DTLR
TRANSPORT
LOCAL GOVERNMENT
REGIONS

BRITISH AIRWAYS

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Civil Aviation Authority

NATS

Noise From Arriving Aircraft
An Industry Code of Practice

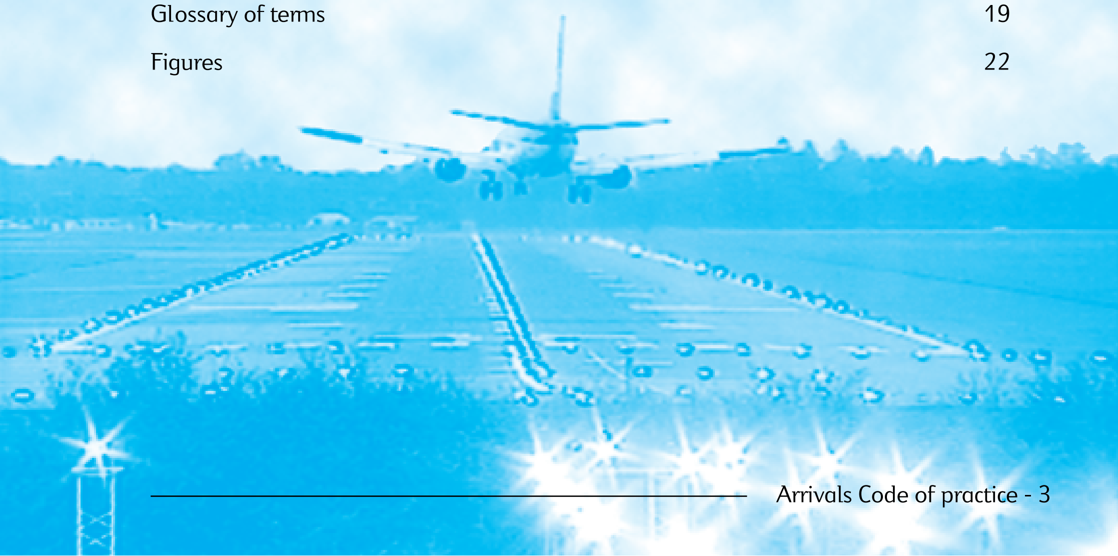
London BAA Stansted

London BAA Gatwick

BAA Heathrow

September 2001

Contents



Executive Summary

This voluntary Code of Practice has been compiled by a group representing airlines, air traffic controllers, airports and the Department of Transport, Local Government and the Regions (DTLR), and is primarily concerned with Heathrow, Gatwick and Stansted airports. Recent successes are noted and practical steps are set out along with longer-term advice concerning measures to reduce noise from arriving aircraft.

The key factor identified is the noise benefit that can be obtained from greater achievement of continuous descent approaches (CDAs as defined in para.6).

Introduction

During the period 1994-99 Government considered the feasibility of setting noise limits for arriving aircraft through the DTLR's Aircraft Noise Monitoring Advisory Committee (ANMAC). This was considered in some depth, including the formation of a technical working group whose work was published in the report 'Noise from Arriving Aircraft: Final Report of the ANMAC Technical Working Group' in December 1999. This considered all aspects of variability of noise from arriving aircraft in great detail. The study summarised the causes of variability of noise heard under the path of arriving aircraft - illustrated here in Fig 1.

In the light of the ANMAC findings, the then Aviation Minister, Chris Mullin, decided against imposing operational noise limits for arriving aircraft. On 10 February 2000 he announced that a code of practice should be established to address this issue. Representatives of the DTLR, NATS, BAA, British Airways, Airtours and CAA/ERCD have compiled this code during 2000 and 2001.

Scope

Using the experience and knowledge of all participants, this advisory Code of Practice has been produced to try and identify steps which could reduce the noise generated by arriving aircraft. As a result the Code is a technical document which is primarily written for pilots and air traffic controllers, but it also includes advice to relevant parties such as airports and the regulators.

This work has concentrated on Heathrow Gatwick and Stansted although it is recognised that much of the Code is potentially relevant to other airports. However it should be noted that CDA arrival procedures are not currently possible for approaches to runway 05 at Stansted due to airspace constraints and to a lesser extent there are restrictions at Gatwick. Paragraphs 22.3 refers.

Background

Nothing in this Code shall take precedence over the requirement for safe operation and control of aircraft at all times. For the avoidance of doubt, all recommendations are to be read as "subject to the requirements of safety".

1. Approach noise is a specific measurement in the International Civil Aviation Organisation (ICAO) noise certification process whereby all aircraft types are assessed and certificated. The approach noise certification measurement point for large fixed wing aircraft is very close in to the airport (2 km from threshold), where aircraft configuration and flight conditions are very tightly defined. The ANMAC Technical Working Group report showed that further away from the airport there is significant variability in arrivals noise levels for a given aircraft type. The study identified the many factors which caused this variability, and determined what measures could best mitigate the higher noise levels (at the upper end of the range of variability) for each aircraft type. It was recognised however that the safety requirements of the industry, especially ATC procedures and operations in poor weather, place constraints on which factors can be modified to reduce noise. Within these constraints this Code identifies measures that may deliver reductions in arrivals noise.

2. The report highlighted continuous descent approach (CDA), in the descent from 6000ft to establishment on the final glideslope, as the leading technique for reducing arrivals noise (this is illustrated at Fig 2). This Code of Practice therefore strongly emphasises measures intended to improve achievement of CDA.

