

Supporting  
European  
Aviation



# FABEC VFE Workshop #2

## 7<sup>th</sup> December 2021

Latest updates on EUROCONTROL work on CCO / CDO and

VFE

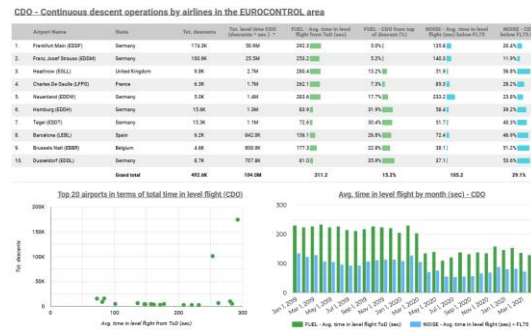
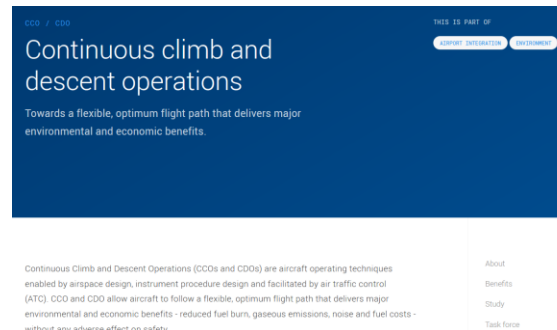
David Brain

EUROCONTROL



# European CCO / CDO TF – Deliverables and next steps

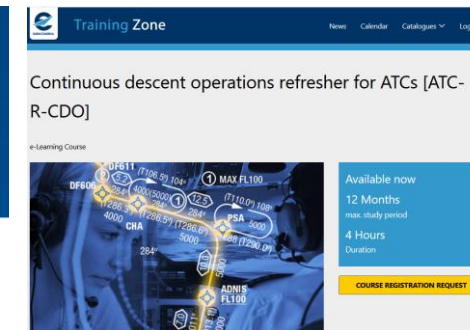
- The European CCO / CDO has delivered five main deliverables: the European CCO / CDO Action Plan, the European CCO / CDO Performance Dashboard, the CCO / CDO Toolkit together with an ATCO refresher training on CCO / CDO and a Flight Crew CBT, both available on the IANS website.

**Continuous climb and descent operations**

Towards a flexible, optimum flight path that delivers major environmental and economic benefits.

Continuous Climb and Descent Operations (CCOs and CDOs) are aircraft operating techniques enabled by airspace design, instrument procedure design and facilitated by air traffic control (ATC). CCO and CDO allow aircraft to follow a flexible, optimum flight path that delivers major environmental and economic benefits - reduced fuel burn, gaseous emissions, noise and fuel costs - without any adverse effect on safety.



**Continuous descent operations refresher for ATCs [ATC-R-CDO]**

Available now  
12 Months max. study period  
4 Hours Duration  
COURSE REGISTRATION REQUEST



**Continuous descent operations refresher for flight crews [ENV-CDO]**

Available now  
12 Months max. study period  
4 Hours Duration  
COURSE REGISTRATION REQUEST

- Mandate ended 2020
- At the end of the mandate of the European CCO / CDO TF in December 2020, the TF members agreed that the priority actions of the TF were to:
  - Provide RNDSG / NETOPS members with regular updates on CCO / CDO performance in Europe; and,
  - Provide stakeholder support in the implementation of CCO / CDO

