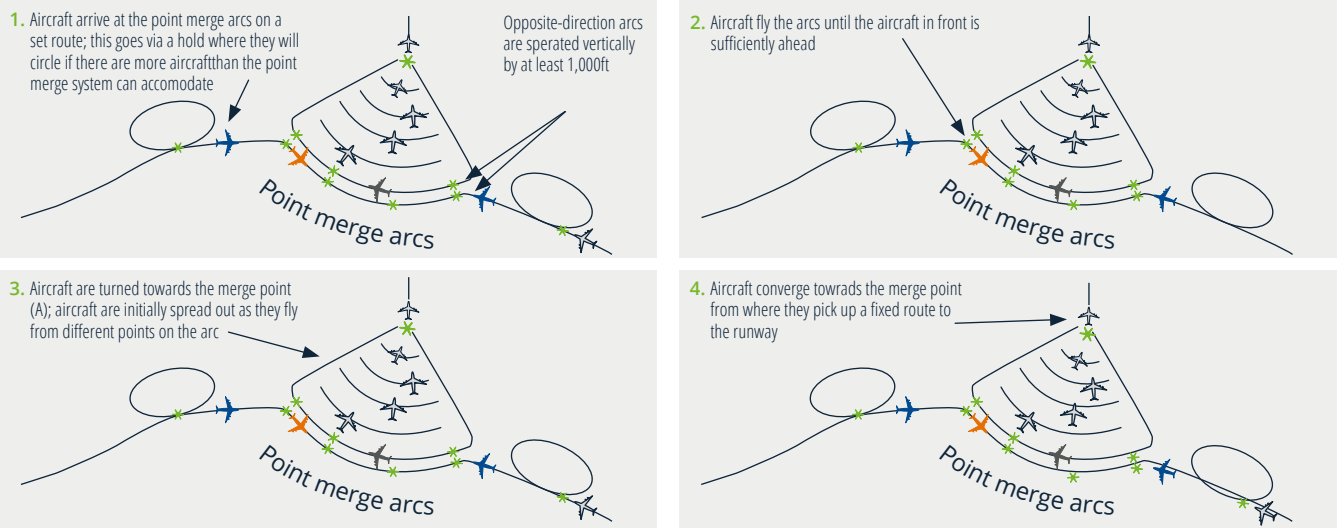


Figure 10 Point Merge schematic illustrating merge concentration at the merge point (Skybrary)

Point Merge is one element of the ICAO Aviation System Block Upgrades and is referenced as a technique to support continuous descent operations (doc 9931).

Point Merge will not improve the noise situation around Gatwick because of the implied absolute concentration of noise at the Merge point, and therefore is not proposed as a recommendation in this Review.

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Community Perspectives on Concentration and Dispersal

As was detailed in the London Airspace Change Proposal consultation findings[39] published in April 2014, public reaction to the prospect of increased concentration of flight arrival paths resulting from the then proposed introduction of Point Merge for Gatwick highlighted the controversial nature of the debate over dispersal versus concentration of flights.

The following two community statements illustrate two commonly expressed but completely contradictory, sentiments – as expressed by various residents, further complicating the decisions facing airspace planners. The first quote is from Penhurst Parish Council, a community northwest of Tunbridge Wells against concentration, and is taken from the London airspace consultation report, see footnote:

"It appears that as far as arrivals are concerned Gatwick Airport Limited is intent on changing the current tactically vectored flight paths across a broad swathe to a single flight path (depending on wind direction) from a new so called Point Merge and suggesting this could be supported by a respite flight path. As there are no indications as to where these would be we cannot support this concept. It would be grossly unfair on those whose lives would be devastated with a continuous stream of overhead flights from a Point Merge when they previously had substantial relief from the tactically vectored flight paths across a broad swathe. The current system is a proven, safe and a fairer distribution of incoming flights." Penshurst Parish Council – a community located very close to the final approach track, to the northwest of Tunbridge Wells.

The second statement is an example of a written submission to the Independent Arrivals Review which expresses a contrary lack of support for maximum equitable dispersal.

"We continue to ask for an exclusion zone over Tunbridge Wells..... The Tunbridge Wells Community represented by TWAANG does **not** *request maximum equitable dispersal rather than a concentration of flight paths."* Tunbridge Wells Anti-Aircraft Noise Group.

[39]http://www.londonairspaceconsultation.co.uk/wp-content/uploads/2014/04/NATS_GAL_LAC-Report_FINAL-01-04-14.pdf

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Community Perspectives on Concentration and Dispersal

The alternative contrary prospects of distribution or avoidance of noise to rural areas (and Areas of Outstanding Natural Beauty) is also identified and expressed by many communities both east and west of Gatwick;

"Concern is raised about new routes over peaceful areas and proper research is needed into any potential health and well-being impacts, noise impacts and the impacts of annoyance caused by increasing the frequency of flights." Tandridge District Council.

Based on the wide variety of opinions expressed to the review team, a balanced mix of concentration and dispersal is most likely to deliver a meaningful, fair and equitable distribution of noise, and will provide an opportunity for respite.

Respite

Respite, is a procedure that must be planned. For example procedures could be planned or designed for different arrival routes to the same runway at Gatwick to be used at different times of day, providing residents predictability. Respite can be designed into airspace structures more easily once aircraft tracks are predictably concentrated on to safely separated routings, enabling the use of them to be alternated or varied.

There is currently no agreed minimum distance between routes such that alternating their use would result in acceptable noise respite. However the CAA has analysed the question and has published the findings illustrated in the chart at **figure 11**.

The Review therefore recommends:

- That GAL considers proposing to the CAA, the establishment in airspace design criteria, of a minimum distance between arriving tracks for aircraft, to deliver for arrivals; both a meaningful dispersal and an opportunity for respite. This is likely to apply to aircraft before they have joined the final approach track, which for Gatwick will therefore be at 3000 feet or above.

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Respite

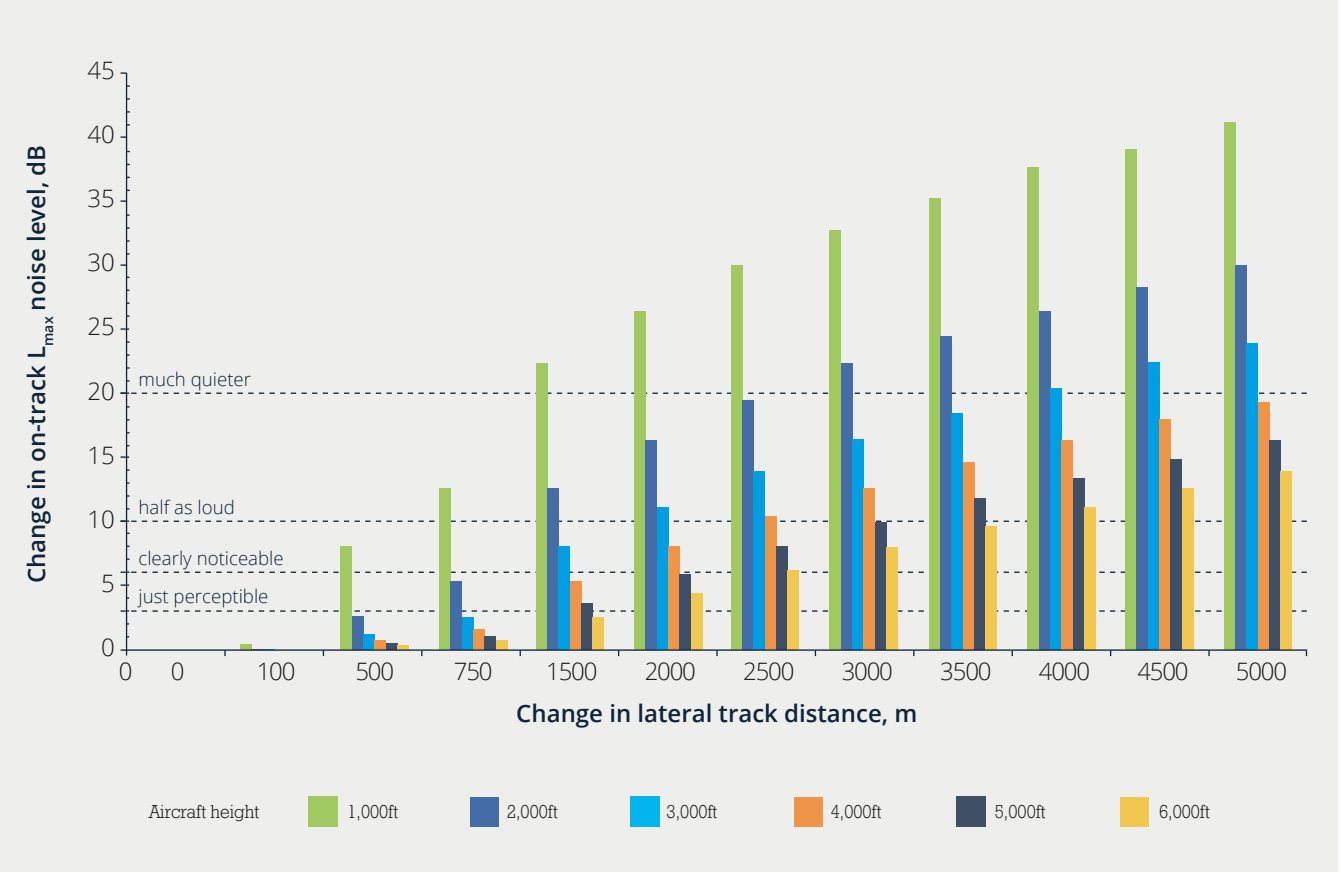


Figure 11 Noise degradation with height and distance (CAA)*

*Note that 1 nautical mile = 1852m

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Fair and Equitable Dispersal

For the purposes of this Review, the Terms of Reference make clear that, in considering the concerns raised by local residents, the review team will give particular attention to assessing the feasibility and implications of adopting a policy of *"fair and equitable dispersal"* which a number of campaign groups have expressed as a priority.

Dispersion, dispersal or dispersed aircraft tracks, refer to aircraft that are instructed to follow the same routing, for example from a holding stack to a landing, yet fly a variety of different tracks when measured over the ground. Dispersion is the consequence of aircraft performance, pilot or air traffic control tactical decision, air traffic conditions, weather and time of the day. The combination of these often variable, factors includes; the arrival procedure's design criteria, weather including wind and visibility, aircraft type, performance characteristics and actual aircraft weight. All of these factors can influence the horizontal track and vertical profile actually flown.

Concentration of aircraft is effectively the opposite of dispersion. It takes place when aircraft instructed to follow the same routing thereby consistently follow very similar tracks over the ground and even similar vertical profiles.

For most UK airports including Gatwick, departing aircraft have clearly set routes, the Noise Preferential Routes, to follow during the initial stages of flight. For arriving aircraft, the subject of this review, there are currently no such clearly defined routes leading to the final approach track, except in the exceptional circumstances when radar is not available. NATS use the arrival route flexibility within the Gatwick Radar Manoeuvring Area to vector and sequence aircraft in as safe and efficient manner as possible.

Aircraft on final approach use an Instrument Landing Systems (ILS) for precision approach guidance. The ILS is essentially a pair of radio beams which provide precise lateral and vertical guidance for the aircraft along a straight line extension to the landing runway with a descent profile set at 3 degrees, which equates to approximately 310 feet per nautical mile (nm). Hence an aircraft at 10nm from touchdown will be about 3100 feet above the runway.

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Fair and Equitable Dispersal

The approach stabilisation initiative of 2013 extended the daytime ILS joining point from 7nm to 10nm, it has been at 10nm at night (23:30-06:00 local time) since before 2004. One effect of the 2013 change was to concentrate all daytime arrivals (prior to 23:30) into a narrower swathe, increasing the number of aircraft over those areas, creating the impression within the swathe that more aircraft are using Gatwick.

An analysis of residents requests to the review team shows overall that either a concentration of aircraft routes away from the location of the correspondent was requested or have indicated that the random nature of radar vectors to the ILS both east and west of Gatwick prior to 2013 was an acceptable means of fairly and equitably dispersing aircraft noise. The minimum ILS joining point at that time was 7nm.

Proposals to establish exclusions zones around individual towns and villages were also received by the review. These have not been selected as deliverable options. There is no rational and fair basis on which to select one community for exclusion over another, and in the unlikely event that such a zone could be made operationally possible, because of vertical constraints, it is unlikely that it could deliver a meaningful noise relief.

