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Continuous Climb Operations (CCO)

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Workshop on preparations for ANConf/12 − ASBU methodology
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Intended Audience

Intended audience:

- air navigation service providers;
- aircraft operators;
- airport operators; and
- aviation regulators.

Objectives

Provide guidance on continuous climb operations (CCO) to harmonize their development and implementation.

Overview

- What is a CCO?
- Rationale
- Understanding CCO
- Procedure design
- Specific issues
- References

What is a Continuous Climb Operations

- CCO is an aircraft operating technique enabled by airspace design, procedure design and facilitation by ATC, enabling the execution of a flight profile optimized to the performance of the aircraft.
- The optimum vertical profile takes the form of a continuously climbing path.

Continuous Climb Operations - Rationale

The climb phase uses a significant proportion of the total flight fuel and, efficiencies in this phase could provide significant economy of operation and environmental benefits in terms of both noise and emissions.

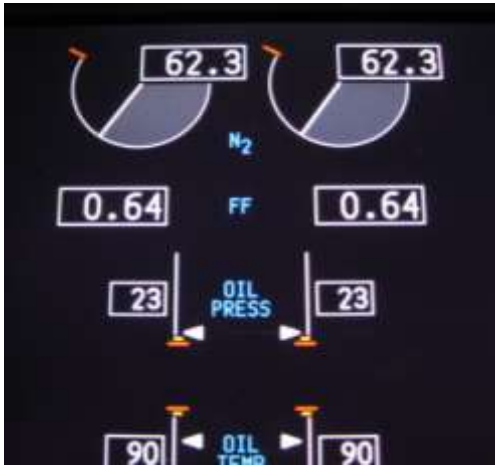
Understanding Continuous Climb Operations (CCO)

Continuous Climb Operations:

- Are enabled by airspace design, procedure design and ATC facilitation
- Requests collaboration between stakeholders
- Allows aircraft to attain initial cruise flight level at optimum air speed with climb engine thrust settings set throughout the climb

Understanding Continuous Climb Operations (CCO)

- Increase efficiency, flight predictability and airspace capacity
- Reduces noise, fuel burn, emissions and controller-pilot communications
- Maintain safety



Understanding Continuous Climb Operations (CCO)

- Ideally the departure design is such that arriving traffic is able to descend at their optimum descent profile

- Before any CCO trials or operations commence, the proposed implementation needs to be the subject of a local safety assessment.

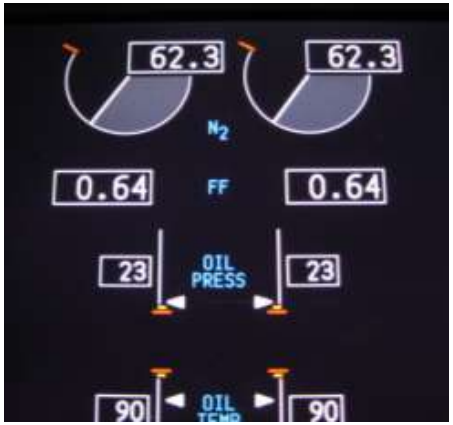
Procedure and airspace design

- Need an understanding of the optimum profiles for aircraft operating at the airport
- Avoid height and speed constraints that prevent efficient climb profiles
- Avoid the need to resolve potential conflicts between the arriving and departing traffic flows through ATC height or speed constraints.

Optimum Vertical Path

The optimum climb gradient will vary depending on:

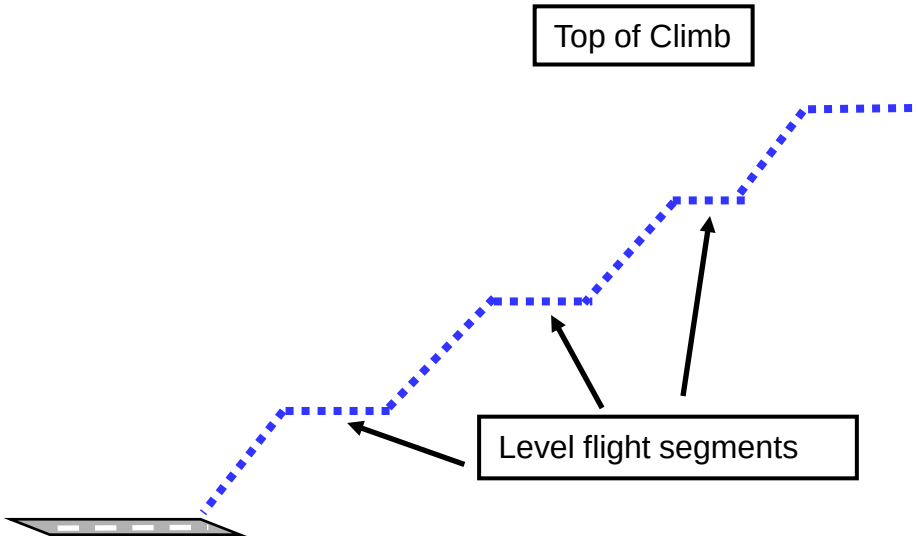
- type of aircraft
- its actual weight
- the wind
- air temperature
- atmospheric pressure
- other dynamic considerations