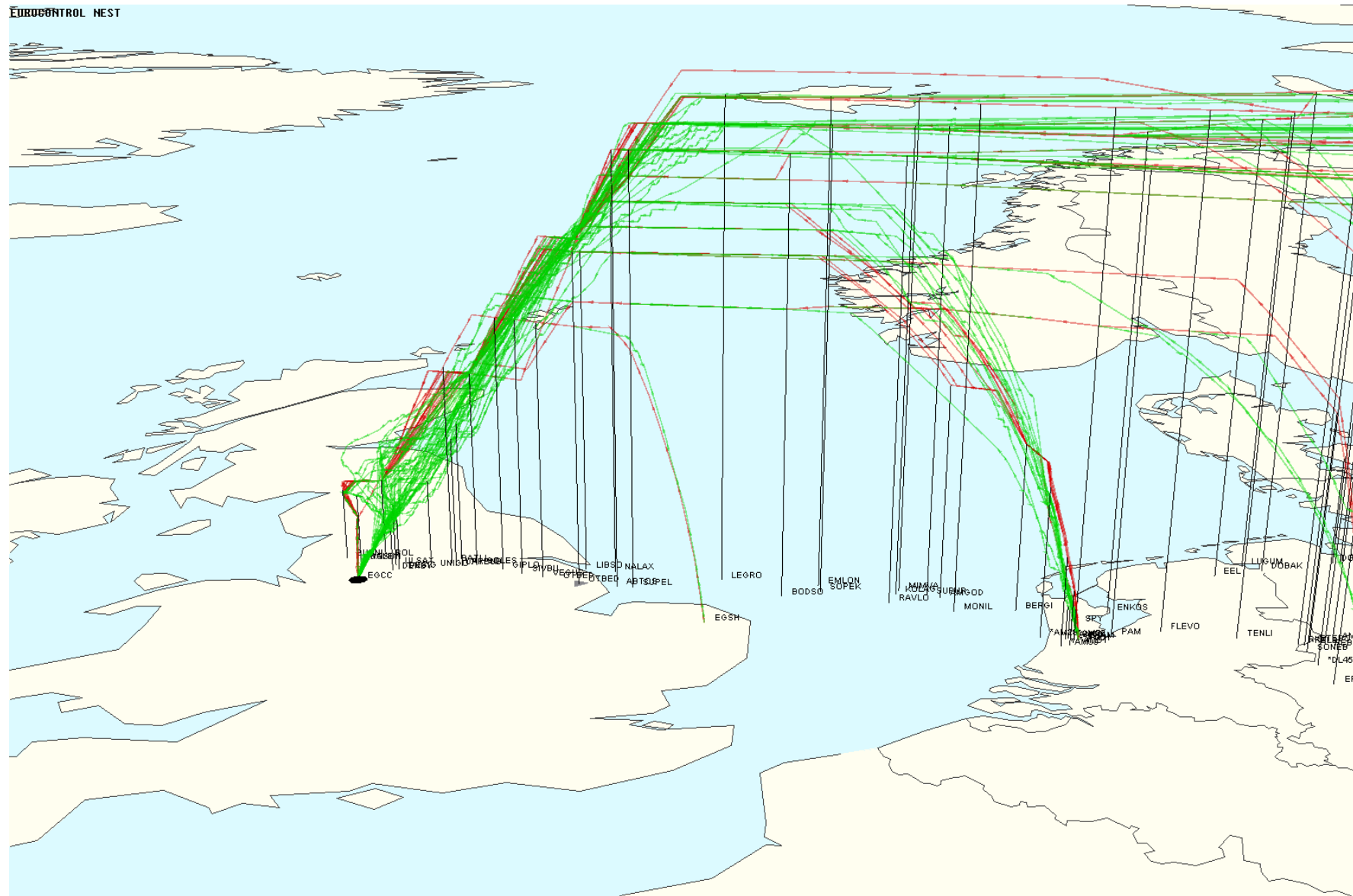
# European CCO / CDO TF - CCO / CDO performance (Airports): April – August 2021

Airport	No. flights APR-AUG	Average level flight (sec) - FUEL	Average level flight (sec) - Noise
Paris-Orly	25.515	317,7	75,8
Paris-Charles-de-Gaulle	52.462	303,6	109,2
Frankfurt	54.210	223,7	78,8
Nice-Côte d'Azur	22.300	211,2	124,8
Munich	29.440	194,0	79,2
Brussels	23.893	162,5	36,7
Milan/ Malpensa	24.765	148,2	58,9
Zürich	26.345	146,3	28,7
London/ Heathrow	35.839	140,8	48,7
Madrid/ Barajas	45.032	117,2	50,6
Amsterdam/ Schiphol	57.224	108,4	86,6
Palma de Mallorca	37.644	106,2	40,0
Vienna	27.403	98,6	43,7
Berlin/ Schoenefeld	20.359	93,3	47,2
Barcelona	35.106	87,6	44,8
Athens	37.031	73,8	49,0
Rome/Fiumicino	24.244	67,6	34,1
Lisbon	24.318	52,1	40,0
Copenhagen/ Kastrup	20.800	50,4	39,8
Oslo/ Gardermoen	22.250	27,6	19,0
<b>ALL</b>	<b>2.008.822</b>	<b>134,3</b>	<b>67,4</b>

