



Continuous Descent Approach

Implementation Guidance Information

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CDA

Implementation Guidance Information

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Important Notices

Safety

Nothing in this guidance 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".

Before Continuous Descent Approach (CDA) trials or operations commence, the proposed implementation shall be the subject of a local safety assessment. (EUROCONTROL Safety Regulatory Requirement ESARR4 – Risk Assessment & Mitigation in ATM).

Scope and Objective of this Guidance

This guidance is intended to facilitate harmonised implementation of CDA at aerodromes in the ECAC area.

The objective of a CDA is to reduce aircraft noise, fuel burn and emissions by means of a continuous descent, so as to intercept the approach glidepath at an appropriate height for the distance to touchdown.

A CDA is an aircraft operating technique in which an arriving aircraft descends from an optimal position with minimum thrust and avoids level flight to the extent permitted by the safe operation of the aircraft and compliance with published procedures and ATC instructions.

Keeping aircraft as high as possible for as long as possible can be more effective at reducing noise impact on the ground than Low-Power/Low Drag (LP/LD) techniques alone. (*LP/LD is 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.*)

Important Notices

CDA can be optimised within energy, speed and safety constraints by avoiding, as far as possible, unnecessary flap, air brake and engine thrust and avoiding early lowering of landing gear. Aircraft energy and speed management is therefore a critical factor in successful CDA implementation.

The proportion of aircraft achieving CDA will depend on local traffic conditions and local airspace characteristics, although a good success rate may be achieved in high traffic density situations. To support the success rate of CDAs in a high density environment, development and implementation of supporting planning and arrival tools may be necessary.¹

Collaboration and Culture

Successful and safe implementation of CDA requires effective collaboration and communications between the aerodrome operator, the Air Navigation Service Provider (ANSP) and aircraft operators at an aerodrome together with support from appropriate State authorities such as the safety regulator.² Effective implementation of CDA may require some change to present practice and must therefore be supported by senior management commitment. Success will also require an open exchange of information such that all parties can assess progress.

Future Development

This brochure should be regarded as a living document that will be adapted as experience is gained on implementation of CDA. If appropriate, additional complementary materials may be produced to aid implementation.

ICAO Working Arrangements are in the process of assessing CDA on a global scale and may also produce CDA guidance. However, the basic CDA techniques described here, which have been harmonised on a European basis, are not expected to change substantially.

- 1 - *The development of such tools to support CDA is being covered by another EUROCONTROL initiative - "TMA 2010+".*
- 2 - *EUROCONTROL is currently developing guidance on Collaborative Environmental Management.*

Executive Summary

Background

The effects of aircraft noise and atmospheric emissions can give rise to aerodrome constraints and operational costs. At present several instances of CDA exist that are not harmonised; implementation of a harmonised, capacity friendly version of Continuous Descent Approach (CDA) technique would therefore be beneficial to all European ATM system stakeholders and has been requested by aircraft operators.

CDA will be most appropriately deployed where an aerodrome has existing or potential noise issues - typically where noise-sensitive areas are being over-flown at medium altitude by arriving aircraft. However the application of CDAs may be extended to all airports as a means of reducing the environmental impact of aviation. Increases in traffic density may require Air Traffic Control (ATC) support tools to continue the use of CDAs.

In trials, significant reductions in noise and savings in fuel consumption have been demonstrated. If 50% of arrivals at the 20 busiest ECAC airports achieved CDA, this would equate to savings of approximately 50 - 100M€ annually (based on June 2007 fuel prices).

This document provides guidance for the local implementation of a simple and effective CDA technique that does not adversely affect capacity in high-density air traffic situations.

As local conditions require, CDA may comprise any of the following:

- Standard Arrival Routes (STARs) (including transitions) which may be designed with vertical profiles. The routes may be tailored to avoid noise-sensitive areas as well as including the vertical profile (see ICAO PANS-OPS Doc 8168, Volume II) and the provision of Distance To Go (DTG) information;
- the provision of 'distance from touchdown' (hereinafter referred to in this document as 'distance to go' (DTG)) information by Air Traffic Control during vectoring; or
- a combination of these: STARs being used in low traffic density, and DTG estimates being issued by ATC as and when radar intervention is required e.g., during busy periods.

These reflect best practice and have been taken into account in the production of this guidance document.

Introduction

Depending on local circumstances, the effects of aircraft noise and atmospheric emissions can impact on the quality of life of communities close to an aerodrome and ultimately result in aerodrome constraints. This is a key reason why aerodromes are now the most capacity critical component in the European ATM system. These adverse impacts and their associated constraints also have significant societal and economic costs. Fuel-use is a fundamental environmental issue both from a finite global resource and an emissions perspective. Fuel is also a major airline cost element. It is now generally recognised that technology is unlikely to offset the growth in demand for air transport and the potential for aircraft noise, fuel use and atmospheric emissions to constrain Europe's ATM system, will therefore increase. The significance of environmental issues close to aerodromes is recognised in ICAO provisions such as the 'balanced approach' to noise management (ICAO Resolution A33-7, Appendix C), ECAC Environmental Policy Statement, EU Directives (2002/30/EC) and the EUROCONTROL Environmental Policy and Strategy (2001). ECAC Directors General of Civil Aviation (DGCAs) require that European noise abatement harmonisation shall be processed through EUROCONTROL working arrangements.