3. It is important to note that, for Chapter 3 jet aircraft (high by-pass ratio turbofans), the benefits of increased altitude typically outweigh those gained from a low power/low drag technique (see paragraph 7) prior to joining final approach, where there is to

some extent a choice or trade-off between the two. Controllers and pilots should therefore seek to facilitate/achieve CDA wherever possible. In general, a level segment of a given length will result in less noise at ground level the higher it is flown. For example a level segment at say 2500ft is likely to result in a noise level of the order of 8dB greater than if it were flown at 5,000ft. It is acknowledged that controllers and pilots are not typically confronted by a simple choice of this sort for individual flights, but it is important that the broad principle should be widely understood. This is further illustrated in Figure 3.

4. In addition to the noise benefit, reduced fuel burn and hence emissions result from the use of CDA techniques thereby producing an overall environmental benefit.

Definition of CDA

5. With effect from 4 October 2001 the following definition of CDA will be added to the UK AIP - "A noise abatement technique for arriving aircraft in which the pilot, when given descent clearance below the Transition Altitude by ATC, will descend at the rate he judges will be best suited to the achievement of continuous descent, whilst meeting the ATC speed control requirements, the objective being to join the glide-path at the appropriate height for the distance without recourse to level flight." Hitherto, although Heathrow, Gatwick and Stansted airports have adopted working definitions for monitoring CDA at night, no precise definition of continuous descent approach has been given in ICAO documentation nor in the UK AIP. The theoretical "ideal" CDA profile is a descent at 3 degrees from 6000ft, as illustrated in Fig.4. The group has recommended that a definition (covering both day and night) should be published taking into account:

- ICAO PANS-OPS requirements: e.g. Vol II Pt III, 5.6 requires that, on the intermediate approach segment, "…a horizontal segment with a minimum length of 2.8km (1.5nm) should be provided prior to the final approach for Category C and Category D aircraft …";

- the standard ICAO safety requirement of intercepting the final approach glideslope from below;

- at a given altitude, a level segment used to decelerate an aircraft, at or near thrust-idle, will tend to generate less noise than an extended level segment at or near a constant airspeed;

- the monitoring capabilities of the GEMS NTK system currently in use at Heathrow, Gatwick and Stansted, including altimeter and radar tolerances, software interpolation, etc;

- 2.5nm was identified as a reasonable value for the maximum level segment length at the three airports. Other studies have used a value of 2nm but 2.5nm was found to be an appropriate distance for modem aircraft to enable them to decelerate in level flight sufficiently to meet ATC speed requirements.

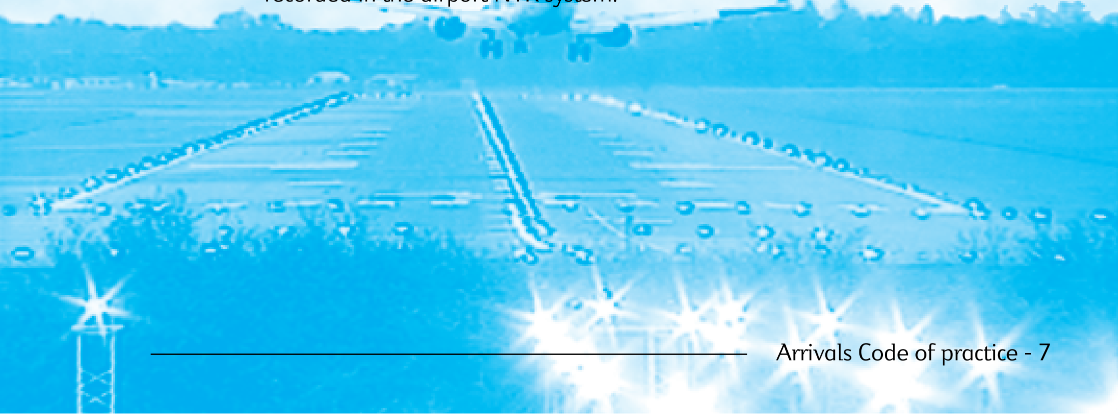
6. For practical purposes a recommended working definition of CDA is as follows: an arrival is classified as a CDA if it contains, at or below an altitude of 6000ft:

- no level flight; or

- one phase of level flight not longer than 2.5nm

  i) for monitoring purposes, due to the constraints of the GEMS system and the different elevations of airports, CDA achievement will be monitored from a height of 5,500ft above aerodrome level (aal) at Heathrow, Gatwick and Stansted airports.

  ii) 'level flight' is interpreted as any segment of flight having a height change of not more than 50ft over a track distance of 2nm or more, as recorded in the airport NTK system.



Definition of low power/low drag (LP/LD)

7. This will be defined in the UK AIP as "A noise abatement technique for arriving aircraft in which the pilot delays the extension of wing flaps and undercarriage until the final stages of the approach, subject to compliance with ATC speed control requirements and the safe operation of the aircraft." This broadly means the aircraft being in as "clean" a configuration as possible, for as long as possible. During the intermediate approach, including the closing heading, and on final approach, thrust reductions should be achieved where possible by maintaining a 'clean' aircraft configuration and by landing with reduced flap. In practice at Heathrow, Gatwick and Stansted this is broadly interpreted to mean the minimum drag configuration (flaps and undercarriage) consistent with ATC speed controls. In turn ATC speed controls are specified to be broadly compatible with LP/LD for most types of aircraft.

Operational Issues for Air Traffic Controllers

8. Minimum joining altitudes on to the ILS

   8.1 Altitudes should continue to be specified such that aircraft do not descend below these altitudes unless they are established on the glidepath. Altitudes specified at Heathrow, Gatwick and Stansted are higher during the night than those specified during the day.

9. CDA techniques for ATC

   9.1 Ranges from Touchdown
   To assist pilots in the management of their descent, ranges from touchdown are to be passed as follows:-

   - When first issuing descent clearance from stack level (a best estimate only is required at this stage).

