

Supporting  
European  
Aviation



# FABEC SC ENV - VFE Workshop

## VFE during climb and descent

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CCO / CDO TF

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## Presentation objectives

- Latest insights on CCO/CDO from the CCO/CDO TF
- Limits to 100% fuel efficiency
- Interdependencies and trade-offs (CCO/CDO and HFE/VFE)
- Indicators for CCO / CDO
  - Can the indicators detect real inefficiencies?
  - Can level-offs be good?

## European CCO / CDO Task Force

Established 2016

- Agreed harmonised CCO / CDO definitions plus metric and parameters for measurement - <https://www.youtube.com/watch?v=mUkMPb5eVJI>
  - Metric: “average time in level flight”
- First ECAC-wide study on CCO / CDO

Re-activated at NETOPS/20 (Early 2018)

Members: 100+

- Airports, ANSPs, Airlines, Industry

Mandate ends – end 2020

Next steps – CCO / CDO to become a permanent agenda item on RNDSG

## European CCO / CDO Task Force

Deliverables (1):

### European CCO / CDO Action Plan

- Released 6<sup>th</sup> November 2020



<https://www.eurocontrol.int/publication/european-cco-cdo-action-plan>

# European CCO / CDO Task Force

Deliverables (2):

## CCO / CDO performance dashboard

- All airports in Europe\*
- All airlines flying in Europe\*

\* Subject to data availability

**Overview**

Airport View -1

Airport View -2

Airline View

Jaar (2019)

2019

2020

Maand

januari

februari

maart

april

mei

juni

juli

augustus

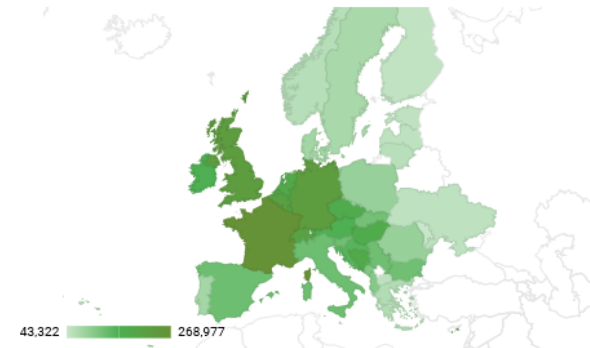
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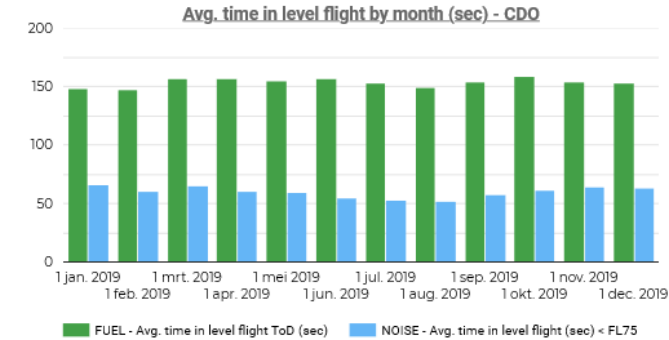
november

december

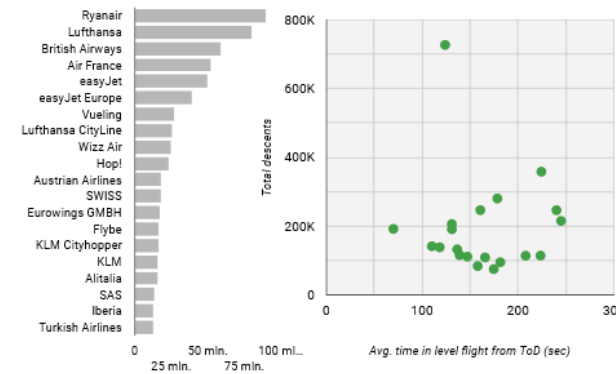
CDO - Continuous descent operations in the EUROCONTROL area