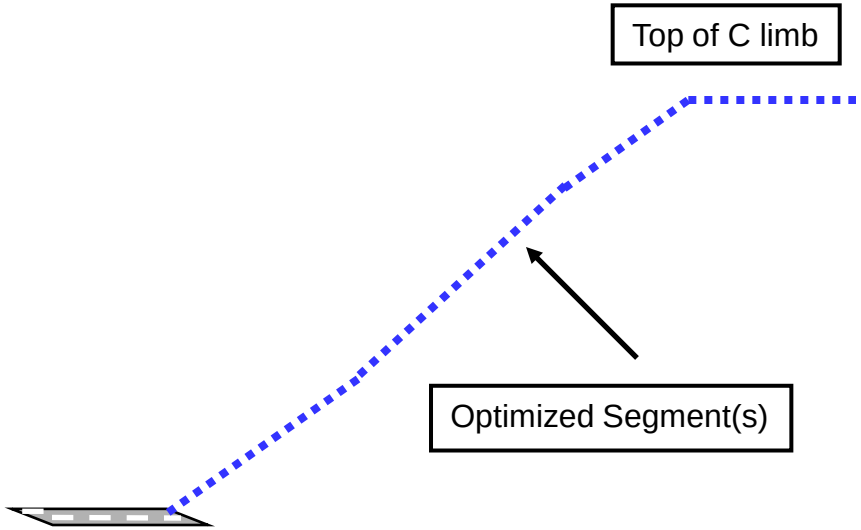
- CCO should be codified as a Standard Instrument Departure (SID) so that both pilots and controllers have a fixed consistent procedure to refer to in advance.

Conventional vs. CCO

Conventional Departure



Continuous Climb Operations



Trade-offs

Between CCO and CDO

- Consider that a level segment for an aircraft in descent would normally burn less fuel than for the same duration of level segment for an equivalent aircraft in climb.
- Balance will depend on local characteristics (e.g. extent of level flight in both phases, significance of noise in the areas affected)

Collaboration

Objectives should be collaboratively identified by:

- airspace users, ANSPs, airport operators as well as by government policy

- may involve local communities, planning authorities and local government

Restrictions

- To not compromise safety and capacity, it may not always be possible to fly fully optimized CCO.

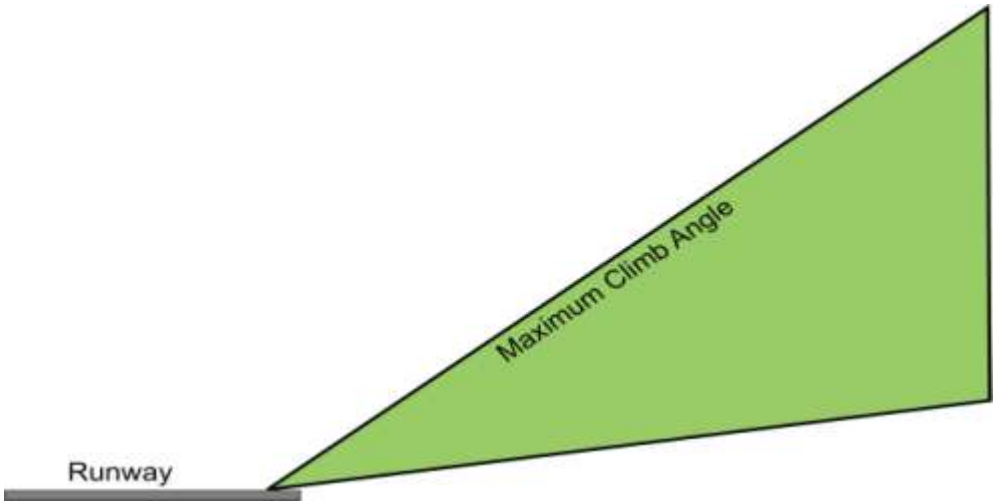
- The aim should be to maximize CCO to the extent possible, while not adversely affecting safety and/or capacity.

Restrictions

- Factors such as other traffic flows, terrain, restricted airspace, aircraft performance, and noise abatement requirements will all serve to modify the design of the theoretical most efficient path, often preventing the realization of the shortest path or the most efficient climb.