   - As soon as possible after first contact with Final Director.

- If the DME is unserviceable, ranges should be passed on the intercept heading to the ILS (these ranges should be as accurate as possible).

- At any time if a previous estimate has become invalid, e.g. following a change in landing sequence, or if a controller considers that a range check would assist a pilot with descent management.

9.2 ATC procedures should ensure that approaching aircraft are normally given descent clearance that is commensurate with a CDA descent from 6,000ft.

9.3 During the night period (2300-0700), particularly close attention should be given to enabling pilots to conduct CDAs.

9.4 Air traffic service providers for Heathrow, Gatwick and Stansted should continue to train their staff in providing information to pilots to enable them to fly CDAs.

Operational Issues for Flight Crew

10. Detailed CDA guidance to cover flight path angle/vertical speed for pilots should be available to the pilot in the cockpit to enable the planning and execution of a CDA approach. This could be either within the FMS system or charts/printed material. These charts are reprinted in Figures 5 and 6. The CAA expects to disseminate these charts by publication either in the UK AIP or, if this is not possible, through an Aeronautical Information Circular (AIC). All aircrew are encouraged to use these graphs to assist in the achievement of CDA.

10.1 Crews familiar with operations at Heathrow, Gatwick and Stansted are recommended to program FMC / FMGC with the expected route and to make full use of the FMC / FMGC descent profile information. It is strongly recommended **NOT** to use a 'direct intercept' to an extended runway centreline since the FMC / FMGC will then calculate the shortest possible routing and will result in the vertical navigation guidance producing a descent below the ideal CDA. An exception to this is straight-in approaches.

10.2 Depending on aircraft type and operators' standard operating procedures, it is recommended that descent should be controlled by VNAV or Flight Path Angle (or Vertical Speed) rather than FLCH or Open Descent.

10.3 Aircraft separation is achieved by vertical separation and accurate vectoring, supported by the use of accurate speed control. It is important that ATC heading and speed instructions are accurately and promptly adhered to. Descent using Vertical Speed control may require the use of speedbrake or thrust to maintain the correct speed.

11. Commensurate with safety and establishing a stabilised approach, crews are encouraged to use the minimum flap setting required for the requested ATC speed restriction and to avoid the early lowering of the undercarriage.

11.1 Research shows that noise is kept to a minimum by operating the aircraft on a Continuous Descent Approach and in as clean a configuration for as long as possible.

11.2 PANS-OPS (Vol 1 Pt V, 3.2.1) provides that "in noise abatement approach procedures ... the aeroplane shall not be required to be in any configuration other than the final landing configuration at any point after passing ...5nm" from the threshold; this corresponds to approximately 1500ft aal.

11.3 If possible, therefore, the landing gear should not be lowered earlier than required to satisfy company requirements for a stabilised approach. This would not normally be until passing or below 2000ft (aal) depending on aircraft type.

12. Pilot training should include CDA approach techniques, and operating procedures should encourage a CDA approach in preference to descents followed by extended level segments. Operators should ensure that pilots are aware that noise abatement procedures are detailed in flight-deck documentation.

13. After landing, if conditions permit, to reduce noise commensurate with safety, normally only idle reverse thrust should be used. It is, however, recognised that safe operation is paramount and that this may not be possible.

Airport Factors

14. Runway exit points should be designed and located to help minimise the use of reverse thrust and runway occupancy times, reducing the likelihood of go-arounds.

15. Successful CDA is significantly assisted by the installation of an ILS or equivalent, so airports are encouraged to provide ILS to all approaches where CDA is expected. When the ILS is unserviceable or is not provided the request to achieve CDA is not negated. Consideration should be given to the establishment of RNAV APVs (Approach procedures with vertical guidance) as the primary back up in the case of ILS/MLS failure in preference to reliance on SRA or NDB approaches. In situations when the ILS/MLS is not available, which are rare, a greater achievement of CDA is likely if RNAV APV procedures are in place.

16. Regular and timely feedback to all parties involved is essential for understanding and improving performance against this Code. In particular, GEMS analysis of CDA performance will enable each airport company to monitor and discuss progress with pilots and ATC representatives at the company's appropriate technical group (e.g. BAA Gatwick's Flight Operations Performance Committee). Each airport's data will be available for referral to individual airlines, and will routinely be sent to NATS, for their own internal review. Data on CDA performance will also be considered at each airport's local NTK Working Group. These working groups currently review monthly CDA performance data at night. This will continue for the foreseeable future and input to these groups, reporting on progress against this Code, will be sought from pilots and ATC.

Regulatory Factors

17. It is strongly recommended that detailed CDA requirements be published in the UK AIP. This will result in chart producers promulgating this to the airlines in their charts. These should include reminders of the need to achieve CDA - to be available on the charts used by flight crew, in the cockpit.

18. It is strongly recommended that an arrivals diagram of the approach area around each airport be published, showing the swathes within which 90% of all approaches from each holding stack lie. This will enable pilots of suitably equipped aircraft to use the automatic vertical guidance features of the autopilot to improve CDA achievement, when operating in a radar vectored environment.

19. Minimum joining altitudes for aircraft to join the ILS should be kept under review.

Strategic Factors

20. Use of standardised approach procedures including Precision RNAV approaches should be evaluated for potential noise benefits, bearing in mind safety and capacity issues.

21. If any research finds that noise can be reduced by changing the current standard speeds issued by ATC, to either higher or lower speeds, then a full study should be implemented to evaluate all the consequences of such a change. Attention is drawn to the recent phraseology changes approved by SRG (see para 33).

22. The Working Group identified airspace planning as a factor which should be reviewed to identify if major benefits would arise from redesigning airspace to enable more efficient arrival routes, which would reduce the overall noise impact on the population.