Measures to reduce aircraft noise impact, fuel use and atmospheric emissions in the general vicinity of an aerodrome should therefore remain a high priority for ATM stakeholders.

In accordance with the ICAO 'balanced approach' to noise management and supporting EC Directive 2002/30/EC and related State implementation plans, potential noise management measures should be subject to analysis to allow alternative solutions to be prioritised before implementation.

Why CDA?

- It's a triple win "People - Planet - Prosperity"
- Can be done now with minimal investment
- Does not affect capacity - it's the "Art of the Possible"

The Term "CDA"

In the absence of an internationally agreed definition of Continuous Descent Approach, EUROCONTROL proposes the following:

"Continuous Descent Approach is an aircraft operating technique in which an arriving aircraft descends from an optimal position with minimum thrust and avoids level flight to the extent permitted by the safe operation of the aircraft and compliance with published procedures and ATC instructions."

NB *The term 'level flight' required to fulfil this definition should be locally determined for performance monitoring.*

Introduction

Document Purpose

This document is intended for use by operational stakeholders at ECAC airports and provides harmonising guidance for the local implementation of simple and effective CDA technique.

Scope and Applicability

The main aim is to reduce noise, atmospheric emissions and fuel-use.

In operational terms, the ideal situation would be to achieve a CDA from top of descent to touchdown. However in many situations this may be unachievable as such techniques can be subject to airspace or other operational constraints.

CDA will be most appropriately deployed where an aerodrome has existing or potential noise issues - typically where noise sensitive areas are being over-flown at medium altitude by arriving aircraft. However, the application of CDAs may be extended to all airports as a means of reducing the environmental impact of aviation. Increases in traffic density may require ATC support tools to continue the use of CDAs.

Using this Document

The parties required to implement CDA at an aerodrome include: aerodrome operators, Air Navigation Service Providers (ANSPs), aircraft operators and national aviation regulators. It is essential that CDA is approached collaboratively and that each party fully understands the entire CDA guidance document prior to commencing activity as this will greatly facilitate close collaboration between the parties. A key element of successful CDA optimisation is appropriate communication with local communities that should be facilitated through agreed community relations channels. Details of stakeholder roles and responsibilities are given in Annex A.

Central to this guidance is the uniform and consistent application of all relevant ICAO provisions - these shall apply in all cases except where a State has provided notification by the appropriate procedure. The decision to apply the guidance in this document should therefore be taken in the light of the ICAO 'balanced approach' to noise management, the underpinning EU Directive(s) and State implementation requirements as applicable (ICAO A33-7 Appendix C, EU Directive 2002/30/EC).

Introduction

EUROCONTROL is able to support the introduction of CDA and is able to offer further guidance and support in respect of CDA implementation.

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CDA Requirements

Operational Aim

The overall operational aim for a CDA is to assist pilots to optimise aircraft approach profiles in order to reduce noise impact on the ground and, where possible, reduce fuel-use and atmospheric emissions. Because noise reduces exponentially with distance between source and receptor, the main aim of CDA is to keep aircraft as high as possible for as long as possible without adversely affecting the application of a safe descent profile. Additional noise reduction may be achieved by incorporating, to the extent possible, LP/LD techniques such as later deployment of flaps and undercarriage.

CDA Overview

CDA phraseology shall provide distance to touchdown information to the pilot and should complement ATC/pilot procedures related to level clearances, level restrictions and/or minimum flight altitudes. This is currently provided for in ICAO PANS-ATM (Doc 4444) by the phrase "miles from touchdown". Although intended for use during Precision Approach Radar and Surveillance Radar Approach, the phraseology is also suitable for use at other points in the approach.

As local conditions require, CDA may comprise any of the following:

- Standard Arrival Routes (STARs) (including transitions) which may be designed with vertical profiles. The routes may be tailored to avoid noise-sensitive areas as well as including the vertical profile (see ICAO PANS-OPS Doc 8168, Volume II) and the provision of Distance To Go (DTG) information;
- the provision of 'distance from touchdown' (hereinafter referred to in this document as 'distance to go' (DTG)) information by Air Traffic Control during vectoring; or
- a combination of these: STARs being used in low traffic density, and DTG estimates being issued by ATC as and when radar intervention is required e.g., during busy periods.