Jan – March 2021:  
Fuel CDO – 128.9 seconds  
Noise CDO – 81.7 seconds



# European CCO / CDO TF – Support to European stakeholders



## RNDSG/104 workshop on CCO / CDO / VFE

### Presentations:

- General support to Stakeholders Gabor Fugedi (EUROCONTROL)
- LoA optimisation – Christian Thein (Luxair)
- VFE en-route – PRU
- Development of VFE-related performance indicators – Andrew Burke (NATS)
- NADPs and other noise-related issues – Fran Hoyas (EUROCONTROL)
- Incorporating speed element into CCO / CDO measurements or harmonised descent speeds – Henrik Ekstrand (Novair)
- Introducing innovative solutions – Olivia Nunez (SESAR JU)
- CCO vs CDO principles – Fran Hoyas (EUROCONTROL)

## RNDSG/105 workshop on CCO / CDO / VFE

### Presentations:

- General support to Stakeholders Gabor Fugedi (EUROCONTROL)
- LoA optimisation – Christian Thein (Luxair) – with specific examples (AFR?)
- VFE en-route – PRU
- Development of VFE-related performance indicators – Andrew Burke (NATS)
- NADPs and other noise-related issues – Fran Hoyas (EUROCONTROL)
- Incorporating speed element into CCO / CDO measurements or harmonised descent speeds – Henrik Ekstrand (Novair)
- Introducing innovative solutions – Olivia Nunez (SESAR JU)
- CCO vs CDO principles – Fran Hoyas (EUROCONTROL)
- + CDO from ToD core Europe (DLH / DFS?)

## Conversion of current metrics into emissions (PRU)

Supporting work on EASA / ECTRL ANS/ATM TWG

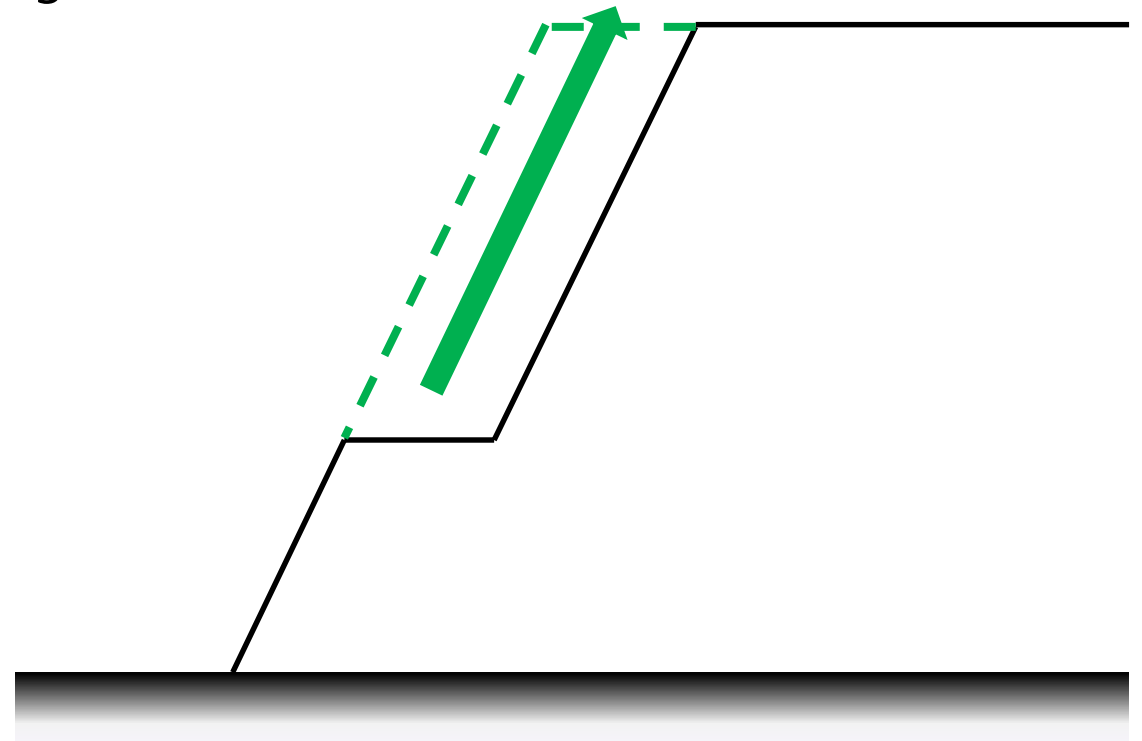
Additional fuel burn/CO<sub>2</sub> emissions of level segments