When considering the community reaction to the relative concentration of flights that has occurred for Gatwick arrivals and which has been reported to this review, it is difficult to envision a situation where any community faced with the prospect of a concentration of all arriving flights, with no procedures for fair and equitable dispersal of noise, and no defined respite periods, would do anything other than protest in the strongest terms.

For this reason, when developing PBN routes to the ILS, or full RNAV arrivals routes for Gatwick, which are a feature of FAS and discussed later in this report, it is the opinion of the review that airspace planners will be expected to ensure a fair and equitable dispersal to deliver respite to residents and, to minimise the effect of any concentration.

The Government policy caveat is that this should not lead to significant numbers of people newly affected by noise, a trade off which seems to be intractable. The review has found that the term *'significant numbers'* is highly subjective and hence open to widely varying interpretations.

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

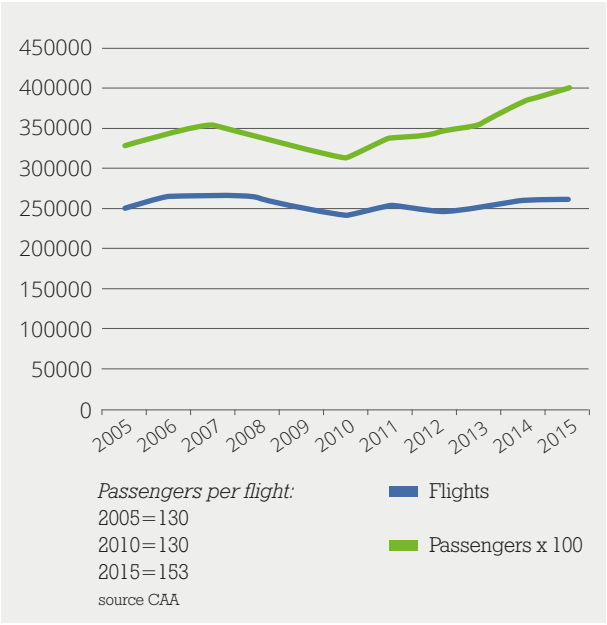


Figure 12 Trends in Number of Flights & Passengers using Gatwick (CAA)

2.4 Noise Abatement Operational Procedures

Arrival Planning

Although Gatwick is reporting record passenger numbers, according to CAA statistics the number of flights at the airport has remained broadly similar over the past 15 years, reporting 260,859 flights in year 2000, compared to 261,582[40] in 2015. The number of flights using Gatwick reached its peak of 266,550 flights in year 2007, while there was a short term fall in the number of flights post 9/11 and following the financial crisis of 2008 reflecting reduced demand. Individual aircraft using Gatwick are now larger with each carrying more passengers creating a divergence trend also seen at other runway constrained airports.

There is evidence that following the introduction of the approach stabilization programme in 2013, an increased concentration of arriving aircraft, further from the airport than was previously the case is likely to occur during busy arrival periods. This has effectively created greater aircraft activity at these locations[41], although this increased concentration has been balanced by corresponding reductions closer to the airport. This programme has undoubtedly led to an increase in the number of noise complaints received by Gatwick.

Arrival demand varies significantly through the day at Gatwick, with the busiest hourly period in 2015 at 35 arrivals planned between 22:00-23:00 local time in the summer peak period. This evening arrival peak occurs because most of the Gatwick based aircraft each operate several rotations each day before finally landing back at Gatwick that night, ready for the following day's operations. Any delays accumulated by individual flights throughout the day are likely to cause a knock on delay to the last arrivals with the trend being a spill-over into the night period (23:30-06:00 local time).

Improvements to airline scheduling and to schedule adherence, although not noise techniques as such, are nevertheless efficiency measures that are expected to be able to deliver improvements to night noise disturbance through reduction of the numbers of flights delayed into the night period. Efficiency measures expected to deliver noise benefit are discussed later in the report.

[40]Provisional full year figure

[41]See Annex 9

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Arrival Planning

Figure 13, illustrating the variations in hourly (GMT) planned arrivals during the peak summer period in 2015 at Gatwick, is published by Airport Coordination Limited, the company managing runway slot allocations for airports in the UK including Gatwick.

Peak Week Hourly Runway Allocation

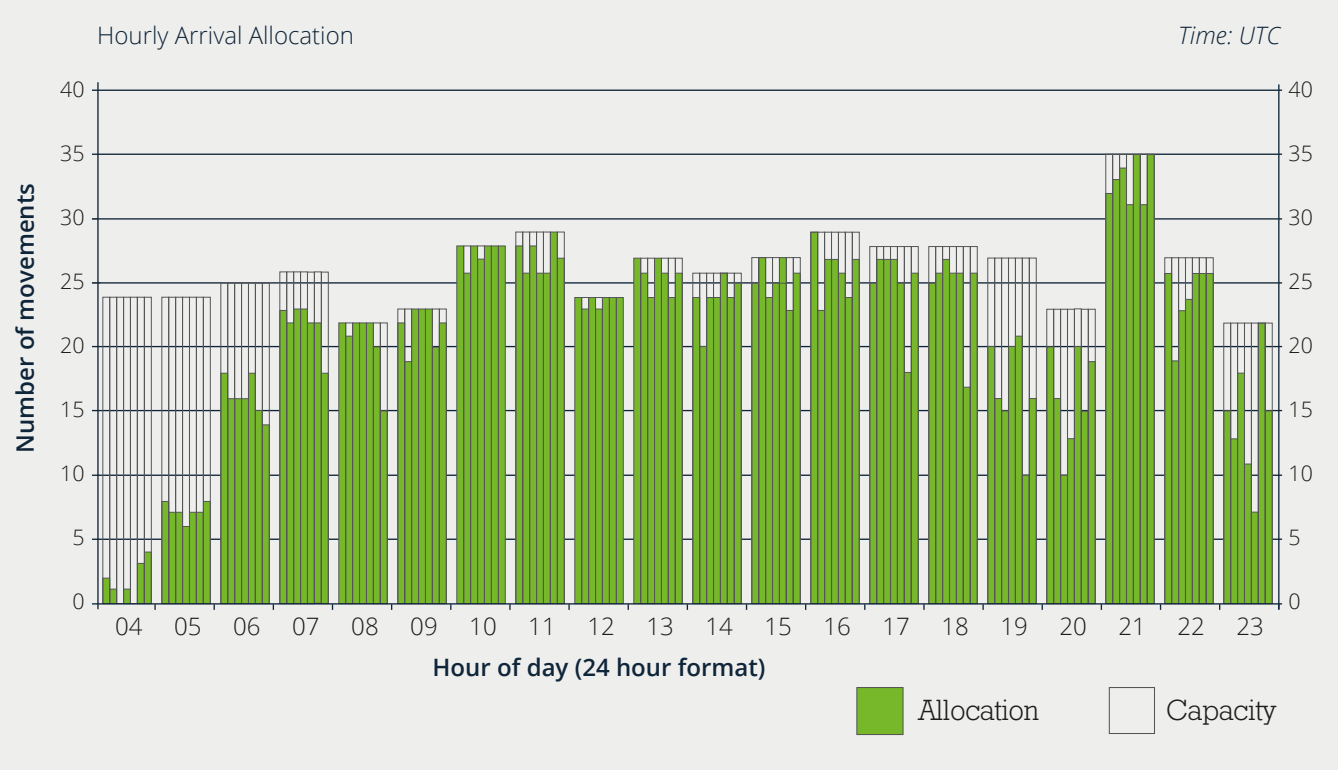


Figure 13 Runway Slot allocations for Gatwick arrivals (ACL[42])

[42]ACL is responsible for data collection, schedules facilitation and slot allocation at 28 airports in the UK and the EU, as well as in Dubai and New Zealand.

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Arrival Procedures

An analysis of the procedures used by aircraft arriving at Gatwick and published by the CAA[43], indicates the use of best practice recommendations for noise by all the organisations involved. NATS, Aircraft Operators and GAL. Conversely, while there is no indication that the appropriate measures were not used or supported by GAL, NATS, CAA or DfT, the measures did not prevent the noise impacts of radar vectoring changes associated with the Approach Stabilisation initiative. This implies that more needs to be done to ensure noise improvements in future. Relevant extracts from the operating procedures are included below for information:

> Aircraft join the final approach path at heights consistent with use of the ILS at that distance from the airport and they will then descend according to the 3 degree glideslope described above. Aircraft on arrival are required by the CAA to be established on the ILS at certain heights and distances from the airfield. These points are known as the minimum joining points. During the daytime the aircraft are currently required to be "established" on the ILS at 10nm from touchdown. This equates to approximately 3000ft above aerodrome level (aal).
>
> At night the minimum joining distance will remain at 10nm. As a result of this requirement the aircraft follow very consistent and narrow flight paths on the very final part of the approach to airports. Where the aircraft is approaching the aerodrome to land it shall, commensurate with its ATC clearance, minimise noise disturbance by the use of continuous descent and low power, low drag operating procedures (referred to in Detailed Procedures for descent clearance in section EGKK AD 2.22 of the UK AIP). Where the use of these procedures is not practicable, the aircraft shall maintain as high an altitude as possible. In addition, when descending on initial approach, including the closing heading, and on intermediate and final approach, thrust reductions should be achieved where possible by maintaining a 'clean' aircraft configuration and by landing with reduced flap, provided that in all the circumstances of the flight this is consistent with safe operation of the aircraft.
>
> Before landing at the aerodrome the aircraft shall maintain as high an altitude as practicable and shall not fly over the congested areas of Crawley, East Grinstead, Horley and Horsham at an altitude of less than 3000ft (Gatwick QNH) nor over the congested area of Lingfield at an altitude of less than 2000 ft. (Gatwick QNH).
>
> Aircraft which land at Gatwick Airport - London between the hours of 2330 (local) and 0600 (local), whether or not making use of the ILS localizer and irrespective of weight or type of approach, shall not join the centre-line:(a) below 3000; ft. or (b) closer than 10 nm from touchdown.
>
> The aircraft shall at all times be operated in a manner which is calculated to cause the least disturbance practicable in areas surrounding the aerodrome.

[43]http://www.ead.eurocontrol.int/eadbasic/pamslight-1B7B18F229BE3E724A2912B0EB12FF51/7FE5QZZF3FXUS/EN/AIP/AD/EG_AD_2_EGKK_en_2015-12-10.pdf

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Arrival Procedures

As noted previously, the approach stabilisation initiative of 2013, implemented primarily for safety reasons but also for capacity improvement, extended the daytime ILS joining point from 7nm to 10nm. The minimum joining point has been located at 10nm at night (23:30-06:00 local time) since before 2004. The CAA recognizing that aircraft are both higher and benefit from a longer stable approach through use of a 10 mile join, agreed that the change to 10nm minimum join during the day was a safety improvement and hence the change was supported.

Many residents reported to the review that they have asked both GAL and NATS to reverse the 2013 change of vectoring methodology, thereby returning the minimum ILS join distance to 7nm. These requests were also widely made to the review team. The review has confirmed that increasing the size of the arrival swathe is expected to deliver overall noise improvements for those on the ground.

An adaptation to radar vectoring methodology using an ILS join point minimum of 8nm from touchdown should extend the arrival swathe 2nm further to the west for Runway 26 and correspondingly to the east for Runway 08 arrivals while still enabling the safety objectives of the previous change. If implemented, the effect will be to increase the arrivals dispersal to more closely emulate the circumstances the prior to 2013 position. Hence the arrival swathe would normally extend from a minimum of 8nm to 14nm. When traffic permits, aircraft from the east for Runway 26 will join on a straight in approach even further east, and for 08, straight-in further from the west. The CAA has indicated that on request from GAL and NATS that it will consider this subject to normal process.

These measures, if implemented, should go a long way towards restoring the arrivals situation to a level of dispersal seen prior to 2015. Proposals to resolve other underlying noise management questions are identified later in this report in Section 4, dealing with noise planning and coordination.

