



Second Arab Forum for Environmental Protection in the Arab Civil Aviation Industry

Session IV: Airports, Operations and Infrastructures

The role of ATM/Operations in achieving the LTAG: Focus on Europe



David Brain

EUROCONTROL: ICAO Coordinator

Marrakech, 26th & 27th February 2024



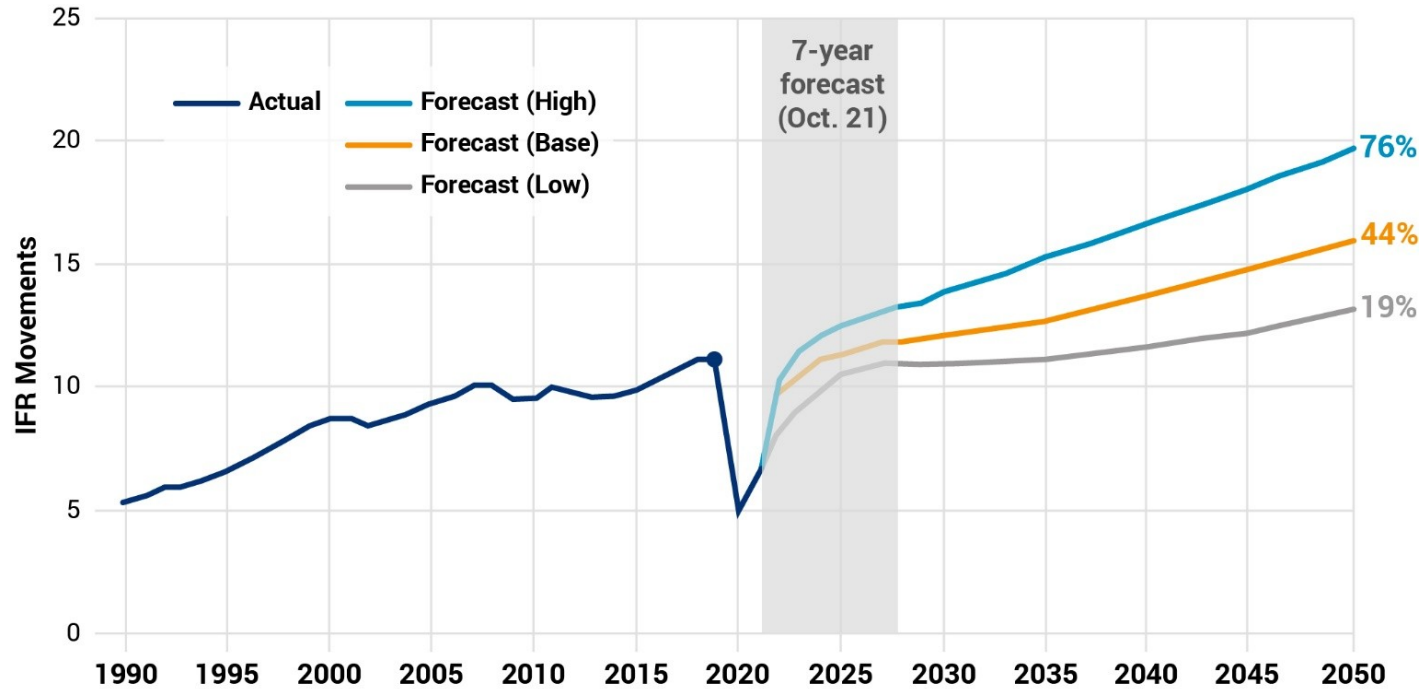
The Challenge Ahead for Sustainable Growth