CDA Requirements

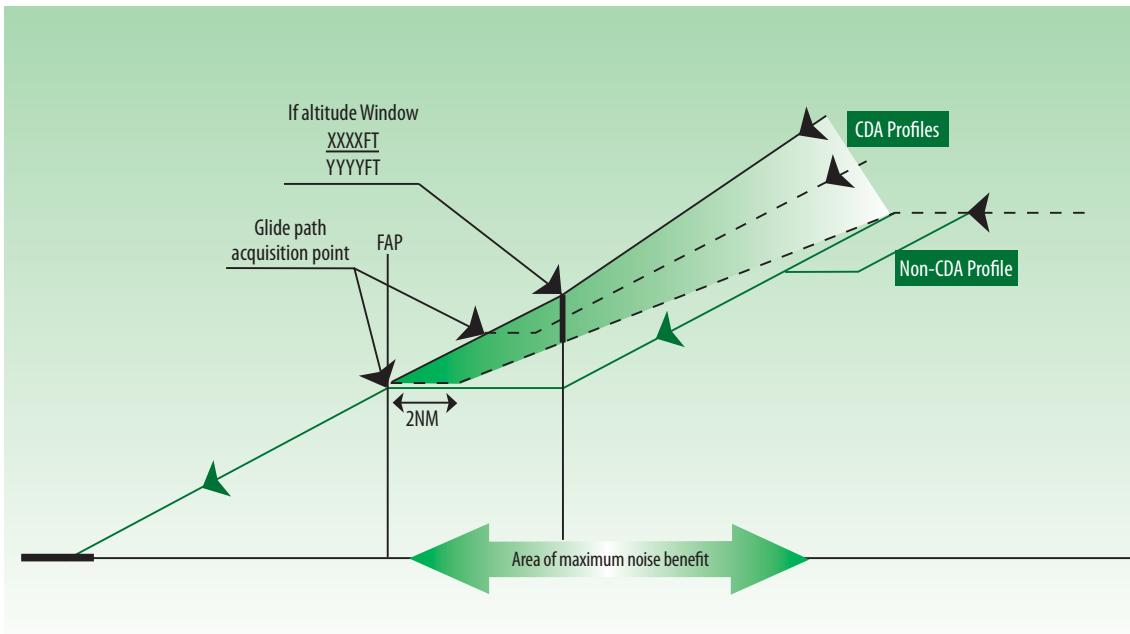


Figure 1 Conceptual Diagram of "CDA"

Key CDA Elements Include:

- Providing accurate and timely DTG information to pilots in order to achieve CDA.
- Avoiding giving descent clearance prior to the point at which a CDA would naturally occur and giving an estimated distance from touchdown to the pilot to allow the aircraft to intercept the approach glide path with a minimum of level flight.
- Provision of appropriate speed requirements to facilitate a continuous descent profile without the need for segments of level flight.
- Avoiding unnecessarily early deployment of flap and undercarriage where this does not conflict with the safety requirements and company operating procedures.
- Incorporating Low-Power/ Low- Drag techniques to the extent possible.

CDA Requirements

CDA Operational Requirements:

- Where the radar-based CDA is implemented, provision by ATC of accurate DTG information to the pilot is required.
- Where the published CDA is implemented, the use of harmonised text and charts is recommended. (ICAO/EUROCONTROL documents)
- Integration into pilot/controller CDA guidance/familiarisation material of unambiguous information pertaining to level clearances, level restrictions and/or minimum flight altitudes.
- Development of strategies for harmonised CDA implementation with a view to:
 - minimising impact on controller/pilot workload, and
 - integrating into ATC guidance/awareness material, general information pertaining to the environmental impact of aircraft speed adjustments on aircraft CDA vertical profiles.
- Adequate planning, recognising the:
 - variables that will affect the initial tactical plan;
 - complexity of integrating multiple traffic flows into a single stream;
 - controller workload may vary the point at which a DTG update is given;
 - need for glide path intercept from beneath to avoid rushed or un-stabilised approaches;
 - desire to have information available to airborne systems prior to top of descent;
 - flight crew procedures/airborne system ability to apply the appropriate profile for descent;
 - publishing of DTG information as part of the STAR and/or transition procedures will allow the descent trajectory to be optimised.
- Published CDA application in STARs (including transitions):
 - STARs are designed to specify standard routes from the enroute network to the initial approach fix and, with an appropriate transition, may provide the necessary guidance to the final approach fix.
 - P-RNAV STARs and Instrument Approach Procedures (IAPs) should be designed with a vertical profile that allows for differing aircraft types/ masses and atmospheric conditions.

CDA Requirements

- STAR and transition charts shall contain information on DTG at appropriate waypoints.
- STAR-based procedures may also include speeds at waypoints to enable a more predictable profile and enhance pilot monitoring of the descent.

In order to allow pilots to stabilise and decelerate the aircraft on final approach it is recommended that, where operational and terrain constraints permit, the final approach path is intercepted at an appropriate height for the distance from touchdown (eg based on a three degree glidepath this may be approximately 10 miles at 3000 feet).

The transition altitude in the terminal area may affect the pilot's ability to judge best rates of descent to achieve CDA. Pilot workload may be significantly increased when a change from standard altimeter setting to QNH is required during a CDA.

Allowance should be made for this in flying technique and in performance expectation, especially when QNH is significantly different to standard pressure.

Where published CDA is implemented and the need to vector aircraft on approach is likely to arise, EUROCONTROL strongly recommends that the provision for the tactical facilitation of CDA by ATC advising pilots of DTG is also adequately planned, developed and published in accordance with this guidance.

ATM Techniques

Overview

The purpose of the CDA technique is to minimise noise disturbance on the ground while at the same time meeting ATC requirements. CDA should avoid unnecessary periods of level flight and requires interception of the approach glide path at the appropriate altitude/height for the distance from touchdown.

Implementation

The following principles could be considered when implementing requirements associated with the application of Continuous Descent Approach techniques.