Final approach to Gatwick (Proposed)

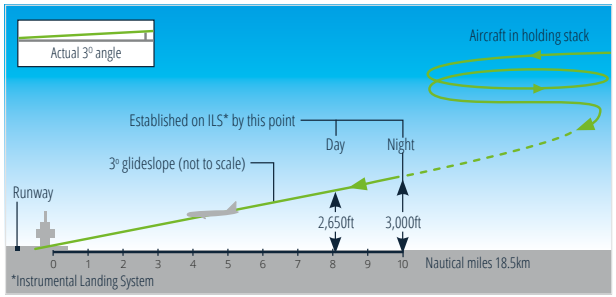


Figure 14 Profile of proposed ILS joining Point Change

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Arrival Procedures

The Review therefore recommends:

- That GAL explore with NATS the potential for aircraft to be vectored to be established on the ILS at a minimum of 8nm from touchdown outside of night hours, rather than the current 10nm. This adaptation to vectoring methodology should extend the arrival swathe 2nm closer to the airport and increase the arrivals dispersal to more closely emulate the operations prior to the 2013 change. Hence the arrival swathe would normally extend from a minimum of 8nm to 14nm, with aircraft joining on a straight in approach when traffic permits.

Precision Area Navigation (P-RNAV)

There are currently no defined fixed routes or heights for aircraft to follow from the stacks to the final approach at Gatwick in normal operations, but both Trajectory Based Operation (TBO) and Performance Based Navigation (PBN) arrival procedures with full 4D flight trajectory management are planned for the Single European Sky and in the UK Future Airspace Strategy. The use of these technologies and techniques enables the creation of consistent mechanisms for fair and equitable dispersal of noise with defined respite procedures.

In alignment with ongoing European regulatory developments, the CAA has announced a mandate for the adoption of RNAV-1 PBN standards by all aircraft that use routes to/from key London Airports including Gatwick, from November 2017, with later implementation of the routes themselves. The mandate is expected to set a minimum standard for the London airspace with some airports adopting a more advanced version of PBN on some routes to achieve greater benefits.

Precision-Area Navigation (P-RNAV) is a form of Performance Based Navigation (PBN).

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

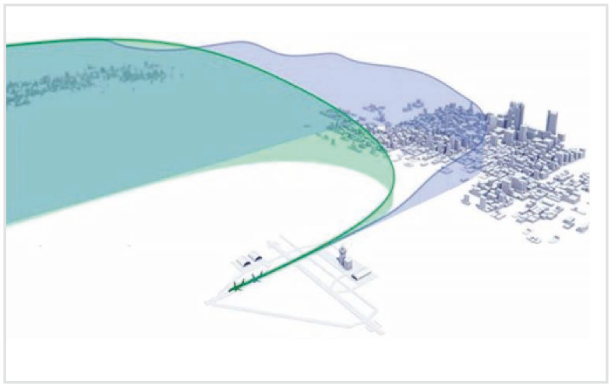


Figure 15 Using P-RNAV arrival routes to reduce the numbers of people affected by noise

2.4 Noise Abatement Operational Procedures

Precision Area Navigation (P-RNAV)

The concentration of flights is possible because of the accuracy of RNAV design. The accuracy and predictability associated with RNAV related concentration – aircraft are able to consistently fly fixed routes across the ground - is that it is possible to make a more efficient use of airspace by allowing more aircraft through a block of airspace with less air traffic controller intervention. It is also theoretically possible to devise routes that largely avoid areas of population, for example over water. The disadvantage is that if the defined route is over land and the aircraft are operating at a relatively low level, as is the case during the approach to land, those affected are disturbed consistently. Noise is not shared as illustrated in **figure 15**.

Where environmental issues are a greater priority, the routes can be designed to make best noise use of the airspace available and, where possible, to by-pass densely populated areas, subject to other considerations set out in Government policy. The fewer radar vectors then necessary, also means less uncertainty on the flight deck with regard to the anticipated tactical route and the distance to go to a landing, improving prospects for the efficient achievement of CDA objectives.

However, the resulting redistribution and concentration of aircraft (and thus aircraft noise) through use of more accurate navigational techniques is proving controversial for some residents living below those flight paths at airports that have already adopted or proposed these techniques[44]. This has also been the case with some PBN based departure routes at Gatwick[45].

For Gatwick arrivals, several carefully designed P-RNAV routes from the holding stacks to the Instrument Landing System for final approach precision guidance, offer the opportunity to deliver dispersal of aircraft arriving tracks, predictable respite, as well as a reduction of the numbers of people affected by noise.

Clear policy guidance from the on-going research to identify improved methods and metrics for the measurement and assessment of the impact of aircraft noise in rural and quiet areas, is also needed to assist with clarification of precise route selection criteria for planners.

[44]In the USA, Australia and New Zealand (DfT)

[45]See section 1.2

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Precision Area Navigation (P-RNAV)

The Airports Commission, in its SDG technical report Number 01[46], noted in context of PBN implementation that; the Government and aviation industry are committed to ensuring that local communities have a say in how the modernisation programme is delivered. Effective engagement with those that may be impacted by the changes is critical to the development of a modern, sustainable air transport route network.

The timing of any PBN arrival routes for Gatwick is subject to the design and formal consultation process. As such, even though there are clear opportunities to disturb fewer people, any implementation is likely to be after 2022.

The review team has concluded that; since the design, public consultation, agreement and approval of any new P-RNAV routes for Gatwick is likely to be a very lengthy process. To avoid a risk of delaying the noise benefits, the process should be initiated without delay.

A move in this direction is in line with UK policies and must be expected in the next five years. With a view to provide an indication of what P-RNAV procedures could deliver compared to a baseline of today, examples are provided as an Annex. The modelling used in the route examples provided as an Annex give both an indication of potential noise improvements and provide an indication of how far the routes needs to be apart to deliver real respite when another route is flown.

It is the opinion of the review team that the adoption of carefully designed P-RNAV routes from the final approach holding fixes used for Gatwick, to the ILS final approach tracks, provides real opportunity to reduce noise, to disturb fewer people, to deliver fair and equitable dispersal of noise and, to deliver well defined respite measures.

The Review therefore recommends:

- The adoption of carefully designed routes from the approach holding fixes used for Gatwick, to the ILS final approach tracks, provides real opportunity to reduce noise, to disturb fewer people, to deliver fair and equitable dispersal of noise, and, to deliver well defined respite measures. The London Airspace Management Programme should be developed by NATS and GAL to incorporate alternative proposals, to those published in 2013, as soon as reasonably possible, for consultation, agreement and implementation for Gatwick arrivals.

[46]https://www.gov.uk/government/publications?departments%5B%5D=airports-commission

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Operations in Nil or Low Wind

Normally, an aircraft will land and take off into wind unless safety, the runway configuration, or air traffic conditions determine that a different direction is preferable. In selecting the runway-in-use, the unit providing aerodrome control service (Gatwick Tower) takes into consideration, besides surface wind speed and direction, other relevant factors such as upper winds, the lengths of runway available, and the serviceability of approach and landing aids.

At Gatwick, as in the rest of the UK, the prevailing wind is westerly and therefore the reported long term average allocation of runway in use is 70:30 in favour of westerly operations[47] (landing towards the west), and it is not unusual to experience periods of prolonged operation in either one direction or another. This means that arriving aircraft can use a particular landing direction for many days or even weeks without change, hence providing little respite to residents. The Flight Performance Team report contains detail[48].

A characteristic of surface wind, subject to the wider meteorological situation, is that it tends to erode or disappear in the late evening. There will therefore be occasions, normally but not exclusively at night, when wind conditions would permit a change of landing direction, thereby potentially delivering respite for residents experiencing both arriving and departure noise.

It is the opinion of the review that an operating protocol should be developed, published and adopted by GAL to define the criteria and occasions when a change of landing direction could be implemented at Gatwick for noise reasons, when weather and other conditions permit. The objective of the protocol would be to achieve a more even split of arrivals, and to fragment the otherwise continuous use of one runway direction or another because of long term weather patterns. This is particularly relevant, but not limited, to the peak arrival hours that occur in the evening. The target implementation should be before the peak summer period 2016, which has been reported to the review team as a sensitive time for residents concerned about aircraft noise.

[47]http://www.gatwickairport.com/globalassets/publicationfiles/business_and_community/all_public_publications/aircraft_noise/fpt_quarterly_reports/fpt-report-april-june-2015.pdf

[48]http://www.gatwickairport.com/globalassets/publicationfiles/business_and_community/all_public_publications/aircraft_noise/fpt_annual_2013.pdf

Options for Reduction and Mitigation of Noise Disturbance from Gatwick Arrivals

2.4 Noise Abatement Operational Procedures

Operations in Nil or Low Wind

The Review therefore recommends:

- The development, publication and implementation by GAL of an operating protocol to define the occasions when a change of landing direction will be implemented at Gatwick for noise reasons, if weather, safety requirements and other conditions permit. The objective of the protocol being to achieve a more even split of arrivals, and to fragment the otherwise continuous use of one runway direction or another because of long term weather patterns. The impact should be monitored by GAL and the results regularly reviewed by the Noise Management Board (NMB).The target implementation of the protocol should be during 2016 following engagement with airlines, air traffic control and communities.

2.5 Operating Restrictions

This refers to measures that limit the access of aircraft to airports, such as noise quotas, night restrictions or the phased withdrawal of noisier aircraft types.

Those residents that have expressed a view on operating restrictions have proposed to the review team that the review recommend measures to further limit night operations at Gatwick. There are already strict night quotas and other restrictions applied[49].

The review has proposed efficiency measures related to airline scheduling and the introduction by NATS and GAL of improved capacity management tools for Gatwick which, if implemented in full cooperation with airlines and neighbouring air traffic control providers in Europe, can be expected to reduce the numbers of aircraft operations delayed into the night hours at Gatwick, especially during peak period and summer months.

[49]http://www.gatwickairport.com/globalassets/publicationfiles/business_and_community/all_public_publications/aircraft_noise/fpt_annual_2013.pdf

Operating Efficiency

Introduction

The operating efficiency of any airport will have a direct bearing on its achieved capacity, its ability to deliver on time arrivals and, thus the extent to which airborne arrival holding and extended radar sequencing, is necessary.

The efficiency of the wider air transport network beyond the UK, whether Air Traffic Management, Airport or aircraft operation, also has a direct consequence on the ability of Gatwick to operate at optimum efficiency.

There are a number of international collaborative activities, including Air Traffic Flow Management (ATFM) and Airport-Collaborative Decision Making (A-CDM) in which Gatwick plays its part effectively as a major node in the European Air Transport System.

Punitive measures are also applied by the EU to airlines that suffer from serious flight delays, by setting and mandating passenger delay compensation (EU 261) in an effort to incentivise on time performance by aircraft operators.

Despite these comprehensive measures, arrival delays still inevitably occur. From an arrival noise perspective, the consequences are increased holding and arrival manoeuvring of aircraft and, the spillover of some delayed flights from their scheduled evening slots, into the night period post 23:30.

A number of additional measures can be used to help mitigate these causes of delay and thus to reduce noise disturbance.

Scheduling

Good schedule planning is essential at airports such as Gatwick with constrained runway capacity. Flight delays are exacerbated by the bunching of arrival runway demand caused in part by peaks within the schedule, but also by airline processes and performance which do not consistently deliver aircraft movements on plan, (recognising that there are very often network factors outside of airline control such as weather, industrial action or unplanned equipment outages).

Moreover, the Air Traffic Flow Management tools designed to smooth aircraft flows to runways are not yet fully integrated at airports and so are not optimised to minimize both arrival and departure delays, further compounding the problem. Aircraft holding and arrivals maneuvering in the last minutes of the flights, extending noise exposure, are associated symptoms. Another consequence of delayed flights is the impact of accumulated delay, which for some flights scheduled late in the day, causes consequent unplanned slippage of the actual operation into the night period.

Operating Efficiency

The airport and its community of airline users have a set of planning, governance and performance review structures which are fully compliant with EU Slot Regulations, safety and DfT Regulations, and IATA scheduling guidelines. Despite this, in practice actual demand patterns vary from plan. Particular difficulty is created when over demand is anticipated, which prompts flow rate regulation to manage the number of aircraft down to safe levels in airspace or holding stacks.

There are a number of committees which monitor aspects of airport performance, including the slot performance committee, the Flight Operations Performance Committee and the capacity limits and runway performance improvement groups.

In so far as the review team has been able to ascertain, it appears that more can be done at Gatwick by all stakeholders, to improve flight scheduling and operational resilience, and thus reduce the incidence of arriving flights being delayed into the night hours.

The Review therefore recommends:

- That the Gatwick Flight Performance Team introduce a KPI, enabling the monitoring and reporting of the number of flights delayed from planned daytime arrival, into a night movement (after 23:30 local) and that GAL initiate measures to identify and agree steps, including enhanced use of time based operations, with airlines and with the airport's scheduling committee for implementation within 12 months, to effectively and progressively reduce unplanned night arrivals at Gatwick.