Assumption:

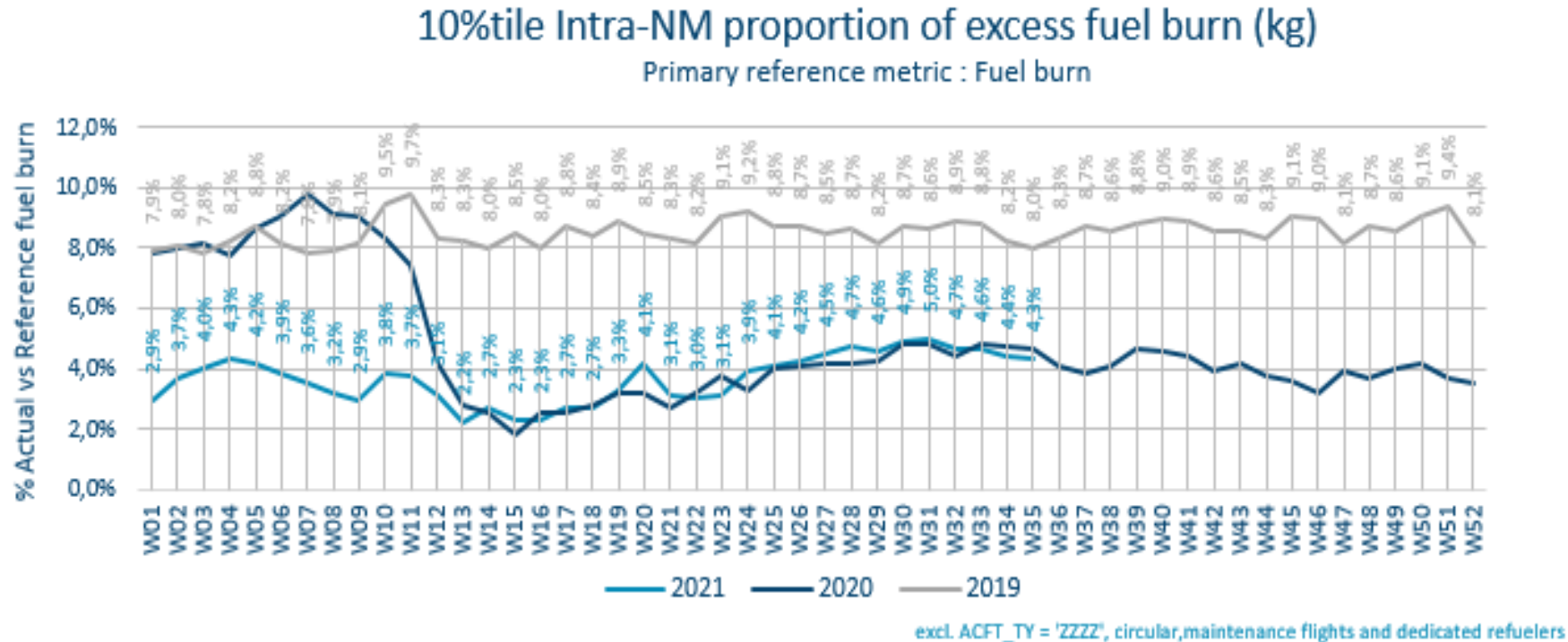
Level segments should ideally be flown at cruising altitude (same distance)

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# NM XFB indicator – and next steps



- Per flight phase
- Per individual airspace (the geographical scope goes down to each elementary sector)
- Gather requirements for future updates (support TWG)