1. At all times, both aircraft and ATC requirements for flight safety override all requirements associated with CDA.
2. The application of CDA techniques does not change existing responsibilities for the avoidance of terrain. Specifically, unless an aircraft is receiving navigational guidance from ATC in the form of radar vectors or a direct-to clearance to a waypoint, the pilot is responsible for ensuring that the prescribed obstacle clearance exists at all times.
3. The aim of applying CDA techniques is to keep an aircraft as high as possible for as long as possible without adversely affecting the application of a safe descent profile, thereby reducing the impact of engine and airframe noise on the ground.
4. Additional reductions in noise and fuel consumption may be achieved by the application of LP/LD techniques. This may result in slightly higher speeds than usual.
5. CDA should not require significant changes to either existing instrument approach procedures or ATC procedures. Some adjustments to technique, both by pilots and ATC, will assist in achieving desired results.
6. As much notice as possible should be given to pilots in order that they may be sufficiently prepared to complete a successful CDA. This will be done by appropriate AIP entry for the relevant aerodromes and, day-to-day, may be by ATIS broadcast or other means. In addition, announcement by ATC may be required as a function of local CDA implementation strategies.

ATM Techniques

7. It is fully expected that use will be made of STARs and transitions, where these have been designed with vertical profiles. To achieve the maximum benefit from reduced environmental impact, the application of CDA techniques in conjunction with such STARs would commence as high as possible, typically at or above FL100. Existing STARs may be modified to include waypoint, altitude, track distance and speed references.
8. During radar vectoring, clearance to descend should, where practicable, be delayed until a point commensurate with an appropriate vertical profile.
9. During radar vectoring, relevant distance-to-go (DTG) advisories shall be passed to pilots by ATC, updated as necessary. It is recommended that an appropriate number of DTG estimates be given at the discretion of ATC.
10. Phraseology – ICAO PANS-ATM (Para. 8.6.4.2 d)

Explicit reference is made to the provision of position/distance information to radar-controlled arriving flights, in the context of "distance to touchdown" for those aircraft on Precision or Surveillance Radar Approach, in the form:

"(callsign) (distance) MILES FROM TOUCHDOWN".

It is considered that this phraseology is suitable for use at any stage of approach. Additionally, confirmation of the landing runway may need to be added.

11. Consideration should be given to providing accurate DTG information by means of distances published as integral elements of STAR/IAP charts, for selected waypoints. DTG information could be provided as integral elements of standard arrival and instrument approach charts (ICAO Annex 4, Chapters 10 & 11 refer).
12. Ideally, an aircraft should be established on the final approach path in a stable configuration at 10 nm from touchdown. A short period of level flight may be required to enable the aircraft to decelerate immediately prior to glide path intercept. The length will depend on parameters such as wind, temperature, weight etc.
13. ATC Training and Awareness material should include an appropriate level of understanding of the CDA techniques that pilots are attempting to achieve, in conjunction with the impact that ATC instructions and clearances could have on flights applying CDA techniques.

ATM Techniques

Documentation

AIPs shall be amended to include appropriate text indicating that CDA procedures may be in operation at individual aerodromes.

ATC Operating Instructions should be amended to include CDA facilitation.

Local CDA Adaptation

Selection of whether to use published CDA procedure, radar based CDA or a combination of the two should be taken locally. Where a combination is used, the DTG "miles from touchdown" information should be issued whenever vectoring an aircraft from a STAR or transition and updated as necessary. When making this selection the following should be borne in mind:

- Optimum noise performance for individual flights using CDA will be achieved by publishing the procedure as part of an aerodrome STAR and/or IAP. However, at busy aerodromes, this may not always be possible because of the implications for runway capacity and only a proportion of flights may actually complete a CDA.
- As traffic increases, the ability to deploy CDA using published STARs and transitions may reduce unless ATC arrival management tools are available.
- The use of tactical DTG by means of ATC advisories will allow pilots to achieve a CDA or partial CDA even in busy periods. However the noise performance for individual flights may not be as good as a pure optimised P-RNAV CDA procedure (i.e., without vectoring).
- The combination of both published CDA with tactical radar-based CDA should offer the optimum performance for aerodromes where arriving aircraft are routinely vectored during busy periods.
- CDA will achieve maximum noise, fuel and emission performance when combined with some degree of LP/LD technique, such as later deployment of flaps and undercarriage.

ATM Techniques

Aircraft Operations and ATC Techniques

The following aspects shall be taken into account when devising CDA techniques and associated guidance and training:

- Aircraft energy (speed, altitude and weight) and distance to go are fundamental to optimising CDA. A good understanding of the energy concept by ATC is vital to ensure that controllers issue appropriate clearances to achieve successful CDA.
- Speed control may be applied by ATC for reasons other than CDA until the aircraft reaches a specified distance from touchdown, from which point the pilot must configure and stabilise the aircraft to achieve a safe landing.
- The response of aircraft to instructions issued by the controller may not be uniform due to:
 - Wind changes
 - Different aircraft mass
 - Pilots' response
 - Some aircraft systems initiate turns earlier or later than others
 - Aircraft may turn at different rates
 - FMS systems are programmed with different algorithms
 - Type of approach to be flown

There will be opportunities for continuous improvement if adequate and timely feedback is collaboratively evaluated and an open 'no blame' culture exists.

Distance to Go

The following aspects should be taken into account in local CDA procedures, guidance and training:

- The first information on DTG shall be given at the earliest appropriate opportunity subject to airspace and operational constraints.
- Any change to planned route has an immediate effect on the optimum flight profile and the crew will need to make adjustments to regain the profile.

