Continuous Descent

A guide to implementing Continuous Descent

IATA canso ACI EUROPE AIRPORTS COUNCIL INTERNATIONAL EUROCONTROL

The effects of aircraft noise and atmospheric emissions can cause constraints at aerodromes and increase operational costs. The implementation of **Continuous Descent Approach** (**CDA**) at airfields is acknowledged as being one method that helps mitigate these problems. Consequently, implementation of harmonised, capacity-friendly versions of the CDA technique can be beneficial to all European ATM system stakeholders and is in demand by aircraft operators.

AN INDUSTRY-WIDE COLLABORATIVE EFFORT

The European CDA implementation programme is a collaborative European project that has the backing of all players in European ATM.

In September 2008, CANSO, IATA and EUROCONTROL signed up to a Flight Efficiency Plan that includes a specific target to increase European CDA performance and achievement. This was followed in October 2008 by a Memorandum of Understanding between ACI EUROPE and EUROCONTROL to work on a range of collaborative initiatives to improve efficiency at airports, and these include CDA. This resulted in the publication and launch in 2009 of the ***European Joint Industry CDA Action Plan***, which built on the high-level commitments and set out specific actions for the European Aviation Industry to ensure CDA's rapid deployment.

The implementation plan is to ensure the widespread adoption of harmonised CDA techniques:

- To as many airports as possible;
- For as many flights as possible;
- For the longest extent possible for each flight; and,
- Optimising existing CDA implementations where possible.

The aim is to achieve short-term gains' and secure the rapid deployment of CDA, even if on a 'simple' basis to start with, but with a view to continuously improved performance in all of these areas.

CDA OVERVIEW

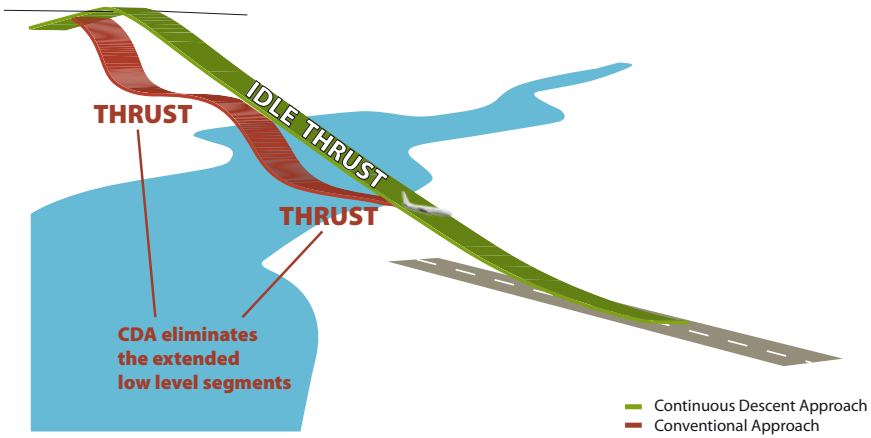


Figure 1 - Conceptual Diagram of "CDA"

Continuous Descent Operation (CDO) and Continuous Descent Approach (CDA)

In ICAO Document 9931, the '**Continuous Descent Operations Manual'**, CDO is defined as "an aircraft operating technique aided by appropriate airspace and procedure design and appropriate ATC clearances enabling the execution of a flight profile optimized to the operating capability of the aircraft, with low engine thrust settings and, where possible, a low drag configuration, thereby reducing fuel burn and emissions during descent. The optimum vertical profile takes the form of a continuously descending path, with a minimum of level flight segments only as needed to decelerate and configure the aircraft or to establish on a landing guidance system (e.g. ILS)."

Doc 9931 also says:
"Note: *The Generic term "CD Operations" (CDO), has been adopted to embrace the different techniques being applied to maximize operational efficiency while still addressing local airspace requirements and constraints. These operations have been variously known as, Continuous Descent Arrivals, Optimized Profile Descents, Tailored Arrivals, 3D Path Arrival Management and Continuous Descent Approaches*".

The European definition, as approved by Stakeholders is:

"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".