Arrival Manager/Departure Manager (AMAN/DMAN)

Among the capacity management tools used by air traffic control are the Arrival Manager (AMAN) systems which have been developed and deployed in Europe, and elsewhere. The AMAN for Gatwick is located at Swanwick and owned by NATS. AMAN are primarily designed to provide automated sequencing support for the controllers handling traffic arriving at the airport, continuously calculating arrival sequences and times for flights, taking into account the locally defined landing rate, the required spacing for flights arriving to the runway and other criteria. The AMAN system interacts with several systems, including the Flight Data Processing System (FDPS) and Radar Data Processing System (RDPS). It uses a combination of flight-plan information, radar information, weather information, local airspace and route information, and an aircraft performance model in its trajectory prediction, resulting in a 'planned' time for any individual flight.

Operating Efficiency

Since the AMAN has certain conditions it needs to satisfy (such as the required landing rate, or spacing, on the runway), when 2 or more aircraft are predicted at or around the same time on the runway it plans a sequence, generating new *'required'* times that need to be applied to the flight(s), in order to create/maintain the sequence.

As well as providing sequence information to the Air Traffic Controller , the system also normally outputs the required time for the controller in the form of Time to Lose/Time to Gain information (a typical output might be *'L2'*, which means the flight needs to lose 2 minutes to fit into its position in the sequence). The controller is then responsible for finding and applying an appropriate method (vectoring, path stretching, speed changes or holding) for the aircraft to meet its time or position in the sequence[50].

While AMAN is used to plan the sequence of arrivals to Gatwick's runway, the Departure Manager (DMAN) a planning tool is also in use for Gatwick, but this time located at the airport, intended to improve the departure flows at the airport and increase the predictability of take-off times. DMAN calculates the Target Take Off Times (TTOT) and the Target Start-up Approval Times (TSAT) taking multiple constraints and preferences into account. As a result, the DMAN provides a planned departure flow with the goal to maintain an optimal throughput at the runway.

In common with many other airports, for legacy reasons at Gatwick, even though both systems are calculating and managing real time runway capacity allocation, there is no system integration between the AMAN and DMAN. This is not efficient. Because the system at Swanwick is operated by NATS and the system at Gatwick is owned by GAL, it appears that the investment, procurement and technical policies for the integration of such systems are not adequately aligned.

The Review therefore recommends:

- That the requirements specification of any system upgrade to, or replacement of, any sequencing tools must take full account of the need to integrate the AMAN at Swanwick and DMAN at Gatwick, such that they are each fully informed of, and take into account the capacity allocations of both arrival and departure functions.

[50]http://www.skybrary.aero/index.php/Integrated_Tower_Working_Position_(ITWP)

Operating Efficiency

XMAN

Known as Cross-border Arrivals Management (XMAN), the procedure sees NATS Air Traffic Controllers in the United Kingdom working with those in the surrounding airspace in France, Ireland, Belgium and the Netherlands to slow aircraft down up to 350 miles away from London Heathrow, in order to minimize holding times on arrival.

Since April 2014, NATS has recorded a reduction of up to a minute in holding times for those aircraft influenced by the trial. This equates to annual savings of 8,000 tons of CO2 and $2.5 million in fuel, as well as a reduction in noise for communities beneath the holding stacks for Heathrow.

XMAN is deployed at the NATS en-route centre at Swanwick with the support of neighbouring ATC centres in Europe (in whose airspace Heathrow arrivals are sometimes required to change speed to meet new planned arrival times) In the opinion of the review, the operation of XMAN should be extended as soon as possible to include Gatwick arrivals.

The Review therefore recommends:

- That within 6 months, GAL and NATS conduct a joint investigation to establish and agree whether the XMAN extended arrivals manager is an effective tool to reduce arrival holding at Gatwick and if so; to agree and publish within 9months when XMAN can be deployed for Gatwick and what results can be expected.

Time Based Separation (TBS)

Time Based Separation (TBS) is a newly certified method to more efficiently meter aircraft arrivals at capacity constrained airports, to improve runway utilisation, runway resilience and to reduce delays. It was introduced into operational service at Heathrow in 2015[51].

TBS is required for busier airports in Europe including Gatwick as a part of the Single European Sky ATM Masterplan[52], but the current time scale is post 2020.

Gatwick operates today in a Single Runway Mixed Mode configuration, interleaving departures into the arrival stream. A standard Arrival-Departure-Arrival spacing is around 6nm in light winds. With the exception of the

[51]http://www.wsj.com/articles/how-heathrow-airport-cut-down-on-flight-delays-1442423115

[52]https://www.atmmasterplan.eu/oisteps/AO-0302

Operating Efficiency

A380, this is in excess of the current wake turbulence separation requirements for most aircraft pairs. As the wind increases, Gatwick Tower will request that Gatwick Approach (NATS at Swanwick) reduce this spacing to 5.5nm or even 5.0nm to compensate for the slower groundspeed of aircraft.

Gatwick therefore already has a degree of resilience to strong headwind conditions. This is different to Heathrow pre-TBS, where the arrival spacing was often constrained by the wake turbulence separation. However, at Gatwick the *"ideal"* spacing at the start of the day is often not known and any reductions can lag some time behind the changes to the actual wind conditions. In addition, the spacing can only be delivered in 0.5nm increments meaning that, for example, even if 5.7nm were needed it would still be necessary to deliver 6.0nm. This means that at the start of the day and as wind conditions change there will be periods where additional spacing is being provided.

The benefits of TBS at Gatwick will come from (a) a reduction in the wake turbulence separation behind A380s and some other less common pairs in strong wind conditions and, more significantly, (b) increasing the consistency of the arrival spacing to make the most effective use of the runway. If, for example, the actual time gap required to get a departure away is 140s then the TBS system is able to convert this into a distance based on the up-to-date wind conditions and display this to Approach and Tower in the form of an *"indicator"*. This can be done in increments of 0.1nm, and is able to update as the wind conditions are detected to change. This means the *"buffer"* between the time provided between two successive arrivals and the time required to get a departure away can be minimised, improving predictability and giving an overall capacity benefit. This latter benefit was also an objective of the Approach Stabilisation Initiative[53].

Possible future enhancements of TBS could go even further, taking into account the specific Arrival and Departure aircraft types in order to fully optimise the spacing to be delivered by Approach. TBS implementation for Gatwick is due by 2023 as part of the Single European Sky, to deliver improved runway resilience and reduced arrival delays.

Because NATS manages the arrival sequencing for Gatwick, it is NATS at Swanwick that will determine the investment case and implementation schedule in collaboration with GAL. The associated devices at Gatwick Tower will rely on the Swanwick system.

The Review therefore recommends:

- GAL and NATS should evaluate the potential efficiency benefits of an earlier implementation of advanced TBS technology (timescale for completion of evaluation within 12 months).

[53]Section 1.10

Communications & Noise Management

Community Relations

The CAA has made clear that the aviation industry, the regulator, and policy-makers must work in a unified fashion to tackle noise impacts – this is not only an obligation owed to the communities who experience many of the downsides of aviation, but with to increasing capacity squeezes it is also likely to be a pre-requisite of any new infrastructure constructed.

It is widely accepted that there is no single solution to aviation noise and instead it must be managed and actively reduced through a series of complementary measures, all of which should be encouraged through a unified set of policies to ensure that industry has the right incentives to act.

However, even if this approach is successful in reducing aviation noise to a significantly lower level than that which communities experience today, pressures imposed by demand growth mean that it is essential to do more to engage those local people who feel that when expansion occurs, they are most likely the sole losers and the aviation industry, travelling public, Government and wider economy all gain at their expense.

The CAA says that given their inherently close relationship with local communities, often facilitated through existing Consultative Committee structures, airports, are best placed to take a lead in coordinating industry action, and in assessing which measures best fit the individual circumstances of these communities.

As noted in section 1.2 of this report, despite the existing mechanisms in place for Gatwick, the opinions expressed by communities that have engaged with this review have highlighted:

- The perceived inability of communities to influence noise factors through the normal community engagement process provided by the airport, including the noise complaints procedure and the Airport Consultative Committee.
- Insufficiently coordinated and sometimes inconsistent communications regarding arrivals procedures and noise mitigation from GAL, CAA, NATS and the DfT.

The review team has also noted in the context of the arrivals review that the ubiquitous use of social media and of flight Following Apps has enabled the rapid dissemination of information and sometimes misinformation, which the institutions involved, (GAL, NATS, CAA and DfT) have had variously neither the resource, coordination mechanisms, nor experience to respond to effectively.

Communications & Noise Management

Further, from the perspective of noise mitigation, the management and introduction of the 2013 approach stabilisation initiative; and the result of the London Airspace Change proposal for Gatwick with respect to LAMP 1A changes, whereby GAL elected to withdraw the proposal after consultation, is symptomatic of a failure in one or more of the institutions to plan or communicate these measures effectively.

The analysis undertaken by the review has found that these shortcomings are widely recognised and acknowledged. GAL, NATS, the CAA and DfT have all expressed to the review team a desire to see an overall improvement in effective planning and communication, and acknowledge their role in its delivery. The CAA for its part has commissioned and recently published an independent review of the CAA Airspace Change Process[54] (ACP) which was conducted by Helios.

The findings of the Helios review of the ACP address a number of the issues reported to this Gatwick arrivals review, especially in relation to planned or proposed airspace changes and accordingly make a large number of key recommendations pertinent to all UK airspace changes, including the future management of issues which relate to Gatwick arrivals such as process, transparency, communications and governance. The Helios recommendations for greater CAA involvement through the change process, effectively providing approval at each incremental stage; for CAA to be actively involved in the consultation process – in particular to be the recipient of responses and for CAA to seek greater clarity in Government guidance, will according to the findings of the arrivals review, each contribute to improvements in any future airspace change process impacting Gatwick and its residents and its communication.

Gatwick Airport and NATS, both with operational rather than rule making roles, each have larger and well established Corporate Communications organisations tasked with a range of activities deemed appropriate for their needs.

The airport has a team of staff dedicated to community engagement, which includes responsibility for noise matters, including noise complaints management, charitable activity on behalf of the airport and for broader community relations, for example with respect to careers planning, or engagement with schools, colleges and universities.

[54]http://publicapps.caa.co.uk/docs/33 AirspaceChangeProcessIndependentReviewFinal.pdf

Communications & Noise Management

As a part of the review process, enquiries were made with other UK airports to identify the airport which is regarded by its peers as best in class for community relations. It soon emerged that the team at Manchester Airport had earned that accolade, they were kind enough to share their experience with the Gatwick Review team, for which sincere thanks. The head of community relations at Manchester attributes the progress there to the lessons learned from the experience of building their second runway (opened in 2001), following which the understanding of and responding to community needs became a key driver leading to increased focus of the airport management on ensuring that community communications and relationships were a priority.

Analysis of the processes and policies at Manchester and Gatwick revealed that the community communications methodologies and practices at both airports are in fact very similar, although in general are more mature at Manchester, who were able to illustrate a greater number of on-going community engagement initiatives with schools, employers, local councils and residents. The most striking difference was in the level of manpower resource dedicated which at Manchester, an airport with about 60% of the traffic levels of Gatwick, was double the size of the Gatwick team.

In practical terms, this additional man power has meant that Manchester has had the resources to do a better job of building community relations and of producing information aimed at improving community understanding of the airport's role as an economic asset to the region and in managing aircraft noise. One example can be illustrated for instance by the Runway Data Sheet, now a Review recommendation for Gatwick; under Land Use Planning.

The Review therefore recommends:

- That GAL allocates additional manpower, as soon as possible, to strengthen the Airport's Community engagement capability.

While this recommendation addresses a particular resource shortcoming for GAL as regards managing community relationships, it does not deal with the wider issue, identified during the review, namely the coordinated cross stakeholder management of noise issues, nor their consistent communications, by the institutional stakeholders involved, namely GAL, NATS, CAA and the airlines operating at Gatwick. This issue is addressed below under noise planning and coordination.

Communications & Noise Management

Noise Complaints Policy

The feedback to the review team regarding the noise complaints policy[55] and procedures employed by GAL suggests that an overhaul of the Gatwick noise complaints policy and procedure is an essential step to restore the trust in the system for residents sensitive to aircraft noise. Again, for airports elsewhere, it has become evident in the review that it is a commonplace phenomenon for the noise complaints procedure of an airport to become a focus of community ire. This seems to be a symptom of frustration at the perceived inability of some residents to be able to make their voices heard by the aviation stakeholders able to deliver real change.