    22.1 The basic configuration of the London TMA (which covers much of the airspace over South-East England) is a product of historic evolution, and is to a great extent dictated by the runway alignments at the major airports. Additional constraints are the locations of the terminal holding stacks, which in turn have been strongly influenced by the overall en-route airways structure linking the major traffic orientations. Because of such interactions as these, substantial change to any element of the airspace structure in the London TMA is always likely to have knock-on implications for other parts of the system, quite possibly extending well beyond the LTMA, in order to maintain current safety standards and capacity provision.

22.2 A dominant consideration is the position of the holding stacks; this will continue to become even more important in the short term as traffic increases, although the longer term future is less clear and will depend in part upon the eventual degree of success of the Eurocontrol 'gate-to-gate' concept. Even when holding is not required, aircraft approaching Heathrow and, increasingly, Gatwick and Stansted, are normally routed via one of the holding areas.

22.3 The present airspace structure constrains the extent to which CDA optimisation procedures can be achieved in some areas. These constraints at present do prevent a 'CDA where practicable' requirement for Stansted runway 05. Other examples of cases where CDA achievement can be relatively difficult include Gatwick 08L/R approaches because of the airspace constraints set by Heathrow departures above, and the extended intermediate approaches to Heathrow on easterlies from the BIGGIN and LAMBOURNE holds.

22.4 There are no quick or easy solutions to these problems, and some may not be soluble without a full-scale airspace redesign in order to achieve the greatest possible noise amelioration commensurate with safety and efficient use of airspace.

22.5 This does not, of course, mean that operational improvements in the particular cases mentioned should not be sought within the present structure. The variability of existing performance suggests that there is some scope for improvement. But the structural limits to that potential are noted.

22.6 No major structural changes are currently planned in advance of the introduction of full RNAV procedures. The reorganisation for RNAV may, however, provide an opportunity to consider whether new or relocated holds might be introduced. Considerations of geometry and track distance to run mean that CDA achievement could be substantially enhanced, notably for the Heathrow BIGGIN and LAMBOURNE stacks on easterlies and the ABBOT stack for Stansted runway 23, if it were possible to optimise their locations.

22.7 While recognising the structural constraints in the short to medium term, CAA Directorate of Airspace Policy, NATS and the DTLR will continue to keep under review the possibility of limited changes to airspace and/or to holding arrangements which could facilitate CDA or other arrivals noise improvements. The ANMAC Technical Working Group recommended that "serious consideration should be given to commissioning a more detailed analysis of ... proposals for airspace changes which might produce environmental benefit".

22.8 Those involved in developing the future RNAV airspace environment for terminal areas should seek appropriate expert advice on environmental factors, and should use their best endeavours to ensure that, subject to safety requirements, consideration and determination of airspace changes take full account of the need to minimise noise from arriving aircraft.

23. PANS OPS requirements state that 3 degrees is the "optimum angle...the operationally preferred angle...and anything in excess of 3 degrees may only be used where alternate means of satisfying obstacle clearance requirements are impractical." Most current aircraft are designed around current PANS OPS 3 degree approaches and are not certified to fly at angles greater than 3 degrees in CAT II or III conditions. Further arrivals noise reductions would be possible in the future if new aircraft were designed to permit a steeper approach gradient. Approaches steeper than 3 degrees might provide a noise benefit by placing aircraft higher at any given point on the approach, but raise potential difficulties in terms of certification of approaches, particularly in low visibility. Because of these factors this Working Group concluded that approaches steeper than 3 degrees are unlikely in the near to medium term at Heathrow, Gatwick and Stansted.

24. Airlines should require that aircraft manufacturers design aircraft and FMS systems in such a way as to make it straightforward for the pilot to be able to set and monitor progress against a CDA profile.

25. Guidance should be available to ATC to assist them in identifying accurately the predicted distance to run for arriving aircraft.

26. Training for ATCOs and pilots should include information on the environmental benefits of CDAs.

Other factors

27. External factors can mean that achievement of CDA is more difficult in certain circumstances, for example periods of adverse weather or aircraft emergencies.

28. Positioning flights between airports in and around the London TMA are sometimes flown at altitudes below 6000ft. Such flights will be registered by the NTK system as non-CDA approaches. DTLR will consider further with the airports and NATS how best to manage and monitor these flights having regard to all relevant operational, environmental and airspace management considerations. There are, however, relatively few of these movements.

29. It is recognised and accepted that it is not practical to instruct go-arounds to climb to an altitude of 6000ft, and that consequently these will register as non-CDA on subsequent re-approach to the airfield. There are, however, relatively few of these movements.

30. Unpressurised aircraft may require a shallower descent gradient than pressurised aircraft.

31. ATC (assisted by the airports) should monitor the *ex post* accuracy of a random sample of distance to run information from time to time with a view to improving the accuracy of distance information and hence CDA achievement rates both at night and in the daytime.

Recent Successes

32. In compiling this Code of Practice, a number of initiatives have been identified and implemented that should lead to an increase in the number of flights using CDA techniques.

33. The phraseology used by ATC nationally to permit aircraft to descend on the glidepath has recently been reviewed and this should reduce the need for level segments to be flown as aircraft join the ILS. The phraseology now approved is "When established on the localiser, descend on the ILS, QFE (Pressure) Millibars/ QNH (Pressure) Millibars, Elevation (Number) feet."

34. Graphs to assist flight crew in managing their descent in line with ATC instructions, produced by ERCD in conjunction with British Airways, are included in this Code (Figs 5 and 6 also referred to in para.10).