# Metric work in EUROCONTROL – example from DECMA/ATS

Initial analysis of vertical flight efficiency in cruise for European city pairs

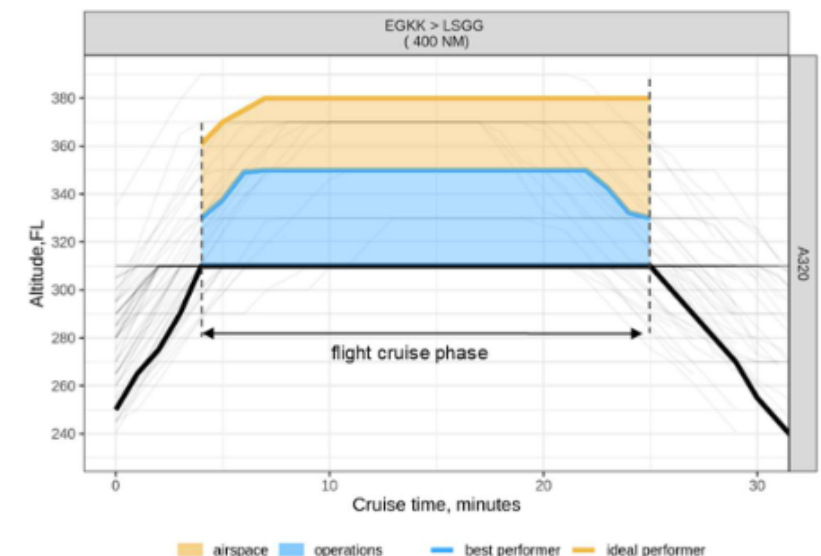
- OBJ - to quantify the contribution of **airspace vs operations** to the inefficiencies.
- Uses an indicator of deviation of individual profiles from two different reference profiles:
  - a best performer (**operations**) of the corresponding city pair; and,
  - an ideal performer (**airspace**) of the corresponding distance between city pair (both defined per aircraft type as the 90th percentile)
- These two references enable the assessment of the amount of deviations, as a proxy for airspace vs operations inefficiencies.
- Results - average excess FB: **25kg airspace** : **60kg operations**

<https://arc.aiaa.org/doi/abs/10.2514/6.2021-2346>

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## Metric work in ICAO – supported by DECMA/ASU/AIU/ATS

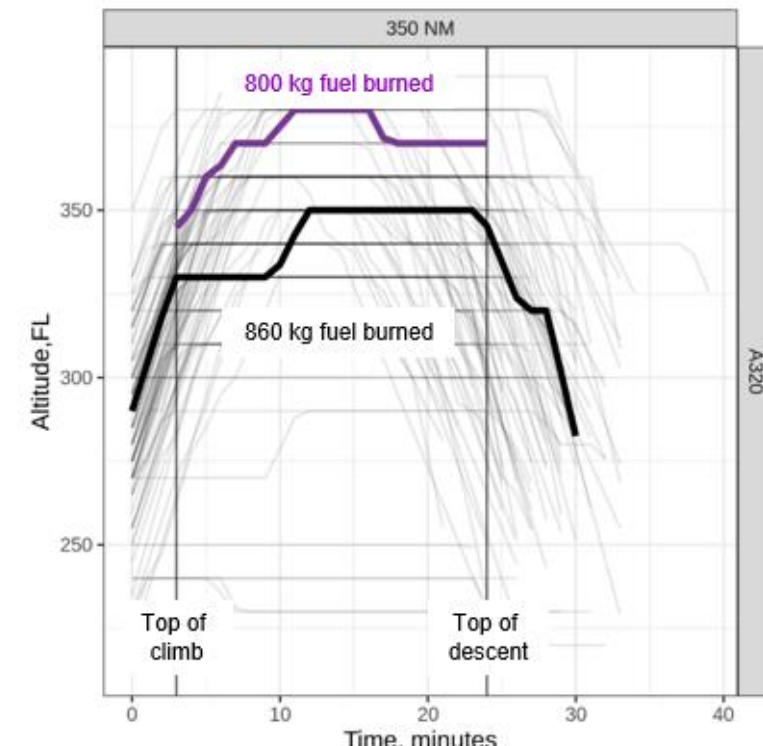
To support global VFE En-Route analysis – a dual approach using two methodologies as two factors to be addressed

(1) - Flights below ~1500nm where step climbs are not usually a factor

- Inefficiency is due to airspace complexity (inefficient CFL / level cap) that limit short haul flights from reaching optimum CFL
- Best performer analysis
- Determine reference profile (e.g. 90th percentile of the observed altitudes)
- Compare actual and reference profile during the cruising phase (FB – kg)