In the case of Gatwick, the current limit of one noise complaint per day per household is considered wholly unacceptable by those residents addressing this issue with the review. It is easy to understand their point of view. There is also an implied lack of transparency. Conversely, the review team has also had direct (and documented) experience of multiple offensive and abusive communications from some residents which is, and should remain, an entirely unacceptable practice.

Our view is that E-mail noise complaints should not be accepted, nor should complaints that do not contain sufficient information; time, date, postcode location, to allow a proper investigation and response by Gatwick and the other stakeholders tasked to identify causes and response.

Therefore it is proposed that Gatwick should establish an enhanced complaints policy with no daily limit and a fully transparent procedure, as soon as possible, using an on-line form as the sole electronic complaint registration medium. The form should require sufficient detail to allow the location (postcode) of the complainant, the date and time of day of the incident, such that the aircraft in question can be identified and associated, to allow empirical noise trend data to be developed and analysed, so that noise mitigation can be targeted and action taken.

Further guidance could include: Any public user of the system shall be able to see the postcode origin, and time of day, of every complaint for the current year, to ensure that the system is fully transparent. For the process to be an effective tool in planning noise mitigation, the complaints system should also permit complainants to add other detail; for example in relation to estimated aircraft height (or in the case where aircraft height information is derived by the complainant from a Flight Following APP or Casper, the source should be noted, as should the specific reasons for the complaint (height, noise, time of day or night). Gatwick may wish to consider publishing a quarterly summary of noise complaints received with post investigation information included. The addition of the noise modification and replacement status for the A320 family of aircraft using Gatwick would be a useful enhancement. Gatwick's existing annual summary noise report analysis already provides a good level of information[56].

[55]http://www.gatwickairport.com/globalassets/business--community/b_7_aircraft-noise/yla-complaints-handling-policy2015.pdf

[56]http://www.gatwickairport.com/globalassets/publicationfiles/business_and_community/all_public_publications/aircraft_noise/fpt_annual_2013.pdf

Communications & Noise Management

The Review therefore recommends:

> That Gatwick should establish an enhanced complaints policy and fully transparent procedure, as soon as possible, using an on-line form as the primary medium, requiring sufficient detail to allow the location (postcode) of the complainant, the date and time of day of the incident, such that the aircraft in question can be identified and established with the location, to allow empirical data to be developed and analysed so that noise mitigation action can be taken. There should be no limit to the number of complaints per household. For residents not possessing computer access, postal submissions should be accepted, but should be required to contain the basic information outlined above.

Noise Planning and Coordination

It will be evident from this report that the policies, procedures and imperatives related to the management of aircraft noise disturbance are extremely complex. The complicated multi-layered interaction between the organisations able to effect any change in the impact of aircraft noise is equally complex. Noise is sometimes the consequent output of other operating imperatives, which might have for some good reason a higher priority.

This complexity can be illustrated by simply posing the question: Who is accountable and responsible for reducing the effects of aircraft noise? The short answer is of course, everyone in aviation. Productive alignment of such a large cohort is immensely complex.

Moreover, although the UK enjoys among the world's most advanced institutional mechanisms for managing and mitigating aircraft noise, it is still challenging to align the collective responsibilities and initiatives of all the stakeholders concerned into a consistent and harmonized direction for any particular location.

Communications & Noise Management

The review has therefore proposed for Gatwick:

- The establishment of a Noise Management Board (NMB) by summer 2016, to be operated under independent chairmanship and comprising representatives from each of the institutions able to effect change for Gatwick arrivals, as well as the chair of the Airport Consultative Committee (GATCOM), and both elected council members and residents' representatives.

The objective of the NMB being to develop, agree and oversee a coordinated noise management vision and consequent strategies for Gatwick, for all stakeholder organisations, intended to improve the situation for arrivals at Gatwick. This should include; joint and coordinated reports through the NMB, on progress of the implementation of these strategies and; through consistent communication and verifiable data, with transparent policies, the facilitation of proper understanding by residents.

Issues that the NMB should consider, aside from the key airspace and aircraft methodologies and airport efficiencies discussed in the report, would also include topics such as; any unintended or unexpected consequences of noise mitigation initiatives, the consistent noise awareness training of operational staff, including air traffic control and pilots and the resolution of any areas for which leadership and accountability between the institutions is interpreted inconsistently, which has sometimes been the case for arrivals noise performance. The Approach Stabilisation Initiative for instance highlighted issues in this area. For airspace design and change planning it also important to note that NATS has significantly greater influence on how traffic is managed above 4000 feet.

The question of how to fairly and appropriately include community representation in such a board is also pertinent. The review has found that noise is a divisive matter. Hence, that it has not been possible to identify a single organization, that can be acceptable to community noise action groups formed in response to Gatwick noise, to represent them on such a board. This representation question has long been an issue for GATCOM. For NMB a suitable mechanism must be identified.

Communications & Noise Management

Post Review Plan

The Independent Review team will have completed its task with the delivery of this Report on 28th January 2016.

Accordingly the Review recommends:

- That Gatwick should publish not later than March 31st a description of the steps that it is intended to take in response to the arrivals report and which, if any of the recommendations it plans to pursue.
- In the interests of improved community relations that; GAL publish not later than January 31st 2017 a report of overall progress towards delivery, of the steps recommended in this report, including relevant status updates from CAA and NATS, with where appropriate the basis for any related decisions.

Summary of Recommendations

When developing recommendations the Review team has sought to achieve the following outcomes, based on its terms of reference and on the policies and guidance material referenced throughout this report;

- Safe operation
- Less noise
- Fewer disturbed
- No negative impact on capacity
- Consistent with regulatory provisions
- Achievable without major airspace changes elsewhere
- In line with the Global Air Navigation Plan and ATM Master Plan
- Compatible with the UK future airspace strategy

Summary of Recommendations

Consolidated Recommendations	
	Immediate > 12 months
	Noise at source
Imm-1	That as an indication of GAL commitment to noise reduction, as a further tangible indication to local communities that the noise impact of the airport is taken seriously and to incentivise an accelerated noise modification by all airlines using A320 family aircraft at Gatwick, GAL should establish an earlier sunset date for unmodified Airbus 320 family aircraft using the airport of December 31st 2017. With an appropriate noise penalty applied for non-compliant aircraft immediately thereafter.
Imm-2	That GAL to engage with DfT, consider proposing to the European Commission the establishment of a sunset date of December 31st 2020 for the operation in Europe of Airbus 320 series aircraft without the Fuel Over Pressure Protector (FOPP) cavity vortex generator noise modification.
	Land Use Planning
Imm-3	That planning authorities for communities impacted by aircraft noise from Gatwick, coordinate to conduct their own joint review of the application of land use policy in context of Gatwick aircraft noise, with the objective of identifying steps that will enable the increase of its effective use and the improvement of the aircraft noise awareness for existing and potential land users.
Imm-4	That Gatwick develop, publish and maintain with annual updates an information booklet intended for planning authorities, home buyers, estate agents and conveyancing solicitors, to provide reference information on flight routes, terminology and other aspects of the airport operation relevant to communities. NATS and the CAA should also be encouraged to participate, and to verify those elements of the content that reflect their own areas of activity.
	Noise Abatement Operational Procedures
Imm-5	That as soon as possible, the altitude for commencement of CDA at Gatwick should be increased from the current 6000 feet to 7000 feet (FL070).
Imm-6	That GAL collaborates with NATS, CAA and airlines, within 12 months, to agree incremental improvements, to the application of CDA procedures at Gatwick.
Imm-7	That GAL work with NATS and CAA to raise the Gatwick CDA commencement altitude to 8000 feet when feasible.

Summary of Recommendations

Consolidated Recommendations	
Imm-8	That GAL propose a subsidiary CDA taxonomy which includes the commencement altitude of the procedure, e.g. CDA 6000, be established by the CAA to improve lay understanding and to better benchmark later improvements
Imm-9	That GAL considers proposing to the CAA, the establishment in airspace design criteria, of a minimum distance between arriving tracks for aircraft, to deliver for arrivals; both a meaningful dispersal and an opportunity for respite. This is likely to apply to aircraft before they have joined the final approach track, which for Gatwick will therefore be at 3000 feet or above.
Imm-10	That GAL explore with NATS the potential for aircraft to be vectored to be established on the ILS at a minimum of 8nm from touchdown outside of night hours, rather than the current 10nm. This adaptation to vectoring methodology should extend the arrival swathe 2nm closer to the airport and increase the arrivals dispersal to more closely emulate the operations prior to the 2013 change. Hence the arrival swathe would normally extend from a minimum of 8nm to 14nm, with aircraft joining on a straight in approach when traffic permits.
Imm-11	The development, publication and implementation by GAL of an operating protocol to define the occasions when a change of landing direction will be implemented at Gatwick for noise reasons, if weather, safety requirements and other conditions permit. The objective of the protocol being to achieve a more even split of arrivals, and to fragment the otherwise continuous use of one runway direction or another because of long term weather patterns. The impact should be monitored by GAL and the results regularly reviewed by the Noise Management Board (NMB).The target implementation of the protocol should be during 2016 following engagement with airlines, air traffic control and communities.
	Operating efficiency
Imm-12	That the Gatwick Flight Performance Team introduce a KPI, enabling the monitoring and reporting of the number of flights delayed from planned daytime arrival, into a night movement (after 23:30 local) and that GAL initiate measures to identify and agree steps, including enhanced use of time based operations, with airlines and with the airport's scheduling committee for implementation within 12 months, to effectively and progressively reduce unplanned night arrivals at Gatwick.

Summary of Recommendations

Consolidated Recommendations	
Imm-13	That within 6 months, GAL and NATS conduct a joint investigation to establish and agree whether the XMAN extended arrivals manager is an effective tool to reduce arrival holding at Gatwick and if so; to agree and publish within 9months when XMAN can be deployed for Gatwick and what results can be expected.
Imm-14	GAL and NATS should evaluate the potential efficiency benefits of an earlier implementation of advanced TBS technology (timescale for completion of evaluation within 12 months).
	Other
Imm-15	To better inform stakeholders, independent academic research should be undertaken to validate the reasons why arriving aircraft are often perceived by residents to be lower than in the past and to identify measures to establish the actual facts in a controlled analysis with community involvement.
	Community relations
Imm-16	That GAL allocates additional manpower, as soon as possible, to strengthen the Airport's Community engagement capability.
Imm-17	That Gatwick should establish an enhanced complaints policy and fully transparent procedure, as soon as possible, using an on-line form as the primary medium, requiring sufficient detail to allow the location (postcode) of the complainant, the date and time of day of the incident, such that the aircraft in question can be identified and established with the location, to allow empirical data to be developed and analysed so that noise mitigation action can be taken. There should be no limit to the number of complaints per household. For residents not possessing computer access, postal submissions should be accepted, but should be required to contain the basic information outlined above.
Imm-18	The establishment of a Noise Management Board (NMB) by summer 2016, to be operated under independent chairmanship and comprising representatives from each of the institutions able to effect change for Gatwick arrivals, as well as the chair of the Airport Consultative Committee (GATCOM), and both elected council members and residents' representatives.
Imm-19	That Gatwick should publish not later than March 31st a description of the steps that it is intended to take in response to the arrivals report and which, if any of the recommendations it plans to pursue.

Summary of Recommendations

Consolidated Recommendations	
Imm-20	In the interests of improved community relations that; GAL publish not later than January 31st 2017 a report of overall progress towards delivery of the steps recommended in this report, including relevant status updates from CAA and NATS, with where appropriate the basis for any related decisions.
Aspirational	
Aspire-21	The adoption of carefully designed routes from the approach holding fixes used for Gatwick, to the ILS final approach tracks, provides real opportunity to reduce noise, to disturb fewer people, to deliver fair and equitable dispersal of noise, and, to deliver well defined respite measures. The London Airspace Management Programme should be developed by NATS and GAL to incorporate alternative proposals, to those published in 2013, as soon as reasonably possible, for consultation, agreement and implementation for Gatwick arrivals.
Aspire-22	That the Gatwick holding areas should be higher, or should be relocated to enable holding aircraft to dwell over water, rather than over Sussex.
Aspire-23	That the requirements specification of any system upgrade to, or replacement of, any sequencing tools must take full account of the need to integrate the AMAN at Swanwick and DMAN at Gatwick, such that they are each fully informed of, and take into account the capacity allocations of both arrival and departure functions.