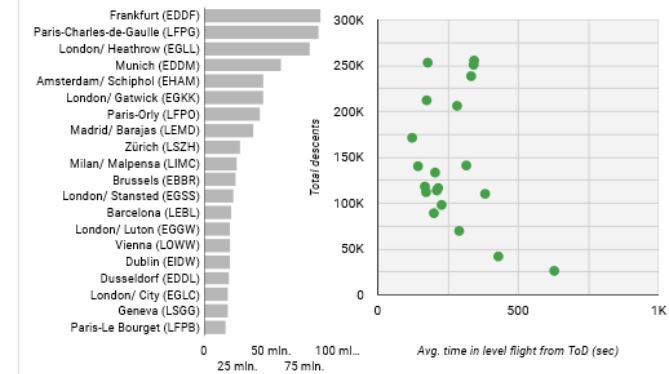
[Click to change to CCO](#)



Top 20 airlines in terms of total time in level flight (descents \* sec)



Top 20 airports in terms of total time in level flight (descents \* sec)



<https://ansperformance.eu/efficiency/vfe/>

# European CCO / CDO Task Force

Deliverables (3):

## CCO / CDO Tool Kit:

- <https://www.eurocontrol.int/concept/continuous-climb-and-descent-operations>

- **ATCO refresher training on aircraft energy management**
- **Pilot CBT on CCO / CDO**



The screenshot shows the 'Training Zone' interface with a dark blue header containing the Eurocontrol logo, 'Training Zone' text, and navigation links for 'News', 'Calendar', 'Catalogues', and 'Login'. The main content area features the title 'Continuous descent operations refresher for ATCs [ATC-R-CDO]' and the label 'e-Learning Course'. Below the title is a large image of a pilot's face with a complex flight path overlay showing various parameters like altitude (4000, 5000), speed (12.5, 104, 108), and heading (284, 104, 108, 100). A blue box on the right side of the page provides course details: 'Available now', '12 Months max. study period', and '4 Hours Duration'.

## Other TF outcomes: CCO vs CDO

- In Appendix H (CCO / CDO facilitation), the AP introduces some findings on CCO / CDO and VFE / HFE trade-offs, in order to stimulate further discussion
- If the option is a level-off in the climb OR descent, for certain aircraft types, a level-off in the climb may result in a lower fuel penalty than the same distance level-off in the descent:
  - It is not only the weight of the aircraft that influences fuel burn and the decision to optimise CCO vs CDO
  - It is the fuel burn differential between optimum and sub-optimum (level segment FL) FLs for heavier and lighter aircraft
- The **FB differential** between different FLs **for a heavier a/c (in climb) is much smaller** than for the same aircraft **when it is lighter** (in descent)
- A 1 min level-off in climb as opposed to 1 min in descent may save more fuel.....

# Other TF outcomes: CCO + track extension vs non-CCO

- If there is a choice between a track extension to facilitate CCO or a level-off without a track extension for a departure, a level-off may save more fuel than the CCO;
- An example 'medium' a/c below:
  - If you add a 1nm track extension, the 1nm will be flown at Cruise level fuel burn
  - A 1nm track extension (5.93kg fuel consumption) is equivalent to a 2.5nm level-off at FL120

- We want to challenge OPRs and Manufacturers with the data
- In some cases, level-offs may not necessarily be a bad thing.....

GW=77.000 Kg / ISA + 0 °C / Wind= 0 KTS					
Level Off Altitude	Level Off IAS (KTS)	Level off TAS (KTS)	FF (KG/Hr)	Fuel consumption (KG/Nm)	Level Off penalty (Kg/Nm)
5000	250	268	2566	9.57	3.64
12000	280	332	2734	8.23	2.30
19000	280	369	2654	7.19	1.26
26000	280	411	2642	6.42	0.49
33000	273 (Cl 10)	448	2658	5.93	0