The terms CDO - CDA are interchangeable and should be read and understood in the same context. For simplicity, this pamphlet will refer to CDA, unless the term 'CDO' appears as a document title.

ACHIEVING THE CONCEPT

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

- The 'simple' CDA: provision of DTG (Distance To Go) information by Air Traffic Control (ATC) during vectoring.
- Standard Arrival Routes (STARs) (including PRNAV, PBN, Point Merge, transitions etc) which may be designed with vertical profiles.
- 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 DESCENT PROFILES

It is acknowledged that the perfect/ideal CDA commences from ToD and ends at touch-down; however the reality of the situation is that airspace congestion and operational limitations do not allow for this in most circumstances. Therefore, the over-riding principle is for the local implementation of a simple and effective CDA technique based on the following:

- CDA is available from Top of Descent (ToD) to a limitation, such as a hold/fix, airspace boundary, Level restriction, etc. CDAs can be flown from ToD to this limitation, and can also be measured.
- The 'limitation' is a known entity and is not necessarily associated with a CDA. This part of the CDA is an optional measurement parameter.
- The CDA is then recommenced from the bottom of the limitation and measured again.

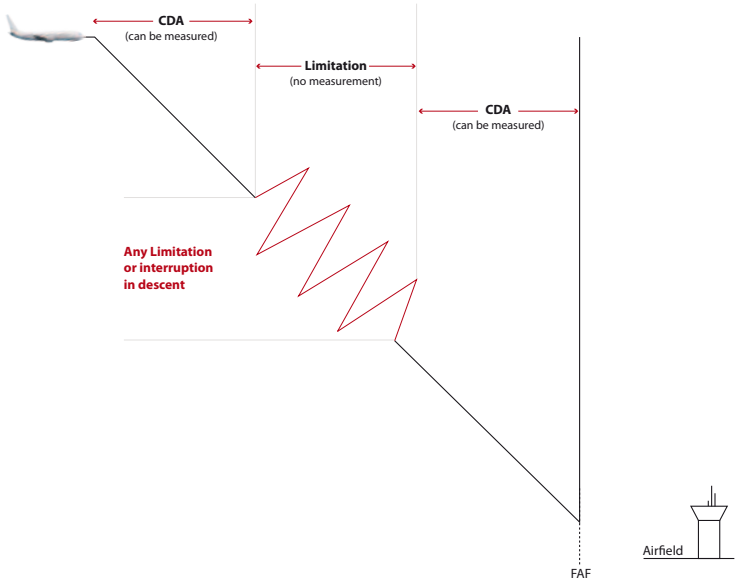


Figure 2 - Descent limited or interrupted – CDA profiles

The principle is that CDA can be implemented from any altitude but, where and when possible, the aim should be an optimised descent profile from ToD.

Future Air Traffic Management tools and procedures will provide more advanced facilitation of CDA. While acting now, we should therefore plan for these developments.

KEY CDA ELEMENTS

One of the most important requirements for successful CDA operations is PREDICTABILITY for the pilot.

Airspace design

As applicable for published CDA facilitation (R-NAV, P-RNAV STARs, PBN, Point Merge, Transition, etc.):

- CDA route profiles should be achievable for all aircraft types and flight conditions (as per flight procedure design).
- CDA altitude constraints should be preferably defined and expressed with "at or above" or "at or below" (rather than fixed prescribed altitude), and should be compatible with speed constraints.

Aeronautical Information Publications (AIPs)

- AIPs should present all CDA-relevant information on charts in a clear and unambiguous manner.

- AIPs should present airspace users with the relevant information and conditions for CDA:
  - Where and when CDA should be offered (applicable runway, time period, etc.);
  - To whom it applies;
  - What CDA facilitation type is offered.

Traffic planning and coordination

- Conditions and criteria for CDA initiation should be clearly identified and communicated.
- Planning and sequencing of arrivals should take into account CDA traffic profile and performance variability.
- Transfer of CDA traffic should be coordinated properly between ATC sectors, if CDA is performed across sectors.