ATM Techniques

- Early ATC advice of changes of DTG will allow the pilot to make more accurate adjustments to the required rate of descent.
- Changes in ATC control responsibility during the arrival segment should not result in a different DTG being given.
- Estimates of DTG can be improved by basing the estimation on separation requirements and the 'number' of an aircraft in the approach sequence.
- Simultaneous ATC instructions to reduce speed and increase descent rates may not be achievable in new generation airframes that retain high energy in the descent phase of flight.

Safety Issues

Nothing in this guidance 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".

The safety assessment of this guidance has found that, in principle, there are no significant reasons why the CDA concept, as defined in this guidance material, is unsafe.

The local implementation of CDA shall always be subject to a local safety assessment, in accordance with the Safety Management principles of ESARR 4. A number of safety issues were identified as part of the safety assessment of this guidance that should be considered as part of the local safety assessment:

- The interaction between CDA and non-CDA traffic.
- Cockpit workload, in particular where radar vectoring and profile management can impact onto a phase of flight that is already subjected to increased workload.
- Accurate DTG information is required for the aircrew to ensure that they are not "rushed" and that the aircraft is able to achieve a stabilised configuration on final approach.
- Account should be taken of variability in descent paths and speed management depending on aircraft weight, the type of FMS and pilot training.

Key Requirements for Success

The main requirement for success is effective collaboration between the Air Navigation Service Provider (ANSP), the aerodrome operator and airspace users, to be managed through a joint working arrangement. Though not a pre-requisite, such collaboration can be best achieved through the implementation of Collaborative Environmental Management (CEM). Separate guidance on CEM is available from EUROCONTROL. Once established, CEM can be used to support the implementation of other environment related operational improvements.

CDA will be most appropriately deployed where an aerodrome has existing or potential noise issues - typically where noise-sensitive areas are being over-flown by arriving aircraft between 3,000 feet and 10,000 feet above the ground.

The following indicate key requirements for successful CDA Implementation:

- A preliminary review by operational stakeholders to establish whether changes to procedures will lead to environmental enhancement and operational/economic benefit and to assist in planning any such changes.
- A positive safety and cost/benefit review including the use of simulators to assess at an early stage whether CDAs are operationally possible.
- Commitment from the senior management of operational stakeholders.
- A willingness to change operational practice to benefit local residents and the aerodrome as a whole.
- Support from regulator(s) will also assist implementation.
- Effective collaboration.
- Adequate ongoing promotion, training, performance monitoring and performance feedback to all those involved as part of a continual improvement process.

NB *Aerodromes without an approach radar service are encouraged to use the principles outlined in the guidance to improve procedures and airspace design when the opportunity arises.*

CDA Benefit

Using this guidance as a basis for implementation of CDA will harmonise the technique across Europe thus reducing proliferation of local rules and avoiding duplicated effort. The application of this guidance may minimise local CDA implementation costs.

Maximum benefit from CDA is achieved when arriving aircraft closely follow an optimum continuous descent profile, whilst simultaneously minimising thrust, avoiding sudden changes in thrust and reducing airframe noise by maintaining a clean aircraft configuration for as long as possible. The nature and extent of the benefit from CDA will vary depending on the local situation but would typically include a significant noise, fuel and emissions reduction along the descent profile prior to the point at which the aircraft is established on the final approach path.

Experience with procedures that fit the definition of CDA indicate that the main noise benefit will be experienced on initial and intermediate approach segments (from approximately 8 to 25 nm from touchdown depending on local circumstances). Research suggests a reduction of up to 5dBA SEL over conventional approaches can be achieved.