35. The instructions in the UK AIP that referred to a minimum descent rate of 500 fpm are to be clarified, enabling extended descents in line with CDA to be achieved without need to notify ATC of lower rate of descent below transition altitude. This will come into effect from 4 October 2001.

The Way Forward

36. All organisations involved in writing the Code are encouraged to indude reporting progress in their respective Annual Environmental Reports, or similar, and to exchange best practice with other organisations around the world.

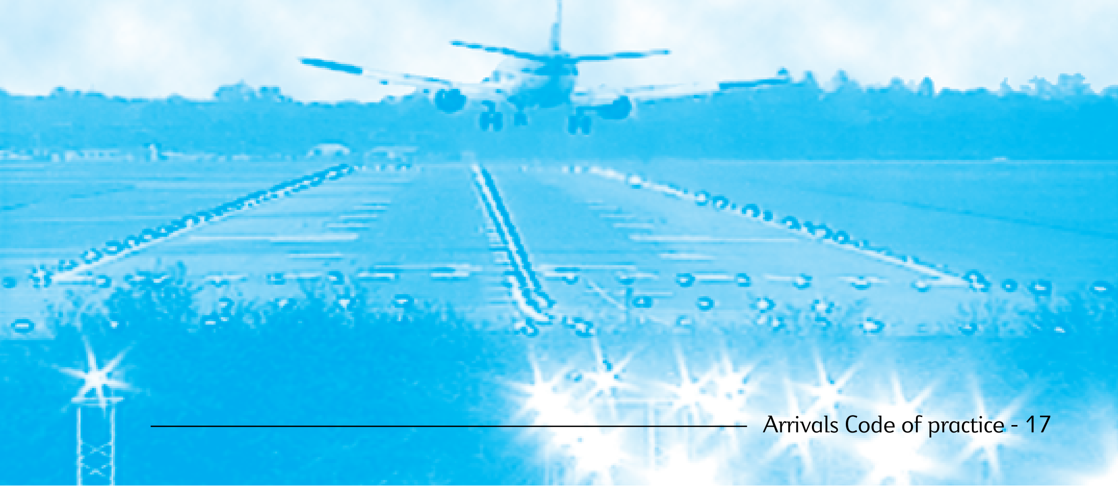
37. The DTLR and CAA are encouraged to promote and disseminate, through their regulatory functions and through participation in ICAO and other international fora, the use of CDA where feasible at airports in the UK and abroad.

38. The Working Group agreed to host a review of the Code during 2002.

Future Research

39. Areas of research have been suggested that may lead to further reductions in noise under the flight path of arriving aircraft. These include:
    - speed controls (appropriate to the stage of flight) - assessments of whether changes may lead to noise reductions
    - R-NAV approaches - the potential for benefits
    - environmental impact assessment of airspace changes - see paragraph 22 above
    - investigation of benefits from a possible future change from ILS to MLS or GPS approach guidance. [MLS eliminates the 'false beam' so may remove the need to intercept the glidepath from below.] These may be utilised in RNAV approaches if appropriate.
    - investigation of the possibility and benefits of extending the ILS glidepath elevation guidance beyond the present 10nm limitation.
    - investigation of the possibility and benefits of increasing the base levels of holding stacks

List of Figs



Membership;

Airtours International Airways

BAA Heathrow

BAA Gatwick

BAA Stansted

British Airways

CAA, Environmental Research and Consultancy Department

DTLR, Aviation Environmental Division

National Air Traffic Services

Organisations commenting;

BAA Heathrow Noise and Track Keeping Working Group

BAA Gatwick Noise and Track Monitoring Advisory Group

BAA Stansted Noise and Track Keeping Working Group

Safety Regulation Group, Civil Aviation Authority

Directorate of Airspace Policy, Civil Aviation Authority CAA

Gatwick Airport Flight Operations Performance Committee

GLOSSARY OF TERMS

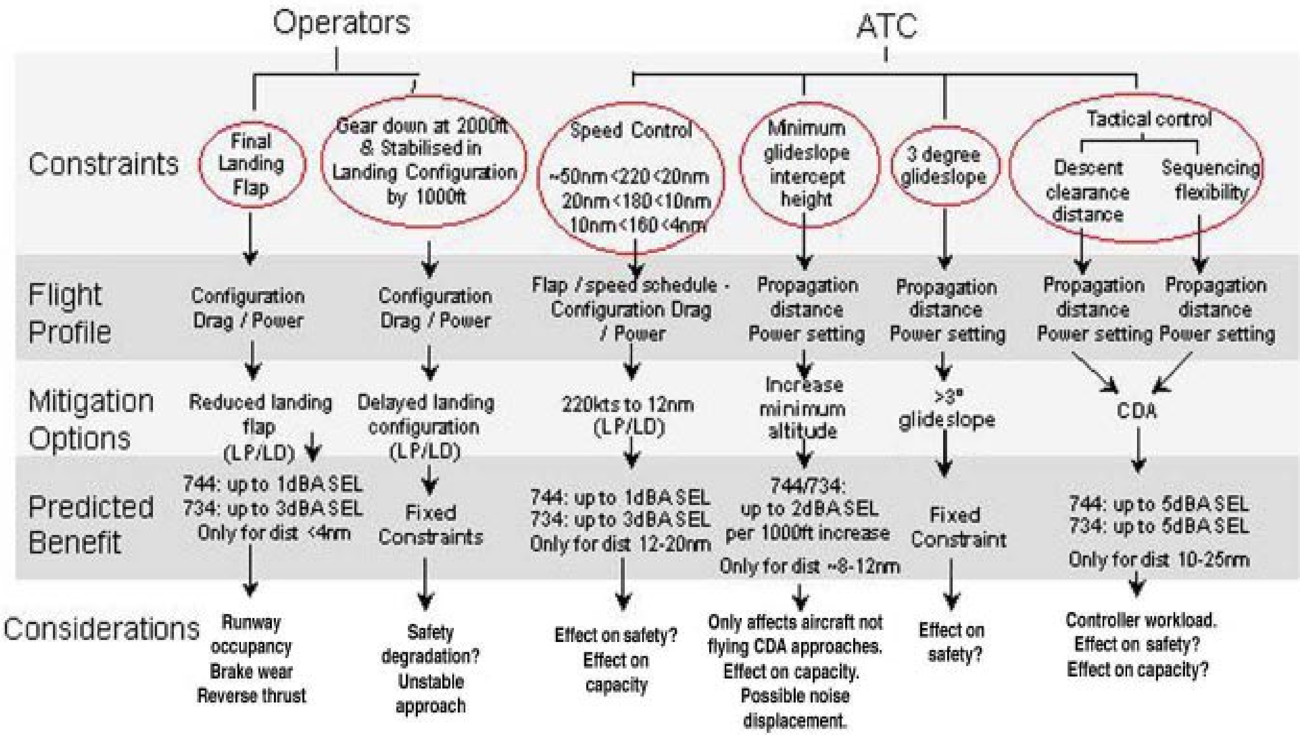
Note that in some cases a more descriptive explanation of terms is given here, rather than the “official” technical definition, in order to assist the lay reader better to understand the terms used.