Tactical Air Traffic Control

- ATCOs should be trained on CDA principles and their influence on flight trajectories.
- ATCOs should be aware of aircraft energy management principles (to anticipate CDA traffic behaviour and to provide instructions consistent with flight management practices).
- ATC should consider profile variations to ensure adequate separation between CDA traffic and between CDA and non-CDA traffic.
- ATCOs can facilitate CDA by giving instructions to 'descend when ready' or 'descend at pilots discretion'.
- ATC should provide pilots with timely accurate distance-to-touchdown information.
- ATC should provide updated DTG at regular time intervals as appropriate.
- ATC speed instructions and/or "direct routeing" instructions should be compatible with CDA philosophy and actual profiles.
- Whenever safety requires it, ATC should interrupt CDA in progress and revert to standard radar vectors with speed and altitude control.
- ATCOs should report any safety issues during CDA.

Flight crews

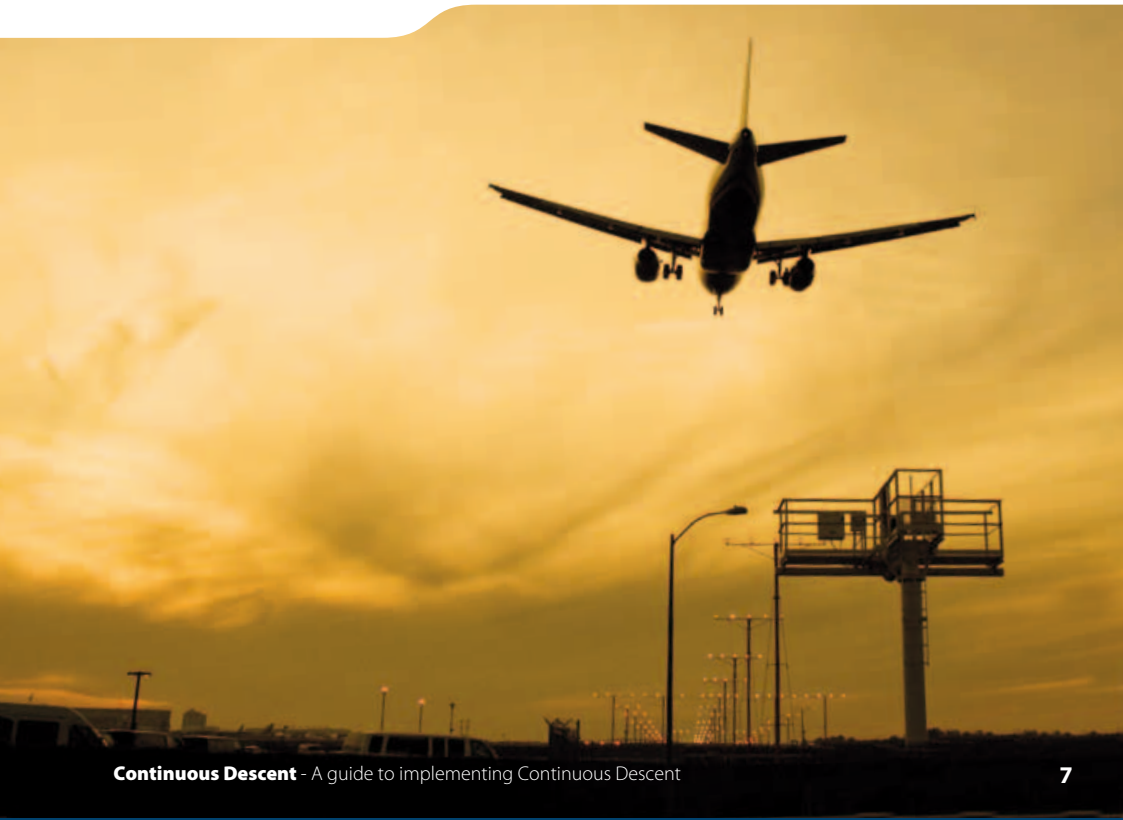
- Flight crews should be trained on CDA principles and interaction with ATC.
- Flight crews should refuse CDA if not appropriate for safe flight management.
- Flight crews should determine the optimum point of initiation and the vertical profile.
- Flight crews should be aware that ATC may facilitate CDA by giving instructions to 'descend when ready' or 'descend at pilots discretion'.
- Flight crews should cross-check present altitude vs DTG.
- Flight crews should keep Flight Management System (FMS) updated, in particular after any intermediate level off or track adjustment.
- Flight crews should ensure the aircraft is stabilised for approach.
- Flight crews should stop CDA if safety considerations require them to do so.
- Flight crews should report any safety issues attributable to CDA through established reporting methods.