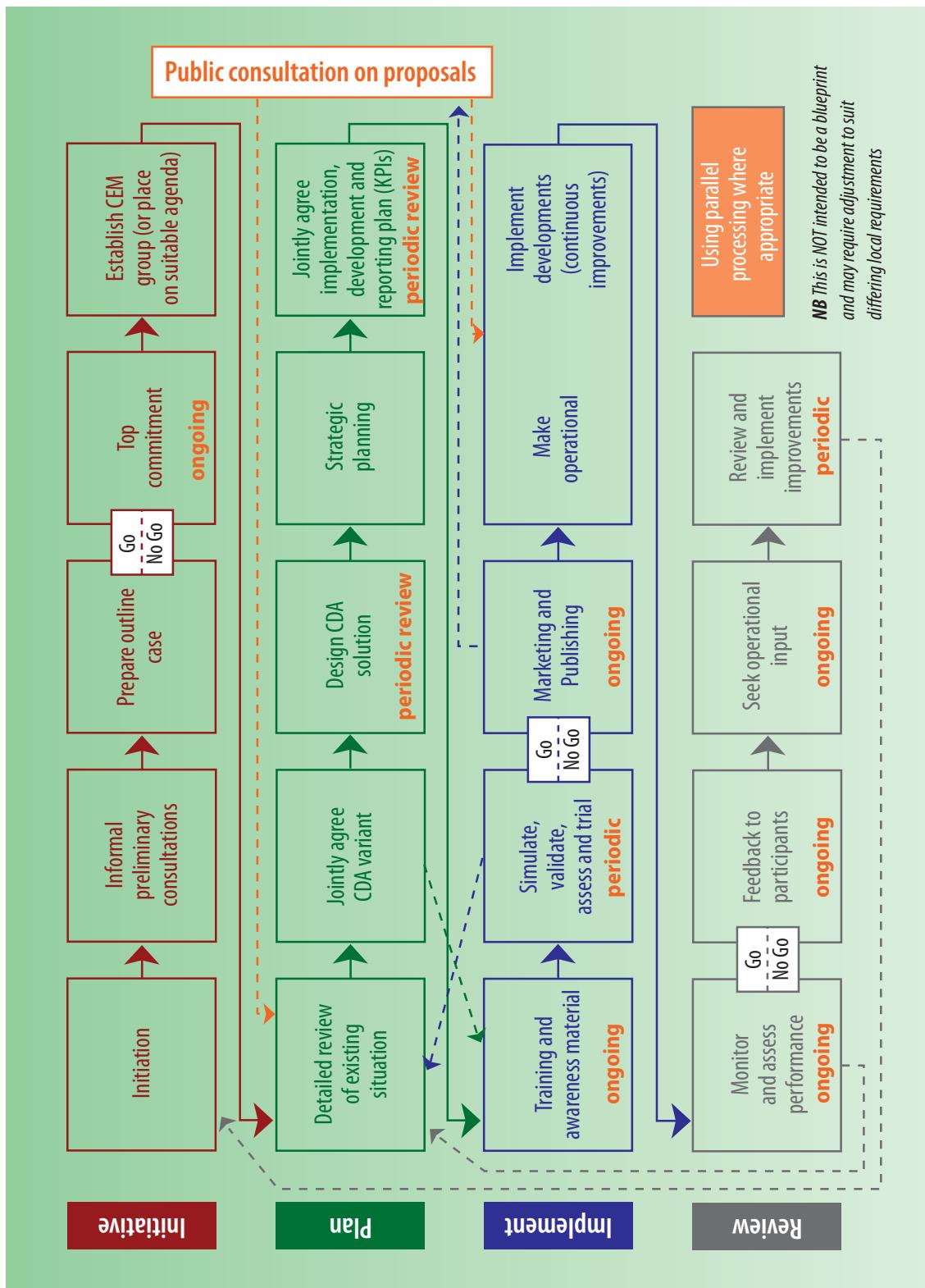
CDA can also reduce fuel costs for airlines. In trials conducted by EUROCONTROL and others, fuel savings of up to 40% during the approach phase have been demonstrated. This equates to between 50 and 150 kgs of fuel depending on the level at which CDA is commenced and the aircraft type. At June 2007 prices, this is the equivalent of between 50 and 100 million euros annually.

CDA is a tactical technique and it is not expected that it will be successfully applied by every aircraft on approach at a particular aerodrome. As experience grows the number of aircraft using CDA should increase to a significant proportion of flights.

The trials that produced the above results were conducted using aircraft of ATR and A320 size; the fuel and emission benefit will be greater for heavier aircraft.

NB *Although at the time CDA is being developed there may be a small increase in approach controller and pilot workload, CDA may lead on to other operational benefits such as fewer RTF transmissions.*

Generic CDA Implementation Plan



Annex A - Roles and Responsibilities

Joint Responsibilities when implementing CDA

CDA implementation can only be achieved through collaboration between operational stakeholders. Therefore, whilst some activities are specialised in nature there are also joint responsibilities for the safe and effective implementation of CDA. This section outlines these joint responsibilities and how they should be managed:

General Responsibilities:

Stakeholders have a collective responsibility to ensure that:

- Local/national implementation are in accordance with this guidance, deviating from it as little as possible.
- Aerodrome operational stakeholders consult in a co-ordinated way with relevant national regulatory authorities at an early stage when considering implementing CDA. This is to secure the support from the regulators, to ensure harmony with any national plans to implement CDA and to inform them of the intention to implement CDA.
- All proposed CDA procedures and guidance are subject to adequate and integrated safety assessment before implementation.
- At an early stage, operational stakeholders conduct an 'Initial CDA Review' of the local situation to broadly evaluate whether CDA will be safely applicable to the aerodrome. The main objective should be to answer four key questions:
 - Does implementation meet the 'Key Requirements for Success' as defined in this guidance?
 - Do arriving aircraft presently fly segments of level flight above noise sensitive areas at less than 10,000 ft?
 - Will implementation of CDA reduce the noise impact on these areas?
 - Can practice be changed in line with this guidance without generating insuperable safety or unacceptable operational problems?
- Senior management from each stakeholder organisation takes an active 'leadership' interest in CDA implementation and releases adequate resources for the task including nominating 'CDA points of contact' for the CDA Collaborative Implementation Group.

Annex A - Roles and Responsibilities

CDA Collaborative Implementation Group (CIG)

It is considered very important that the individual and joint responsibilities and task assignment for each stakeholder shall be approved and co-ordinated through a CDA Collaborative Implementation Group (CIG). The CIG shall comprise representatives from the aerodrome operator, ANSP, lead carrier(s) and appropriate State authorities. It is also acceptable for these duties to be formally included in the terms of reference of an existing body where the required stakeholders are present. Suggested roles and responsibilities for each individual CIG stakeholder organisation are given later in this section. Specimen Terms of Reference for the CIG are given in Annex C.