aal	Aircraft height above aerodrome level (runway datum).
AIP	U.K. Aeronautical Information Publication; colloquially known as the ‘Air Pilot’, published by the Civil Aviation Authority.
Altitude	The vertical displacement of an aircraft measured above mean sea level (the altimeter pressure setting is known as QNH). NB all ATC radar vectoring operations below the minimum stack level are conducted with reference to altitude. Most aircraft operators use altitude throughout the approach.
ANMAC	DTLR’s Aircraft Noise Monitoring Advisory Committee.
ATC	Air Traffic Control
ATCOs	Air Traffic Control Officers
CAA	Civil Aviation Authority
CAT I	An approach in visibility greater than 550m/600m (dependent on runway lighting).
CAT II	An approach in visibility less than 550m runway visual range
CAT III	An approach in visibility less than 200m runway visual range
Category C & Category D	ICAO PANS OPS (Doc 8168) Speed Related aircraft Category: Aircraft are divided into five speed categories. These are based on a nominal threshold speed defined as 1.3 times the stalling speed in the landing configuration at Maximum Certified Landing Weight. The five categories are:- A - <91 kts (e.g. Piper Cherokee) B - 91 kts < 120 kts (e.g. Viscount) C - 121 kts to 140 kts (B737, B757) D - 141 kts to 165 kts (B777, B747) E - >165 kts. (e.g. Concorde)
CDA	Continuous Descent Approach
Chapter 2	Classification of aircraft certification levels as defined in ICAO Annex 16. Chapter 2 types are characterised by the noisier low by-pass turbojet aircraft and early high by-pass turbofan aircraft.

Chapter 3	Classification of aircraft certification levels as defined in ICAO Annex 16. Chapter 3 types are characterised by the more modern, quieter, high by-pass turbofan aircraft.
DTLR	Department of Transport, Local Government and the Regions.
dB	Decibel, a unit used for quantifying sound level, calculated as 10 times the logarithm (base 10) of a sound energy ratio.
dBA	Levels of noise measured on a decibel scale using a frequency weighting that approximates the characteristics of human hearing. These are referred to as A-weighted sound levels; they are widely used for nose assessment purposes.
ERCD	Environmental Research and Consultancy Department, CAA.
FLCH	Flight Level Change - a control logic with set thrust and the aircraft speed controlled by the elevator
FMS	Flight Management System
FMC/FMGC	Flight Management Computer/Flight Management Guidance Control
GEMS	'Global Environment Management System', the proprietary name for the NTK system supplied by Lochard Pty Ltd to the BAA London airports during 1999.
Glideslope	The ILS vertical guidance, set at the London airports for a nominal 3° descent angle.
GPS	Global Positioning System.
Height	The vertical displacement of an aircraft measured above a specified datum, normally the elevation of an aerodrome (aal) (the altimeter pressure setting is known as QFE) or above ground level (agl). In this Code all heights are aal.
ICAO	International Civil Aviation Organisation
ILS	Instrument Landing System.
Initial Approach and Intermediate Approach	Technical terms used in Instrument Approach procedure design and related to obstacle clearance requirements. The Intermediate Approach segment blends the Initial Approach into the Final Approach and is normally aligned with, or not more than 30° offset from, the final approach track. For the purposes of this Code, both relate to the parts of the approach where radar directed marshalling and sequencing of traffic takes place between the