Annexes

Annex 1 - Terms of Reference

The scope of this review, in its initial phase, is Arrivals into Gatwick.

The purpose of this review is to consider, in relation to Westerly and Easterly Arrivals, whether:

a) Everything that can reasonably be done to alleviate the problems which local communities are raising is in fact being done, whether this involves action by the airport or by other parties most closely involved – NATS, UKCAA, DfT or the airlines; and

b) The mechanisms which Gatwick has adopted for providing information to the local community and for handling complaints are fully adequate for the task.

In considering the concerns raised by local communities, the Review Team will give particular attention to assessing the feasibility and implications of adopting a policy of *"fair and equitable dispersal"* which a number of campaign groups have expressed as a priority.

With the above purpose in mind, the review team should provide proposals for consideration by the parties involved in these matters.

In carrying out the review, the team should have regard to Government policies as these relate to the issues under consideration.

Fundamental to the successful conduct of the review is effective liaison with each of the key players involved – Gatwick Airport, NATS, UKCAA, DfT, Airlines and Community Representatives, as these players all have important information relevant to the review and can contribute ideas for improvement.

Particular attention should be given to ensuring the involvement of organisations representing the local communities most affected, and communities which may be newly affected by any proposed changes, and to developing effective means of ascertaining the views of these communities more generally.

The target date for completing this review is January 2016, but it is accepted that this end date may need to be moved back depending on the extent of consultation which the review team decides is necessary.

Annex 2 - Community Feedback: Data from emails and Public

Content from 105 email complaints and data from over 160 feedback forms circulated by local MPs at 2 of the 3 large meetings was collected and logged. Submissions were categorised into 'complaints by issue' and proposed solutions as 'preferred measures for noise mitigation'. Summary data from emails and public meetings are provided here.

	Complaint by Issue					Preferred measures for noise mitigation				
Community Meeting	Fault with Gatwick complaints process	Noise Impact on quality of life	Significant increase in Noise	Airbus whine	Aircraft noise at Night	Fair & equitable distribution	Alternate flight paths	Concentrate paths *	CDA enforced / steeper	Min height limits applied
TOTAL	14	35	158	18	140	133	96	34	148	16
% response (out of 166)	8%	21%	95%	11%	84%	80%	58%	20%	89%	10%

	Complaint by Issue						Preferred measures for noise mitigation					
Emails	Fault w Complaint process	Impact of noise on heath & lifestyle	Too many planes	Planes are too low	A320 series whine	Aircraft noise at night	Fair & equitable dispertion	Other flight path distribution	Revert to pre-2013	Revert to pre-2014	Enforced CDA	Min height limits applied
TOTAL	44	78	74	68	12	44	47	15	32	10	31	39
% response (out of 105)	42%	74%	70%	65%	11%	42%	45%	14%	30%	10%	30%	37%

Annex 3 - Stakeholder Meetings

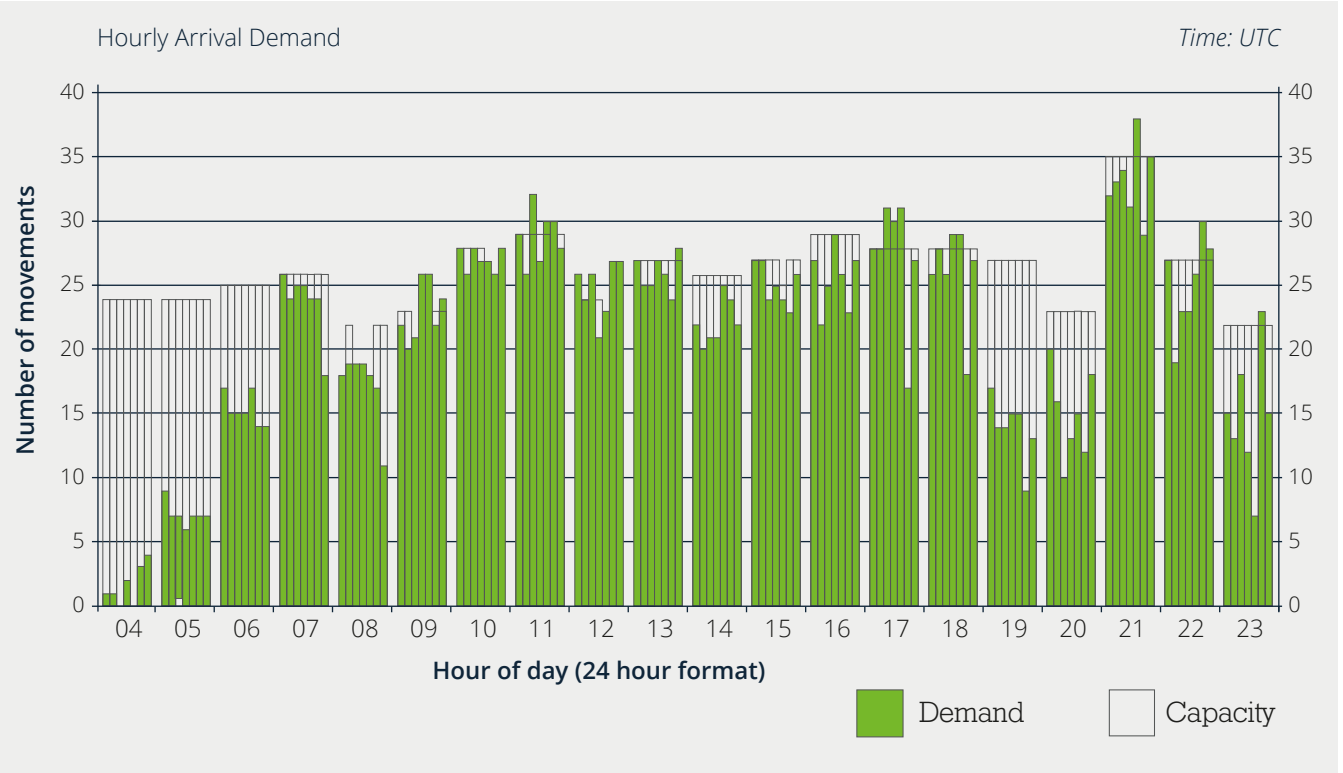
From September 2015 through to end January 2016 the Review Team participated in over 45 meetings with individual residents, community noise groups, government and regulatory authorities, MPs, consulting groups, airlines and the airport operators.

September		October		November		December		January	
Date	Organisation	Date	Organisation	Date	Organisation	Date	Organisation	Date	Organisation
03-Sep	GATCOM-Chairman	05-Oct	Helios	10-Nov	ESCCAN	08-Dec	MP Briefing - Parliament	07-Jan	GATCOM Steering Group
03-Sep	NATS	12-Oct	Manchester airports group (MAG)	11-Nov	TW Aircraft Noise Study Group	09-Dec	GACC	08-Jan	NATS
04-Sep	CAA	19-Oct	NATS	11-Nov	To70	09-Dec	Individual resident	19-Jan	NATS
22-Sep	NATS	20-Oct	Greg Clark MP	11-Nov	Capel PC	09-Dec	Individual resident	20-Jan	Local Councillors, Hever Castle, easyJet, ACL-UK
23-Sep	Reps from GON, CAGNE. East, SPAG, GACC	22-Oct	GATCOM event	12-Nov	CAA	16-Dec	Residents open meeting (Gatwick Hilton)	21-Jan	CAA
23-Sep	DfT	23-Oct	CGANE	24-Nov	NATS	16-Dec	CAA	28 -Jan	Public Meeting on Final Report (Crowne Plaza) GATCOM
24-Sep	Nusrat Ghani MP	23-Oct	To70	25-Nov	GAL - CA / Sustainability	17-Dec	CAGNE & Resident		
24-Sep	easyJet	23-Oct	easyJet	26-Nov	GAL-COO and CEO	17-Dec	CAA		
24-Sep	Tom Tugendhat MP	23-Oct	Crowborough Public Meeting - Nusrat Ghani MP	26-Nov	GAL - non-executive director PAGNE				
25-Sep	High Airspace Meeting - Reps from NATS, GAL, CAA	27-Oct	GAL - Community Engagement Team	27-Nov	GAL Exec - COO and CEO				
		27-Oct	GAL - Exec team	27-Nov	Horsham Public Meeting - Jeremy Quinn MP				
		28-Oct	Local Cllrs Meeting	28-Nov	Tunbridge Wells Public Meeting - Greg Clark MP				
		28-Oct	TWAANG						
		29-Oct	The Tower Company						

Annex 4 - Gatwick Arrivals Demand, Slot Allocation and Night Flight Quotas

Gatwick airport has been designated by the Government as a Coordinated airport under the EU slot Regulation. The demand for arrival runway slots for the summer 2015 season is managed by ACL:

Peak Week - Hourly Runway Demand



Annex 4 - Gatwick Arrivals Demand, Slot Allocation and Night Flight Quotas

All Night Flights require the prior allocation of a slot and corresponding Night Quota (movement and noise quota). Late arrivals and departures during the Night Quota Period, 2330-0600 local time, for lights that are not planned night flights are by prior permission of Gatwick Airport Ltd (GAL). Gatwick night movement and quota allocation procedures are published by Airports Coordination Limited[1].

For 2016 summer season the following runway capacity limits have been declared (ACL):

Gatwick Airport Scheduling Declaration Summer 2016
Hourly Runway Scheduling Limits

S16 Declaration

Start of UTC Hour	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	15hr (05-19)	17hr (05-21)
Total Limit	29	47	54	52	51	49	55	55	55	53	51	52	55	55	54	46	43	41	29	30	784	868
Arrival Limit	20	20	25	26	22	23	28	29	27	27	26	27	29	28	28	27	23	36	27	25	392	451
Departure Limit	20	39	35	29	31	28	29	28	30	29	27	27	28	30	28	25	22	10	10	10	443	475
Arr-Dep Flex	**11**	**12**	**6**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**6**	**2**	**5**	**8**	**5**	**51**	**58**

Changes against S15

Start of UTC Hour	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	15hr (05-19)	17hr (05-21)
Total Limit	-3							2	1			2							-2		5	5
Arrival Limit	-4	-4							3									1		3	-1	0
Departure Limit							1									1		-9	-10	-10	2	-7

[1]hhttp://www.acl-uk.org/UserFiles/File/LGW%20Local%20Rule%201_2015.pdf

Annex 5 - Managing Aircraft Noise

Noise is often defined as unwanted sound. Attitudes to noise are changing within society. Recent studies would suggest that it is likely that concern (or annoyance) with a particular level of aircraft noise is higher than found in the early 1980s. However it should be recognised that attitudes to noise are subjective – what is annoying and intrusive to one person may be acceptable to another. However noise remains a major issue for many communities living around airports and under flight paths.

Aviation is an international industry and as such is governed by international standards. These are set by the International Civil Aviation Organisation – the world aviation governmental organisation currently consisting of 191 member states. In 2001, ICAO agreed a regulatory framework for controlling noise at airports. Under this framework, states are required to pursue a balanced approach to controlling noise at airports.

The balanced approach to controlling noise at airports. The balanced approach has four elements:

- **Reducing noise at source** - to be regulated through ICAO, by means of progressive tightening of aircraft noise certification standards. The current 'Chapter 4' standard for new aircraft took effect in 2006,
- **Land-use planning and management** - to ensure that inappropriate new development is discouraged or prohibited around airports.
- **Noise abatement operational procedures** - steps taken by pilots and air traffic controllers to minimise the noise nuisance from overflights, for example the use where feasible of continuous descent approach; and
- **Operating restrictions** - measures that limit the access of aircraft to airports, such as night restrictions or the phased withdrawal of noisier aircraft types.