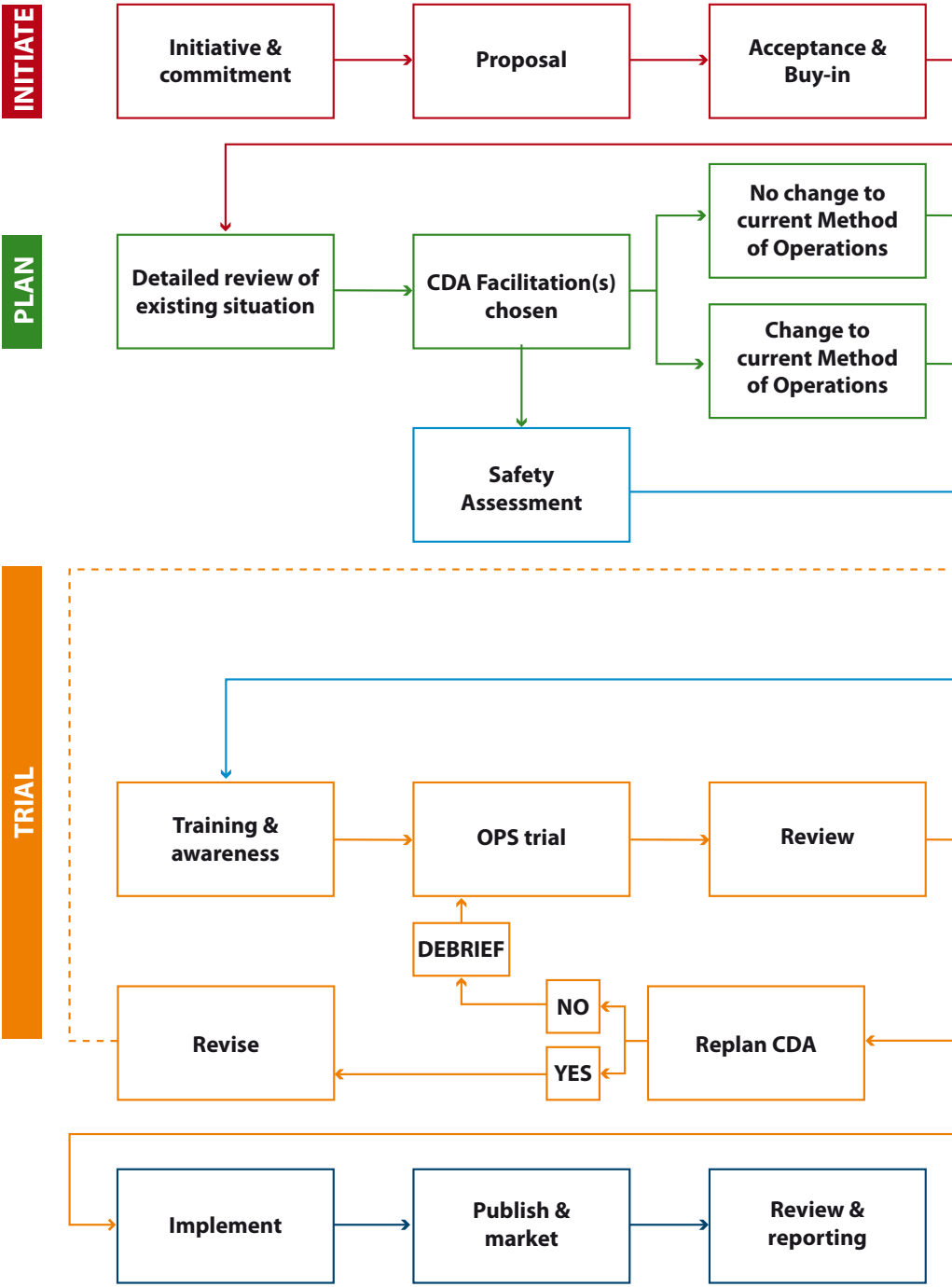
SAFETY

Local implementation of CDA needs to be subjected to a risk assessment and mitigation process on any changes to the ANS/ATM system that might be required.

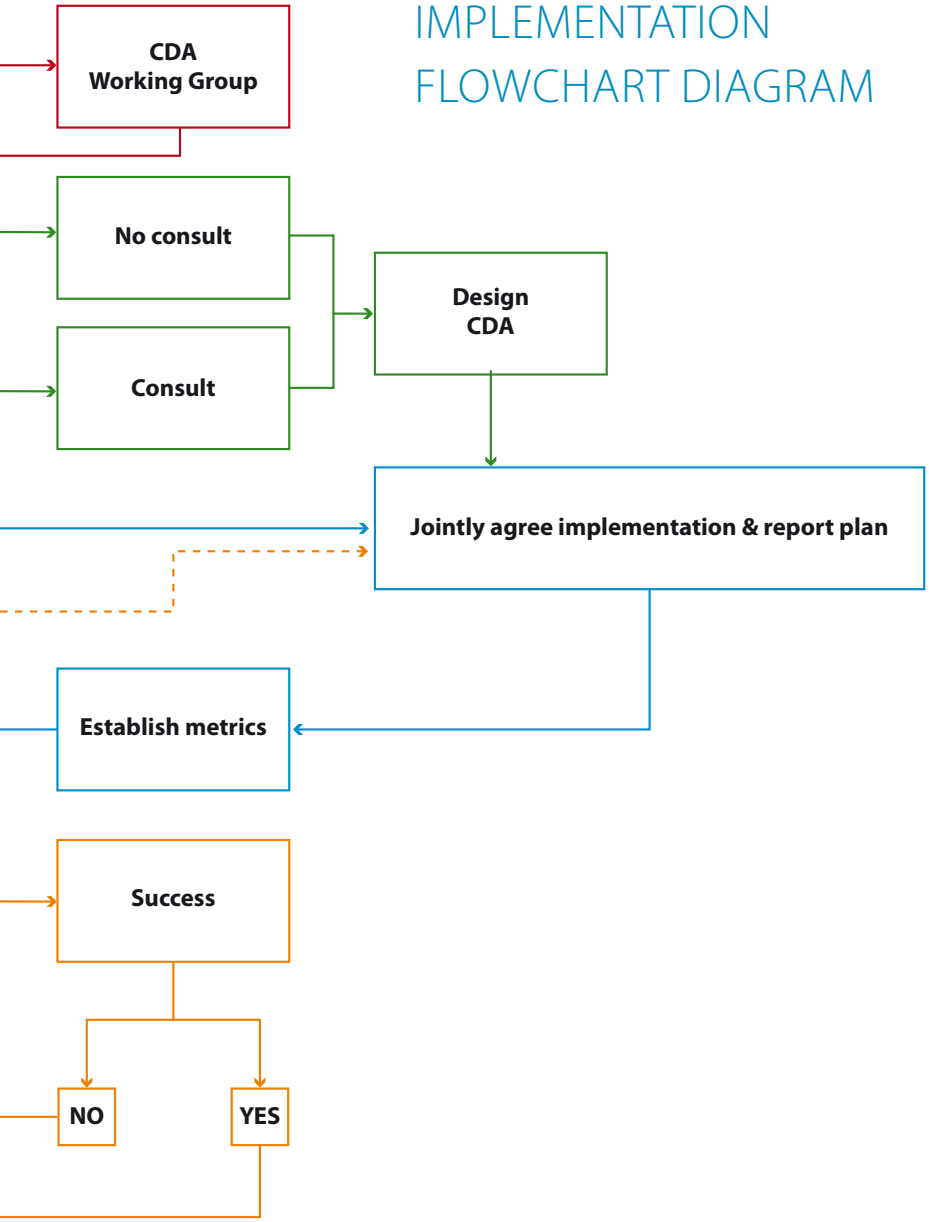
To assist in this task, EUROCONTROL has published the document "***Guidance for safety assessment of Continuous Descent Operations (CDO) implementation at aerodromes in the ECAC area***". The purpose of this document is to provide practical guidance for the development of such a safety assessment.