The CIG will ensure that:

- All parties involved in implementing CDA should maintain an up-to-date understanding of:
 - which organisations are participating;
 - their own role and responsibilities;
 - the roles and responsibilities of other participants; and,
 - the status of the CDA technique (e.g. its definition and scope and when and how it is to be applied).
- A simple CDA Implementation Plan is prepared, designed to fulfil the CIG Terms of Reference.
- CDA facilitation shall be designed in accordance with the criteria detailed in ICAO Doc 8168, Volume II, PANS-OPS, supported by EUROCONTROL procedures design guidance.
- Once draft procedures have been produced an 'Interim CDA Assessment' is undertaken covering safety, capacity and workload issues.
- Following a successful 'Interim CDA Assessment' and adequate training of approach controllers and participating pilots, the provisional procedures should be implemented as a limited trial.
- Following a successful trial, CDA is introduced commencing in periods of low density traffic and that further deployment of CDA be decided by the appropriate authority.
- Adequate local guidance, training and promotional activities and materials are developed and applied to maximise the achievement of CDA. This should be combined with regular feedback and reporting on CDA compliance.

Annex A - Roles and Responsibilities

Once CDA has been introduced, a continuous review of progress should be established in order to identify opportunities to improve performance, including suggestions from operational staff. Open reporting should be encouraged amongst all key members.

State and Regulator role

Member States are encouraged to promulgate the use of this CDA guidance material, associated summary pamphlets and pilot support aides to aerodrome operational stakeholders in support of harmonisation and environmental good practice.

Where the introduction of CDA could affect (or be affected by) another aerodrome (such as in complex TMAs), it is recommended that the national authorities are involved to address this at strategic level.

It is recommended that the regulator undertakes, supports or validates the recommended safety reviews associated with CDA implementation and supports airspace or approach procedure redesign if necessary.

It is a requirement that CDA techniques and definitions are published in the relevant section of the AIP.

Air Navigation Service Provider Role

The ANSP should proactively support the activities indicated in the "Joint Responsibilities" section above and in particular it is recommended that:

- A CDA related ATC procedure is developed and agreed through the CIG following the aims, text and phraseology used in the main body of this document.
- All relevant ATC staff receive adequate awareness briefing and continuation training to allow them to continue to facilitate CDA. Particular attention should be given to assessing distance-to-go and the use of speed control.
- Consideration is given to the use of "standard speeds" during higher intensity traffic operations. These should embrace the speeds appropriate to the aircraft types using the airport.

Annex A - Roles and Responsibilities

It is recommended that all relevant ATC staff are informed of the operational, economic and environmental benefits from using CDA techniques and given regular feedback.

Aircraft Operator Role

Aircraft Operators should proactively support the activities indicated in the "Joint Responsibilities" section above and in particular it is recommended that Aircraft Operators should:

- Consider the use of simulators to assess proposed CDA associated with LP/LD techniques.
- Review company Standard Operating Procedures.
- Encourage pilots to apply CDA techniques in order to:
 - minimise the extent of level flight segments where ATC procedures or instructions allow;
 - optimise the descent profile to improve the noise attenuation effects of increased altitude; and,
 - minimise both airframe and engine noise.

Annex A - Roles and Responsibilities

Aerodrome Operator Role

The Aerodrome Operator should proactively support the activities indicated in the 'Joint Responsibilities' section above and in particular it is recommended that:

- Local strategic advice and policy guidance is provided to the CIG (often the aerodrome will take the central facilitation and co-ordination role).
- Where available, information from a Noise and Track Keeping monitoring system is made available to airlines and the ANSP to support performance management.
- The CIG is adequately supported regarding environmental and community relations expertise including the assessment and evaluation of environmental benefits etc.
- Where appropriate, effective communications with local stakeholders (e.g. community representatives, environmental regulators etc) is provided.

Annex B - Performance Management

Overview

In order to estimate total environmental benefits and to measure compliance, it is important to regularly monitor the level of success in deploying CDA, feeding back progress reports to those involved. This should form the basis of a database of local CDA information

Local benefits will vary due to a range of factors including the base-case average profile, the fleet mix, the CDA type and the number of successful CDA approaches achieved. Achieving the maximum benefit from CDAs will take time and will be supported by good practice, collaborative performance management, including performance assessment, monitoring, reporting and review.

An accurate continuous local assessment of CDA benefits will require sophisticated tools and skills (described below). Where an airport does not have this capability, it is sufficient to monitor the number of CDAs offered and to periodically assess a suitable sample of flights to determine the average proportion of successful CDA deployment.

Operational Performance Assessment

Performance management should use the indicator "% of arrivals successfully achieving CDA" based on the CDA definition in this guidance document.

In determining what constitutes "successfully achieving CDA", it should be borne in mind that the objective of CDA is to avoid, to the extent possible, periods of level flight. The parameters that define level flight should be determined locally.

Once tracking of the recommended indicator is established it may be helpful to collaboratively establish a local CDA performance target in order to identify whether ongoing progress is acceptable.

The recommended indicator value can then be multiplied by the per flight benefit to assess the overall cumulative benefit delivery.

Ideally (but not essentially) a "Noise and Track Keeping Monitoring System" (NTK system) can support the monitoring requirements by providing 4D correlated flight tracks for individual aircraft. NTK systems may be programmed to automatically track the proportion of successful CDAs achieved. It is also feasible to use radar or Flight Data Recorder data to provide sufficient data for periodic assessment of CDA achievement.

Annex B - Performance Management

For radar variant, the track distance information provided should be monitored and checked for accuracy against actual distances flown by aircraft.