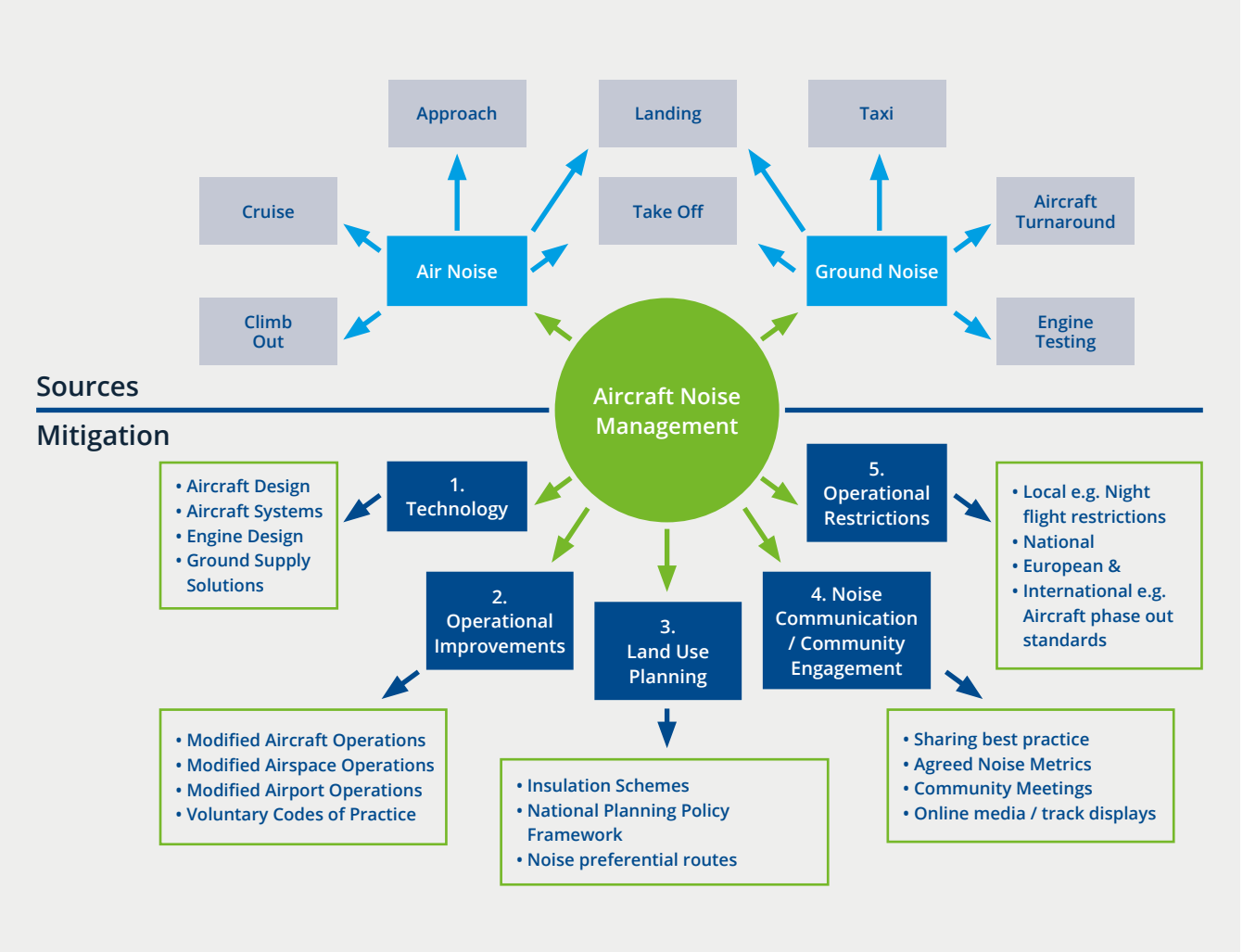


Figure 15 Sources and mitigation of aircraft noise around airports (sustainable aviation roadmap)

Annex 5 - Managing Aircraft Noise

The key elements of this framework have been incorporated in both EU and UK Legislation. Under the European Directive 2002/30/EC of 28 March 2002 which has been incorporated into UK legislation by The Aerodromes (Noise Restrictions) (Rules and Procedures) Regulations 2003 - major airport operators (i.e. above 50,000 aircraft movements per year) must have regard to a number of rules and procedures when introducing noise related operating restrictions).

In particular airport operators have to:-

- take into account costs and benefits of measures,
- be non-discriminatory on grounds of nationality or identity of air carrier or aircraft manufacturer and
- be no more restrictive than necessary in order to achieve the environmental objectives for a specific airport.
- Ensure any performance-based operating restrictions are based on the noise performance of the aircraft as determined by ICAO certification procedures

There is a second EU Directive (2002/49/EC) - the Environmental Noise Directive (END) which affects the control and mitigation of aircraft noise at airports. The aim of this Directive and the related legislation implemented through the Environmental Noise (England) Regulations 2006 and the Environmental Noise (England) (Amendment) Regulations 2008, is to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise. The Regulations require a noise mapping and action planning process to be taken forward on a five-year rolling programme. The scope of the Directive extends to airports with over 50,000 movements a year.

Airport operators have been provided with statutory powers to assist them with the management of the control of noise and emissions. The Civil Aviation Act 2006, among other things, strengthened and clarified powers to control aircraft noise and emissions, in line with commitments in the Air Transport White Paper. In particular airport operators were given statutory powers to introduce noise control schemes and fine aircraft that breach noise controls. The Act also provided powers for all licensed airports to introduce charges that reflect the pollution generated by each aircraft type.

Under Section 78 of the Civil Aviation Act 1982, the Secretary of State for Transport is responsible for noise control at Heathrow, Gatwick and Stansted (*"the designated airports"*). Heathrow, Gatwick and Stansted Airports are designated under section 80 of the Civil Aviation Act 1982 for the purposes of the regulation of noise. The current noise abatement procedures are set out in the Aeronautical Information Publication (AIP). These vary from airport to airport but can include specification of noise preferential routes for departures; day and night time departure noise limits; prohibition of flights over particular areas; use of CDA and Low Power Low Drag operating procedures (commensurate with ATC clearance); glide-path joining point and altitude restrictions and night restrictions.

The Secretary of State also sets the night flying restrictions at the three designated airports. There have been restrictions on night flights at Heathrow, Gatwick and Stansted for many years. The restrictions have been reviewed about every five or six years. The current restrictions came into force in October 2006 and will apply until 29 October 2012. They comprise a limit on the number of movements which can be operated each season, and a noise quota. This relates to an aircraft's noise classification on take-off or landing and serves as a supplementary measure to encourage the use of quieter aircraft. The movement limits and noise quotas apply during the night quota period from 2330 to 0600, but there are additional restrictions on the noisiest types of aircraft between 2300 and 2330 and between 0600 and 0700 to provide further protection.

The night restrictions regime can be summarised as follows:

- a clear set of environmental objectives, with specific measures to reduce noise;
- a progressive reduction in overall noise during the night quota period over the period to 2012;
- a ban on scheduling the noisiest types of aircraft during the night period (2300-0700), with take-offs permitted only in exceptional circumstances;
- a limit on the number of movements that can take place during the night quota period (2330-0600
- only the quietest aircraft allowed to be scheduled during the night quota period – those with a quota count of 0.25, 0.5, 1 or 2; and
- introduction of a noise insulation scheme at the airport aimed specifically at mitigating night time noise. The boundary of the scheme is based on the noise footprint of the noisiest aircraft regularly operating at the airport.

Annex 5 - Managing Aircraft Noise

The Civil Aviation Authority (Air Navigation) Directions 2001 lay down the obligation to develop, promulgate, monitor and enforce policies for the sustainable use of UK airspace and for the provision of necessary supporting infrastructure for air navigation. The CAA's statutory duties are set out in Section 70(1) of the Transport Act 2000. In exercising its air navigation functions, the CAA must give priority to maintaining a high standard of safety in the provision of air traffic services. In addition, the CAA must carry out its functions in the manner it thinks best to:

- secure the most efficient use of the airspace
- satisfy the requirements of all airspace users
- take account of the interests of any person in relation to the use of any particular airspace or the use of airspace generally

The CAA are required to take account of the DfT Guidance on environmental objectives relating to the exercise of its air navigation functions in respect of

- Government's policy on sustainable development
- Government's policy on reducing, controlling and mitigating the impacts of civil aviation on the environment
- the need to reduce, control and mitigate as far as possible the environmental impact of civil aircraft operations; in particular the annoyance and disturbance caused to the general public arising from aircraft noise, vibration and emissions from aircraft engines

The process for making changes to airspace is governed by the CAA's "Airspace Charter", known as CAP 724, and the "CAA Guidance on the Application of the Airspace Change Process", known as CAP 725. These documents specify the roles and responsibilities of a Change Sponsor and those of the independent Regulator. They also provide details on the requirements of a consultation exercise and the environmental assessment of any proposed change.

How is noise monitored?

The Department uses independent specialised expert technical advice provided by ERCD to monitor aircraft noise. ERCD's expert advice assists the Department in developing its policy on aircraft noise generally but more specifically is respect of the three London noise designated airports - Heathrow, Gatwick and Stansted. The work involves the collection and analysis of aircraft noise, flight path and other operational data. At Heathrow, Gatwick and Stansted, routine noise and flight path monitoring is carried out continuously by the airports' Noise and Track Keeping (NTK) Systems. ERCD obtains data from the systems via its own workstations. In return, it provides specialist technical advice on NTK system enhancements.

Every year ERCD estimates the amount of aircraft noise experienced by people living around the three London designated airports during the summer months (mid June – mid September). The noise exposure measure is the Equivalent Continuous Sound Level Leq (16 hour 0700-2300 local time) in dBA. The magnitude and extent of the aircraft noise around these airports are depicted on maps by contours of constant aircraft noise index (Leq) values. The contours are generated by a computer model validated with noise measurements, which calculates the emissions and propagation of noise from arriving and departing air traffic.

Aircraft noise maps, which show lines joining points of equal noise, are a powerful tool for illustrating the impact of aircraft noise around airports. ERCD developed the UK civil aircraft noise contour model ANCON, which calculates the contours from data describing aircraft movements, routes, noise generation and sound propagation. ANCON is used to generate annual noise exposure contours for the London airports at Heathrow, Gatwick and Stansted. The ANCON noise model incorporates internationally agreed best practice as recommended by the world governmental bodies ECAC and ICAO.

What noise metrics are used?

ERCD use Leq. (Equivalent Continuous Sound Level). This measures the noise of each aircraft (i.e. the sound energy, in decibels, that each aircraft movement produces) and averages the total out over a 16 hour day to get what is known as an equivalent continuous noise level (abbreviated as LAeq). It is the most commonly used noise descriptor for all types of noise source, and for aircraft noise its use is widespread across the world. The CAA produces detailed reports on the measurement of noise from aircraft operating at low level[59].

How are aircraft assessed and certificated in respect of noise?

Aircraft and engines are independently assessed and certificated for compliance with the appropriate ICAO standards before they enter service. The European Aviation Safety Agency (EASA) is responsible for this function in Europe.

[59]http://publicapps.caa.co.uk/docs/33/ERCD1006.pdf

Annex 5 - Managing Aircraft Noise

The ICAO noise standards are referred to by 'Chapter' number. Operations involving Chapter 2 aircraft for instance are no longer permitted in the EU other than in exceptional circumstances that must be authorised beforehand. The ICAO Chapter 4 noise standard was agreed in 2001 and was applied to new aircraft types from 2006. It is broadly 10dB more stringent than the previous Chapter 3 standard. In 2013, ICAO agreed a new Chapter 14 noise standard of 7EPNdb below Chapter 4, applicable to future aircraft entering service after the end of 2017 and 2020 for lower weight aircraft. ICAO is now discussing further reduced noise goals for aircraft due to enter service from 2030.

	1998			2011		
Airport	Number of Aircraft Movements	Area of 57dBA contour (km2)	Population within 57dBA contour	Number of Aircraft Movements	Area of 57dBA contour (km2)	Population within 57dBA contour
Heathrow	441,200	163.7	341,000	480,906	108.8	243,300
Gatwick	240,200	76.8	9,000	251,067	40.4	3,060
Manchester	161,800	53.5	44,700	158,300	30.2	27,500
Stansted	102,200	64.5	7,600	148,317	21.2	1,300
Totals	**945,400**	**358.5**	**405,300**	**1,038,590**	**200.6**	**275,160**

Source: CAA Annual Noise Exposure Contour Reports

Annex 6 - Noise from Arriving Aircraft - an Industry Code of Practice

Noise from Arriving Aircraft
An Industry Code of Practice

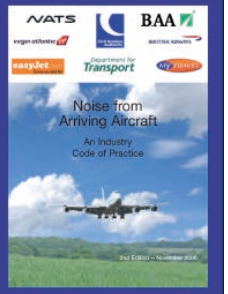
2nd Edition - November 2006

This is an updated Code of Practice for limiting noise from arriving aircraft, which ERCD produced in conjunction with BAA, the Department for Transport, British Airways, easyJet, MyTravel, Virgin Atlantic and NATS.

It covers operational issues for flight crews and air traffic controllers, as well as considering airport, regulatory and strategic factors. The Code gives pilots, air traffic controllers and airport operators guidance on techniques to minimise noise from aircraft landing at airports.