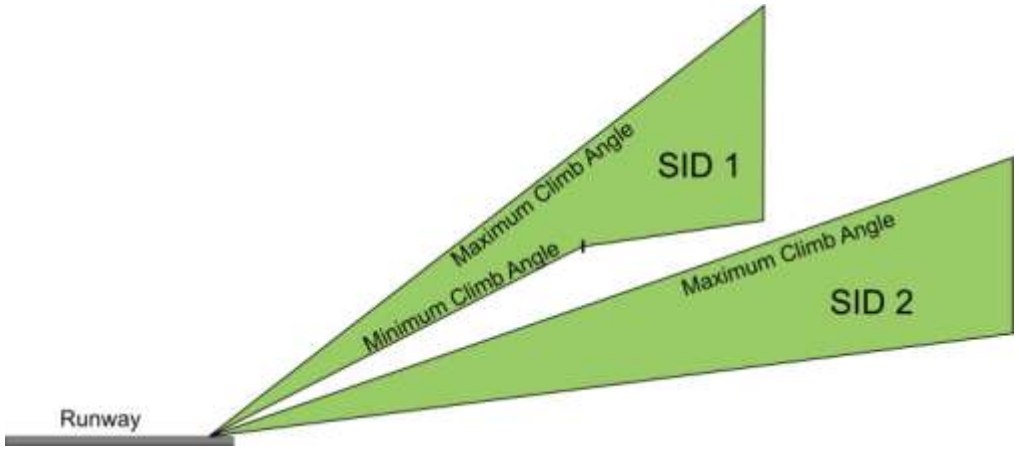
Basic CCO

- Allows for unrestricted climb rates for all aircraft
- Requires a significant amount of vertical airspace be set aside to protect the climb
- May also extend the route in order to give lower performing aircraft the distance necessary to clear obstacles

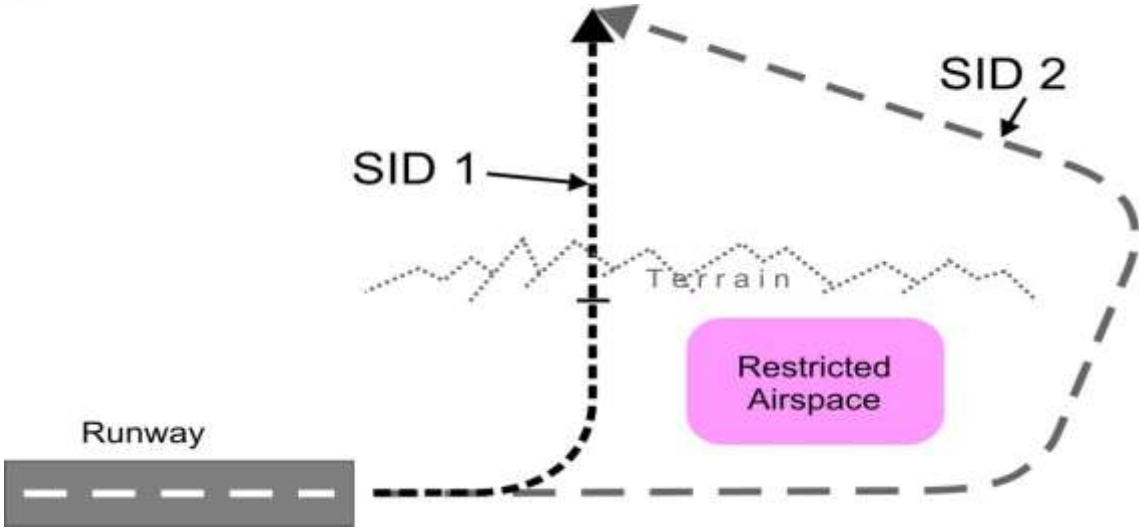


Enhanced CCO

Design with multiple climb gradients



Profile view



Top view

Specific issues

Airspace/procedure design

- Departure route designed to allow the crossing of other flows of traffic to one of more runways and one or multiple airports in the Terminal system, at ranges from the runway(s) that the crossing traffic flows will be naturally separated by height when climbing or descending along their optimum profile.

Specific issues

Flight operation

- Unrestricted climb to cruise flight level with no speed restrictions is also desirable but may not be achievable

- Pilot's ability to conduct a CCO depends also on the ATC clearance to be followed, either tactically or by published procedures.

Specific issues

ATC techniques

- Execution of published CCO requires flexible airspace design and sectorisation with sufficient room to allow the aircraft to ascend in accordance with the parameters computed by the FMS.

References

- Doc 4444 – PANS-ATM
- Doc 9426 - Air Traffic Services Planning Manual
- Doc 9613 – Performance-based Navigation (PBN) Manual
- Doc 9931 - Continuous Descent Operations (CDO) Manual

- Continuous Climb Operations (CCO) Manual (under development)

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