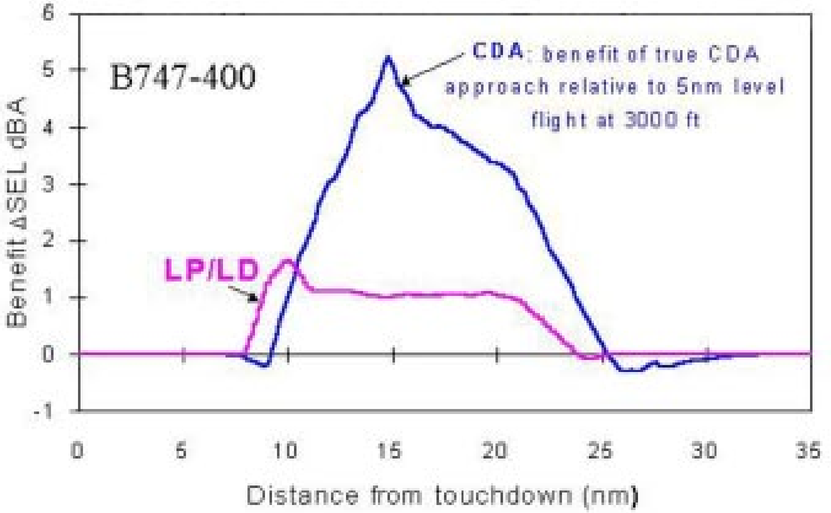
	Terminal Holding Point and the lowest (obstacle clearance) altitude at which an aircraft must be fully established on both the Localiser and the Glideslope (2500 ft at Heathrow and Stansted, and at Gatwick 3000 ft for runway 08R and 2000 ft for runway 26L).
Localiser	The ILS azimuth guidance, coinciding with the extended runway centreline.
LP/LD	Low Power Low Drag approach procedure.
LTMA	London Terminal Control Area
MLS	Microwave Landing System
NATS	National Air Traffic Services Ltd
Nautical Mile (nm)	A distance defined by 1 second of arc at the Equator, equal to 6076 ft (i.e. 1.151 statute miles, or 1.852 km).
NTK	Noise and Track Keeping monitoring system; this is a system that integrates noise data from a number of microphones, the airport's Flight Information System, and the NATS Secondary Surveillance Radar and flight identification. Heathrow, Gatwick and Stansted each have similar systems, as does ERCD (which receives data from the three airports' systems).
Open descent	A control logic with idle thrust and the aircraft speed controlled by the elevator
PANS-OPS	ICAO Procedures for Air Navigation Services: Operations
QFE	Atmospheric pressure at aerodrome level (or at runway threshold) [i.e.ie the altimeter reads zero feet on the ground)
QNH	Altimeter sub-scale setting to obtain elevation when on the ground [i.e.ie the altimeter reads the aircraft's altitude AMSL when on the ground]
RNAV	Area Navigation
SEL	The single event Sound Exposure Level is the noise level in dBA which, if maintained for a period of one second, would cause the same A–weighted sound energy to be received as is actually received from a given noise event.
SRG	Safety Regulation Group of the CAA
TMA	Terminal Control Area
VNAV	Vertical Navigation

Figure 1 - Aspects of Variability in Approach Noise



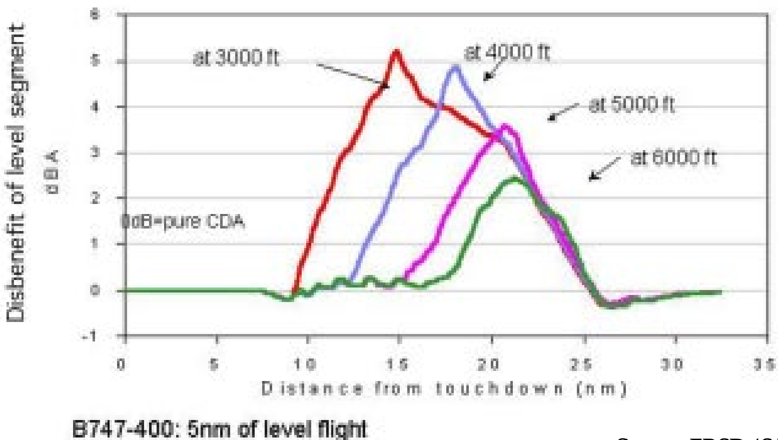
Source "Noise from arriving aircraft"
ANMAC, DETR December 1999

Figure 2 - Benefits of approach noise mitigation procedures



Source ERCD/CAA

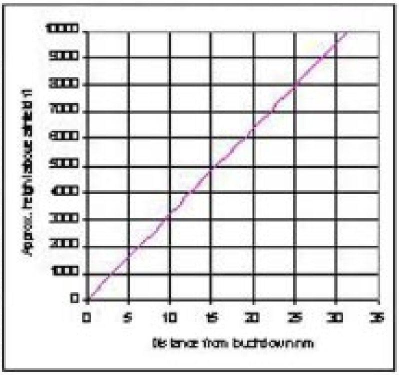
Figure 3 - Disbenefit of level intercepts relative to 'pure' CDA approach



Source ERCD/CAA

Figure 4 - Height vs Distance for a 3 degree Glidescope

Distance from touchdown nm	Approx. height above airfield ft
0	0
1	310
2	630
3	950
4	1270
5	1590
6	1910
7	2230
8	2540
9	2860
10	3180
11	3500
12	3820
13	4140
14	4460
15	4770
16	5090
17	5410
18	5730
19	6050
20	6370
21	6690
22	7010
23	7320
24	7640
25	7960
26	8280
27	8600
28	8920
29	9240
30	9550
31	9870
32	10190
33	10510
34	10830
35	11150