Although primarily concerned with Heathrow, Gatwick and Stansted airports, the Code contains much of relevance to airports worldwide.

Available from the DfT website at:
http://www.dft.gov.uk/pgr/aviation/environmentalissues/arrivalscodeofpractice/



- **Noise from Arriving Aircraft: Final Report of the ANMAC Technical Working Group - Annexes**
  DETR, December 1999
  Available from the DfT

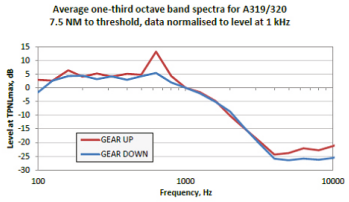
- **Development, design, and flight test evaluation of a continuous descent approach procedure for nighttime operation at Louisville International Airport**
  John-Paul Clarke, et al., Partnership for Air Transportation Noise and Emissions Reduction, January 2006
  Report No. PARTNER-COE-2005-02
  Available from the MIT website at http://web.mit.edu/aeroastro/partner/projects/project4.html

- **The role of advanced air traffic management in reducing the impact of aircraft noise and enabling aviation growth**
  John-Paul Clarke, International Center for Air Transportation, Massachusetts Institute of Technology
  Journal of Air Transport Management 9 (2003) 161-165

Annex 7 - Airframe Noise from Airbus A320 Family of Aircraft

NTK noise measurements at Heathrow

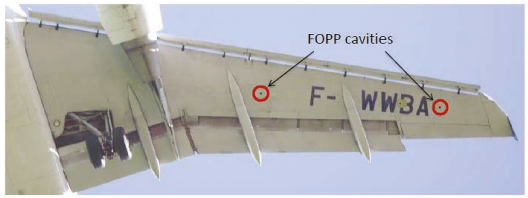
- Tone is emitted around 500-600Hz, close to peak sensitivity of the human ear, hence it is very perceptible.
- Close to the airport it is masked by noise from landing gear, flaps and the higher thrust required in the landing configuration.
- Very audible during intermediate approach phase 7-15nm from landing.



3

Tonal noise source

- Investigation by Airbus has revealed two tonal noise components, generated by the Fuel Over Pressure Protector (FOPP) cavities.



4

Tonal noise from the A320 family

- Following concerns raised around Heathrow airport in 2005, the issue of tonal noise emanating from the A320 family of aircraft on approach was brought to the attention of Airbus by the CAA
- Complaints of a high pitch "whine" which could be heard on the ground at relatively large distances from the airport (Greenwich)
- Similar concerns had also been raised around Paris and Frankfurt airports at around the same time
- Measurements undertaken have confirmed the tonal noise is due airframe noise not engine noise and is on all present A320 family variants, i.e. A318/319/320/321, irrespective of engine variant.

2

Annex 8 - Examples of P-RNAV Routes to the ILS at Runways 26 & 08

All figures below represents a single Airbus A320 aircraft.
The baselines are typical example of today for a single aircraft.
The illustrated P-RNAV routes were based on the published procedures and the following modifications were applied:

- Altitude constraints were removed.
- Speed constraints were removed.
- ILS Glide Slope intercept for RWY 26L was modified to 3000ft QNH. (2000ft QNH (airfield amsl pressure setting published.)
- Waypoints were removed.
- Waypoints were added. Leg coded as Track to fix (direct track to fix, TF) and defined as fly-by waypoints

Figure 1 Runway 08 baseline arrival from west

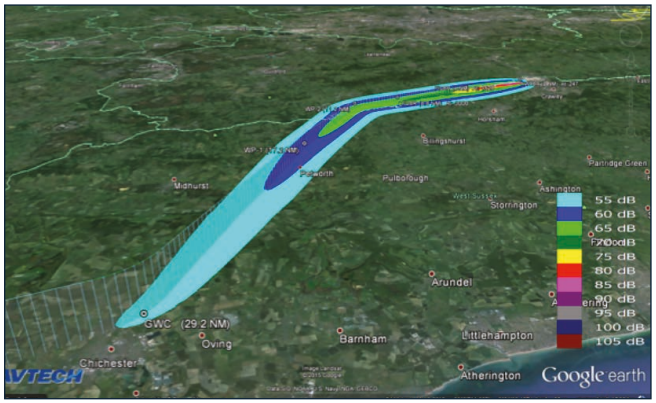


Figure 2 Runway 08 Example of a P-RNAV route for arrivals from the west

Figure 3 Runway 26 baseline example of an arrival from the east

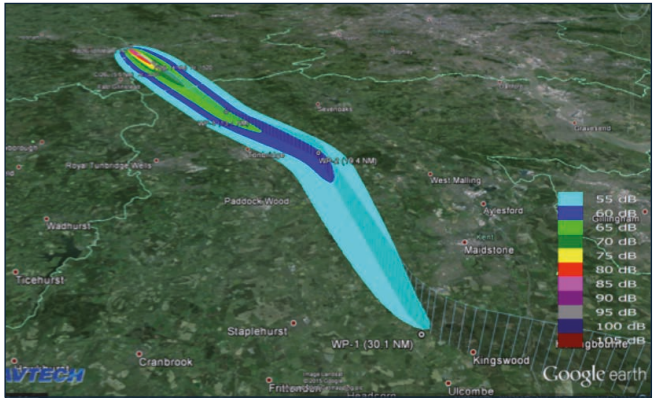


Figure 4 Runway 26 example of a P-RNAV route for arrivals from the southeast under unconstrained conditions

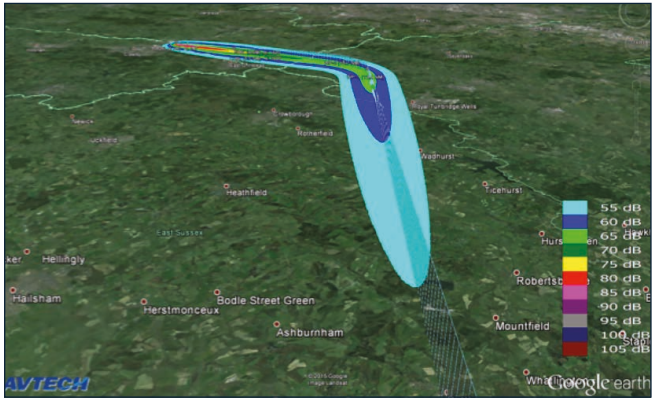


Figure 5 Runway 26 Example of a P-RNAV route for arrivals from the southeast

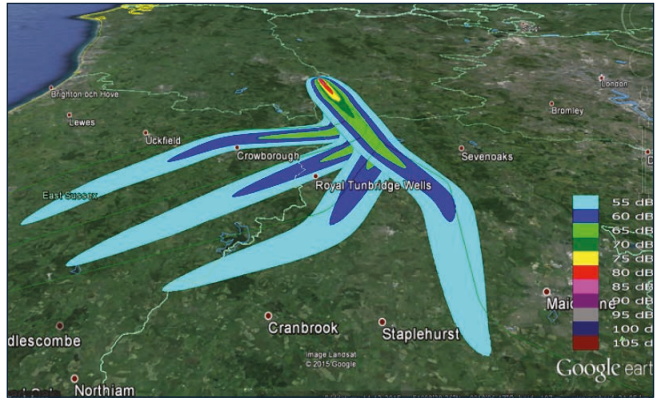
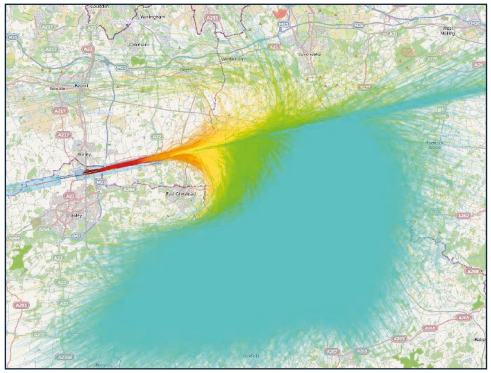


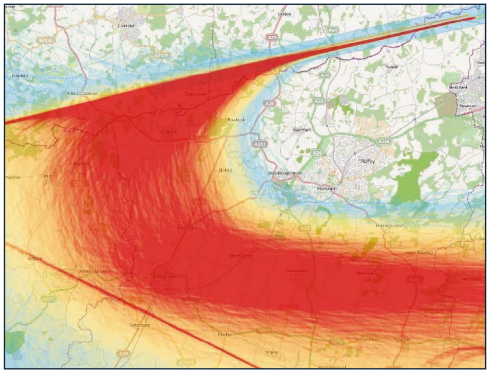
Figure 6 Runway 26 Illustration of dispersal /Respite routes in a P-RNAV arrival environment to the ILS (A320 noise footprint)

Annex 9 - Approach Stabalisation Track Changes

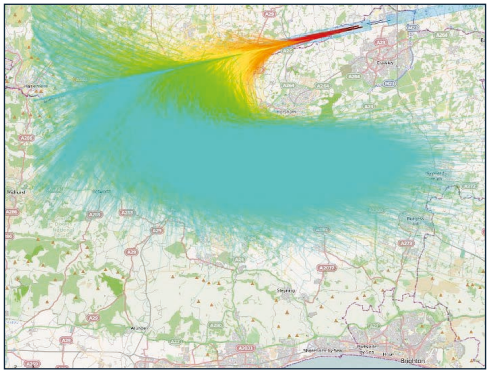
26 Arrivals 1 Apr - 1 Sept 2011 by track density



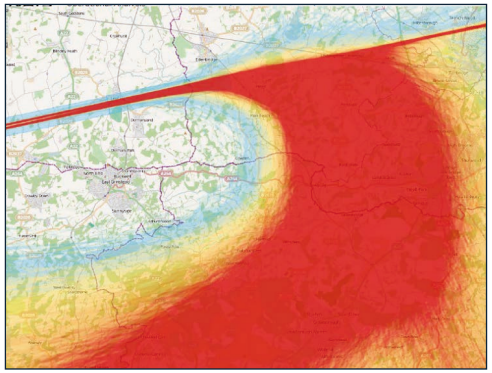
26 Arrivals 1 Apr - 1 Sept 2011 by altitude



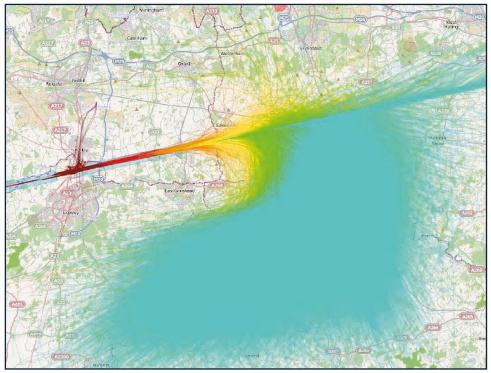
08 Arrivals 1 Apr - 1 Sept 2011 by track density



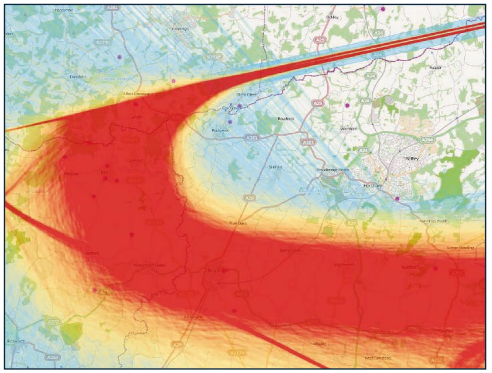
08 Arrivals 1 Apr - 1 Sept 2011 by altitude



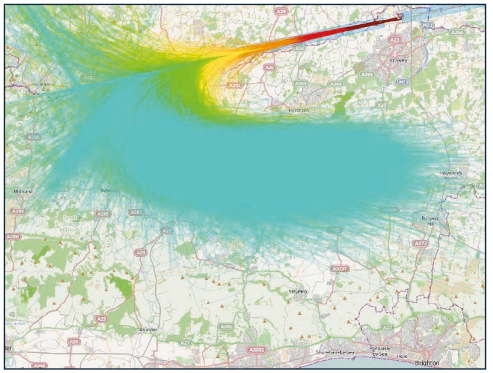
26 Arrivals 1 Apr - 1 Sept 2013 by track density



26 Arrivals 1 Apr - 1 Sept 2013 by altitude



08 Arrivals 1 Apr - 1 Sept 2013 by track density



08 Arrivals 1 Apr - 1 Sept 2013 by altitude