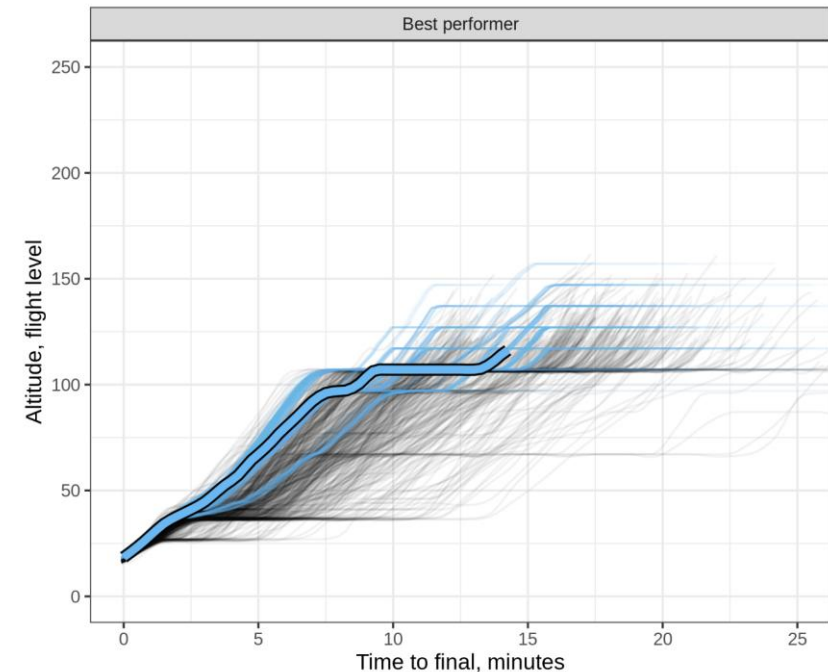
## What limits 100% VFE?

- 100% efficiency is not achievable as some inefficiency is unrecoverable
- Some efficiency is reserved for interdependencies
- CANSO previously estimated the interdependencies relate to half the total inefficiencies in the system – an updated analysis would be worthwhile
- Need a lubricant in the system to enable flexibility to take into account non-standard situations e.g.:
  - Delay en-route / arrival
  - Weather
  - Non-standard situations
  - Emergencies / safety events



# Indicators for VFE: CCO / CDO and VFE en-route

- **CCO / CDO**
  - Harmonisation is essential, in order to demonstrate performance differences and +/- changes over time
  - Optimum would be fuel or CO2 based indicators. Difficulties of such approach are:
    - Data availability from airlines – some happy to share QAR / IATA experiences
    - Singular data source – multiple companies processing data e.g. Jeppesen
    - Legal / Union issues – e.g. in DE
- **VFE en-route**
  - Several other approaches to compare to ACTUAL trajectory e.g.:
    - Optimum – definition
    - Reference
    - Best performer



## Other thoughts

- Green flight initiative - needs some inputs in proposals to take forward
- EZY agreed to discuss possibilities
- Optimise all phases of flight including flight and fuel planning
- Compare green flight to historic fuel burn and COVID fuel burn
- Can we breakdown inefficiency by:
  - Phase of flight?
  - Airspace / traffic complexity?
  - Airline practices?
  - Underlying architecture / procedures?



## Level-offs in climb and descent – a good proxy?

- A level-off is a proxy for inefficiency as fuel flow is higher at lower levels so a level flight segment flown at a sub-optimal FL will increase fuel flow compared to the same level segment flown at the cruise FL
- It is simple, easy to measure and the performance impact is easy to understand
- Historically it is a method that many stakeholders use and in the CCO / CDO TF, when we agreed on the metric “average time in level flight”, it was based upon stakeholder proposals
- But **no metric is perfect**:
  - Level-offs may not necessarily be inefficient (e.g. CCO + track extension)
  - Looking at level-offs alone may hide fuel burn trends
  - An inefficient continuous descent (low RoD) may result in more FB than a level segment - a level-off may be more efficient than a continual descent in fuel burn terms
  - Complementary indicators in fuel burn / CO<sub>2</sub> are required to provide full picture of ENV performance

## Conclusions on VFE indicators for CCO / CDO

- There are several options for measuring VFE in climb /descent and en-route
  - Harmonisation is key for measuring performance
  - Collaborative approach is key
  - OBJ of indicator needs to be defined: Network vs local - sufficient granularity for all stakeholders?
    - Available data for analysis
- Historical stakeholder work on CCO / CDO
  - Focused on level segments
  - New possibilities may arise
- Complementary fuel / CO2 based metrics are required to provide full ENV performance
  - Lots of work currently going on e.g. NM, CAEP, ATM/ANS TG
- Green flight studies
  - Provide further inputs on baseline and benefit pool?

# THANK YOU



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