The guidance document has been developed on the basis of EUROCONTROL's methodology for safety assessment, as applied to the CDA concept in a specimen type airspace and aerodrome. ANSPs can therefore use the guidance document as a basis for developing a local safety assessment, taking into consideration the local operational environment properties, ANS/ATM system architecture and specifics of the CDA to be implemented.




INITIATE
Initiative & commitment
Proposal
Acceptance & Buy-in
PLAN
Detailed review of existing situation
CDA Facilitation(s) chosen
No change to current Method of Operations
Change to current Method of Operations
Safety Assessment
TRIAL
Training & awareness
OPS trial
Review
DEBRIEF
NO
YES
Revise
Replan CDA
Implement
Publish & market
Review & reporting

IMPLEMENTATION FLOWCHART DIAGRAM



Flowchart decode

INITIATE

Initiate/Commitment – Commitment of ANSP, Airlines & Airport operator to assess possibilities to introduce CDA

Proposal – Interested parties to propose what is possible/feasible for CDAs

Acceptance and Buy-In – Acceptance by all parties that the proposal is feasible

CDA Working Group – Establish CDA implementation working group (comprising ANSPs, Airlines, airport, (regulator), environmental personnel, etc.)

PLAN

Detailed review of existing situation – Capture base case including e.g. noise and track keeping, radar data, environmental measurements, extant method of ATM techniques, etc.

CDA facilitation(s) chosen – To achieve the concept

Local Safety Assessment – Runs in parallel with activities

No change to current Method of Operations (MOPS) – This will not require consultation

Change to current MOPS – Consultation and action required. This can run in parallel with Design CDA

Design CDA – This encompasses outcome from consult/no consult and results in CDA design and trial. Members of the design panel should include ANSP (incl. airspace designers), Pilots, airlines, Airport, (regulator). Aircraft simulation for 'flyability' may be required at this stage

Joint Agreement of Implementation Plan and reporting plan – Take CDA Design and Safety Assessment and obtain acceptance of all parties for continuation of the process. Periodic review

Establish metrics – Establish Metrics acceptable to all parties

TRIAL

Training and awareness – Scope training requirements for all parties and ensure communication plans are in place for all participants. Simulation may be required at this stage

Ops Trial – Commence limited operational trial around agreed criteria. This can be expanded to a full trial as and when required

Review of Trial – Conduct review to determine if trial is/was successful

Trial Successful?

No – does CDA need to be replanned?

Yes – Minor revision of CDA then back to training and awareness
Complete Revision required then step back to Design CDA

No – Re-brief then recommence Ops Trial

Trial Successful?

Yes – Move onto implementation

IMPLEMENTATION

Implement – Prepare a full set of procedures as required (including phraseology) to facilitate permanent procedures with all required metrics in place (if relevant)

Publish and Market – Publish CDA in AIP and promote and market CDAs in force to all interested parties that will benefit from CDAs e.g. local communities (noise reduction), etc.

Onward Review and reporting – Continuation of review process, metrics, etc. Produce reports and statistics as required on a periodic basis

Once the trial has begun, a continuous review of progress should be undertaken in order to identify opportunities to improve performance – such a review should include suggestions from operational staff and local airlines. Open reporting should be encouraged amongst all key members and appropriate feedback arrangements implemented to identify those flights in which CDA was started but then terminated or modified.

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