Source ERCD/CAA

Figure 5 - Flight Path Angles for CDA

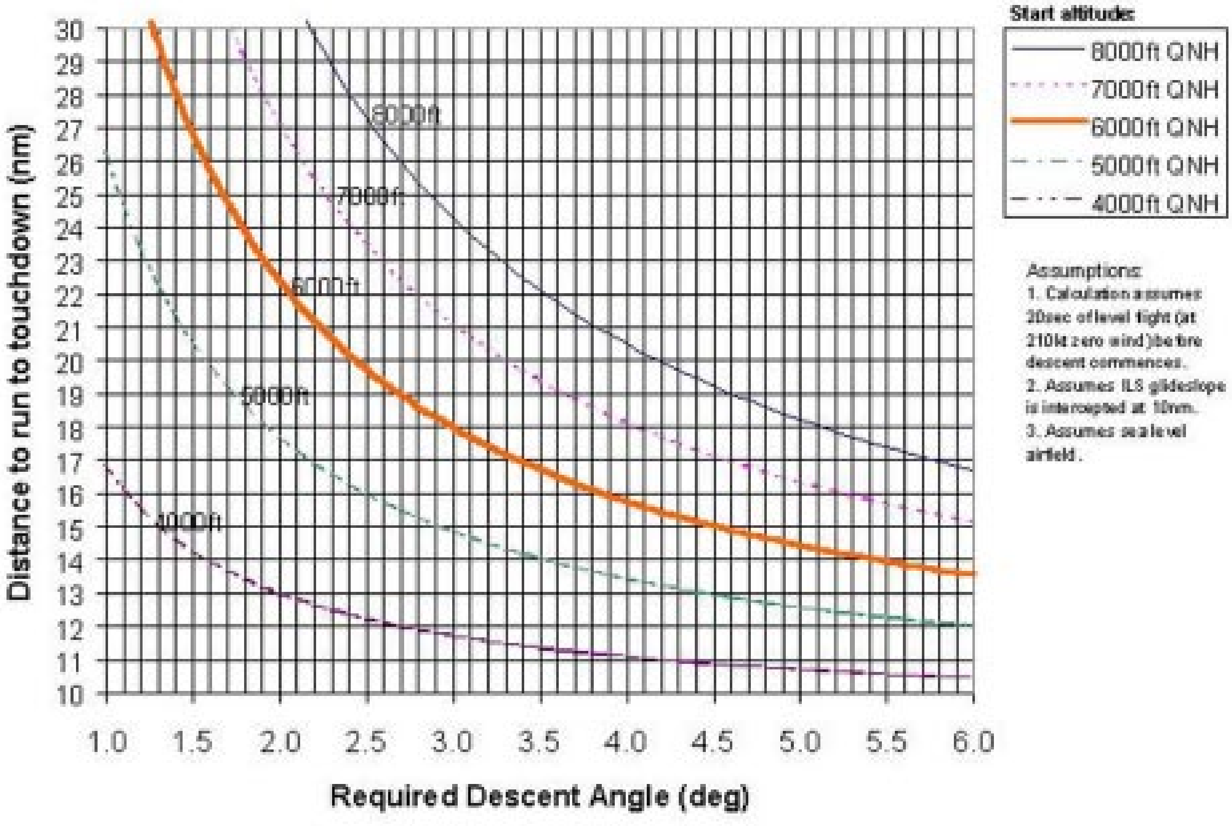
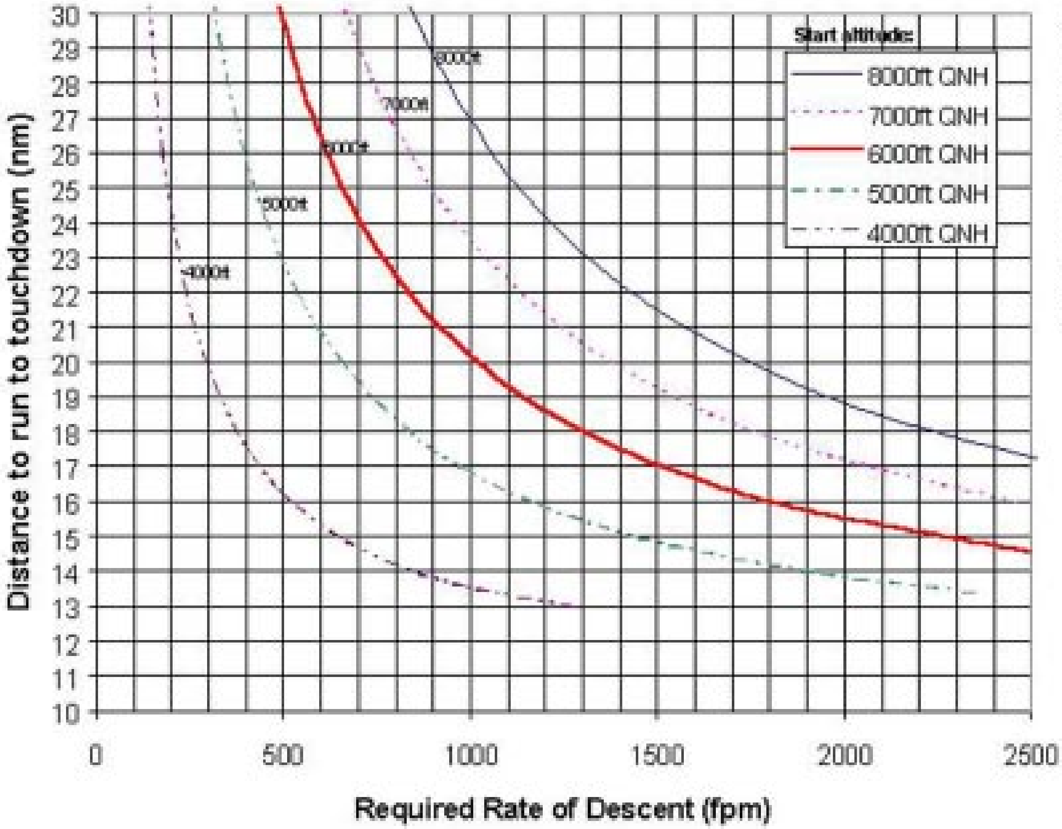


Figure 6 - Vertical Speed for CDA



Assumptions:
1. Calculation assumes 20sec of level flight (at 210kt zero wind) before descent commences.
2. Assumes 210kt initially, 190kt on base leg (max 6nm), and 170kt for last 2nm before joining ILS glideslope at 10nm.
3. Assumes zero wind, sea level airfield.