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# Metric work in ICAO – supported by DECMA/ASU/AIU/ATS

To support global **VFE En-Route** analysis – a dual approach using two methodologies as two factors to be addressed

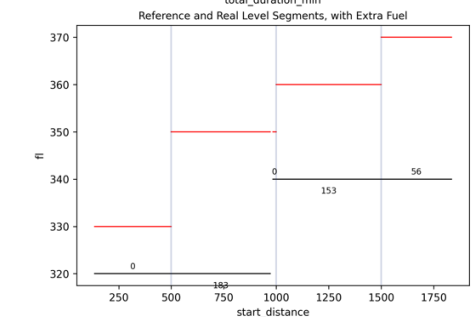
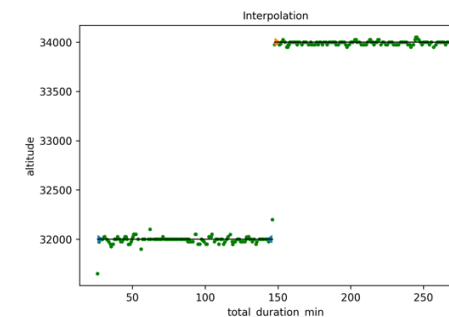
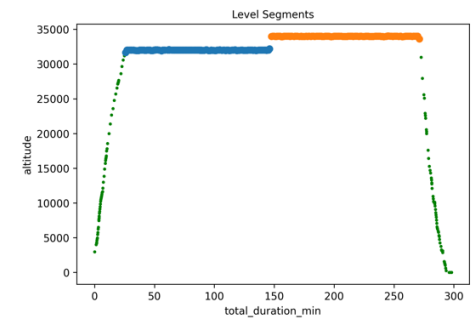
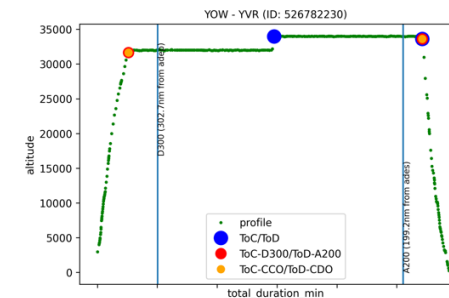
(2) - Flights above ~1000nm where step climbs are usually required

- Inefficiency is due to non-application of optimum CFLs as weight reduces
- Experts agree that it is the specific range (NM/kg) values that indicate the optimal cruising FL for individual aircraft types of different weights
- Based on SR (a/c weights, BADA FB rates, flight distance), we determine a reference profile (optimum CFL)
- Compare FB of actual and reference profile during the cruising phase
- Finished – early 2022?

Stage Length	Weight (lb)	Weight (kg)	OPT FL	NM SL	0-500	500-1000	1000-1500	1500-2500	2500-3500	3500-4500	4500-5500	5500-6500	>6500
1	422000	191000	420	0-500	420								
2	433000	196000	420	500-1000	420	420							
3	445000	202000	410	1000-1500	410	420	420						
4	466000	212000	410	1500-2500	410	410	420	420					
5	493000	224000	400	2500-3500	400	410	410	420	420				
6	522000	237000	390	3500-4500	390	400	410	410	420	420			
7	553000	251000	380	4500-5500	380	390	400	410	410	420	420		
8	585000	265000	360	5500-6500	360	380	390	400	410	410	420	420	
9	606000	275000	350	>6500	350	360	380	390	400	410	410	420	420

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# EUROCONTROL work on CCO / CDO and VFE - Conclusions

- Dashboard for CCO / CDO – <https://ansperformance.eu/vfe>
- Support to stakeholders – 60 major PBN changes in next ~5 years
- LoAs – need to demonstrate benefits and push States to review
- Support to ECTRL / EASA ANS/ATM TWG:
  - Review current metrics
  - Identify candidate metrics for RP4 / Operational performance measurement
  - Transform proxy metrics into CO2
- Research – continues....
  - New metrics for TMA e.g. best / ideal performer
  - VFE in the en-route
    - Support European analysis
    - Support global studies to bring back to Europe
    - Get foothold in RNDSG to address VFE ER

# THANK YOU



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