In order to improve the understanding of why performance variances occur, it is recommended that records be kept of key parameters for periods when performance is being assessed. This should include:

- aerodrome configuration;
- meteorological parameters (visibility, wind speed and direction, QNH etc);
- traffic density; and
- aircraft type.

This data can also be combined with information on single event performance to examine in more detail why variance occurs and to help improve procedures, training and practice. Such information may be commercially sensitive and should be handled appropriately.

Noise Assessment

As part of the cost/benefit assessment the noise impact of aircraft for both before and after the introduction of CDA could be modelled.

Noise modelling should be undertaken using a methodology compliant with the latest version of ECAC Doc 29, Third Edition.

Because of the relatively low individual aircraft noise levels in the areas where CDA is deployed (i.e. typically at more than 10 nm from the threshold) and given the potential for significant variations in factors that can influence measurements, the method of performance evaluation should be determined locally. Noise monitoring should not be taken as a main indicator.

Annex B - Performance Management

Fuel Use and Climate Change Assessment

Fuel use can be calculated using FDR data and simple profiling tools and this information can also be used to calculate climate change-related cost or benefits. EURO-CONTROL is able to analyse fuel-use and provide emissions data.

Using Performance Data

Reporting could include:

- "% of arrivals successfully achieving CDA";
- progress towards target CDA achievement;
- cumulative noise, fuel and emissions benefits; and
- identification and planning for improvements to be addressed.

Performance data should be reviewed regularly by the CIG and feedback should be provided to operational staff to support motivation and engagement.

'Individual event' type performance data (e.g. the trial results or results for a single carrier) should be quickly provided to the relevant stakeholder(s) so that recent events can be evaluated whilst fresh.

It may be beneficial for the organisation responsible for collecting performance data (usually the aerodrome) to facilitate confidential benchmarking between carriers to encourage best practice.

Aggregated performance information can also be used for community reporting through established community relations interfaces and protocols. It would be inappropriate to publicly report performance details of individual flights.

It should be noted that during Low Visibility Procedures (LVPs), adverse atmospheric conditions or for other operational reasons (for example, type of approach), CDA compliance rates may be reduced.

Annex C - CIG Specimen Terms of Reference

The CIG should comprise senior representatives from the aerodrome operator, ANSP, lead carrier(s) and appropriate State authorities. It is also acceptable for the duties set out below to be formally included in the Terms of Reference of an existing body where the required stakeholders are present.

The CIG will ensure that:

- All parties involved in implementing CDA should maintain an up-to-date understanding of:
 - which organisations are participating;
 - their own role and responsibilities;
 - the roles and responsibilities of other participants; and,
 - the status of the CDA procedure (e.g. its definition and scope and when and how it is to be applied).
- A simple CDA Implementation Plan is prepared.
- Once draft procedures have been produced an 'Interim Assessment' is undertaken covering safety, capacity and workload issues. A separate Hazard Analysis should be done prior to the start of the trial.
- Following a successful 'Interim Assessment' and adequate training of approach controllers and participating pilots from the lead or nominated carrier(s), the provisional procedures are implemented as a limited trial.
- Once the trial is commenced, a continuous review of progress is undertaken in order to identify opportunities to improve performance including suggestions from operational staff. Open reporting should be encouraged amongst all key members and appropriate feedback arrangements implemented to identify those flights in which a CDA was commenced but terminated or modified.
- Following a successful trial, CDA is introduced commencing in periods of low density traffic and that the deployment of CDA is gradually extended both in terms of the number of carriers involved and the time period covered.
- Adequate local guidance, training and promotional activities and materials are developed and applied to maximise the achievement of CDA. This should be combined with regular feedback and reporting on CDA compliance.

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Abbreviations

<i>AIP</i>	<i>Aeronautical Information Publication</i>
<i>ATC</i>	<i>Air Traffic Control</i>
<i>ATIS</i>	<i>Automatic Terminal Information Service</i>
<i>CDA</i>	<i>Continuous Descent Approach</i>
<i>CEM</i>	<i>Collaborative Environmental Management</i>
<i>CIG</i>	<i>CDA Implementation Group</i>
<i>DTG</i>	<i>Distance To Go (Distance from Touchdown)</i>
<i>ECAC</i>	<i>European Civil Aviation Conference</i>
<i>FMS</i>	<i>Flight Management System</i>
<i>IAP</i>	<i>Instrument Approach Procedure</i>
<i>ICAO</i>	<i>International Civil Aviation Organisation</i>
<i>LP/LD</i>	<i>Low Power/Low Drag</i>
<i>P-RNAV</i>	<i>Precision-Area Navigation</i>
<i>QNH</i>	<i>Barometric pressure setting to give altitude above mean sea level</i>
<i>RTF</i>	<i>Radiotelephone/Radiotelephony</i>
<i>SEL</i>	<i>Sound Exposure Level in decibels (dB) (see note)</i>
<i>SID</i>	<i>Standard Instrument Departure</i>
<i>SRA</i>	<i>Surveillance Radar Approach</i>
<i>STAR</i>	<i>Standard Arrival Route</i>

Note: *SEL* is used to describe the amount of noise from an event such as an individual aircraft flyover. As the decibel scale for denoting sound energy is logarithmic, a change of $\pm 3\text{dB}$ equates to a halving or doubling of sound energy.



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