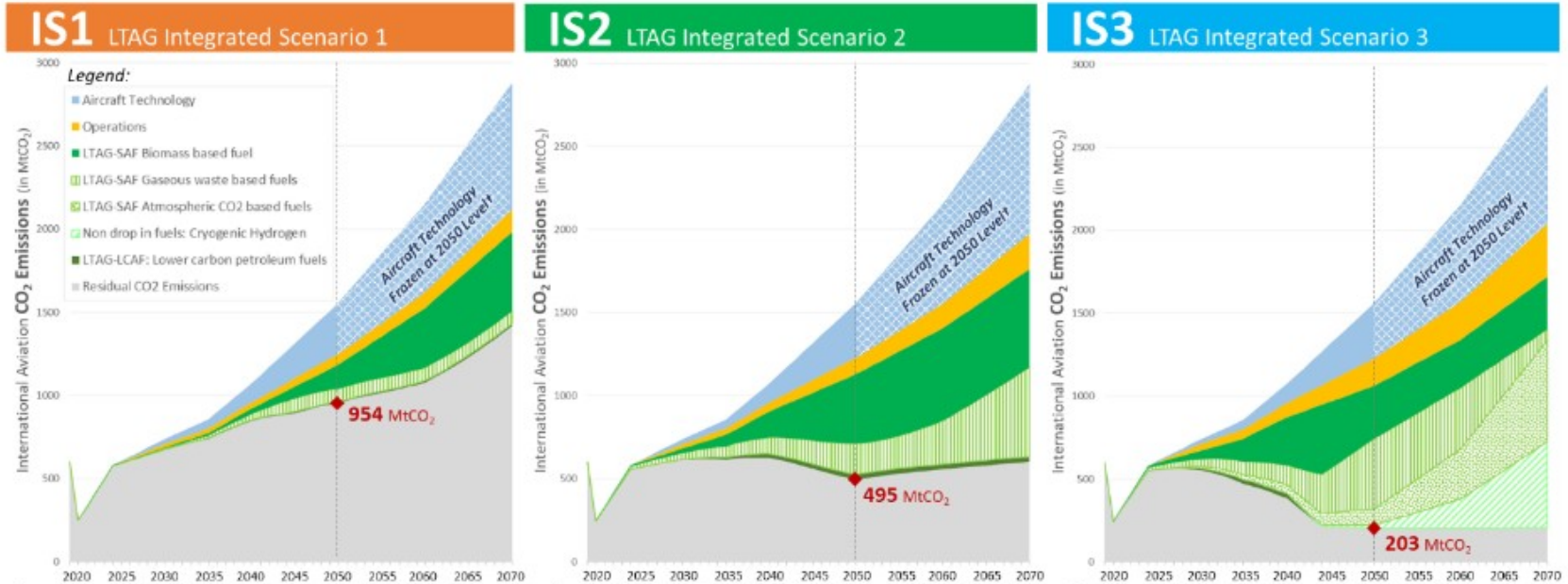
2050
IFR Movements

16 million flights
ECAC

+44%
vs. 2019
Source: Eurocontrol



©EUROCONTROL - www.eurocontrol.int/forecasting



† Caution required with the interpretation of absolute CO₂ emissions levels after 2050 due to modelling assumptions e.g., frozen aircraft technology after 2050. Under these assumptions, CO₂ emissions are higher than in an alternative scenario (and modelling approach) where aircraft technology would continue to improve after 2050.

Figure 1. CO₂ emissions from international aviation associated with LTAG Integrated Scenarios

https://www.icao.int/environmental-protection/LTAG/Documents/REPORT%20ON%20THE%20FEASIBILITY%20OF%20A%20LONG-TERM%20ASPIRATIONAL%20GOAL_en.pdf



ATM contribution by **2030** – Objective Skygreen



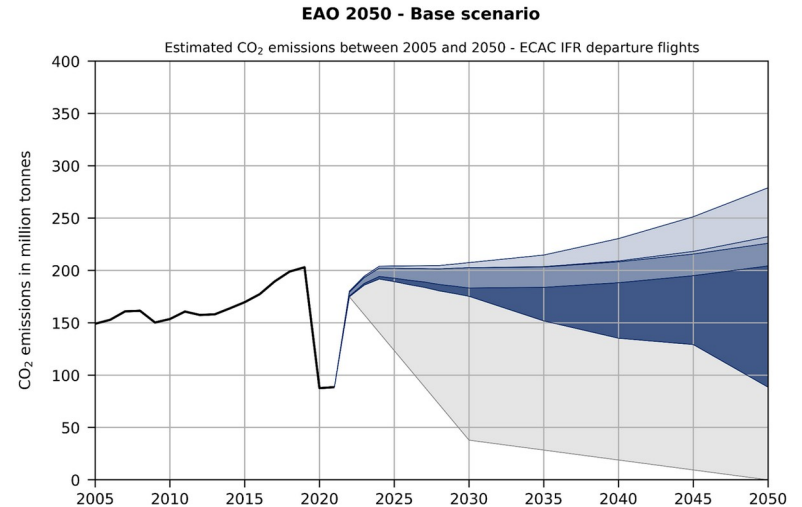
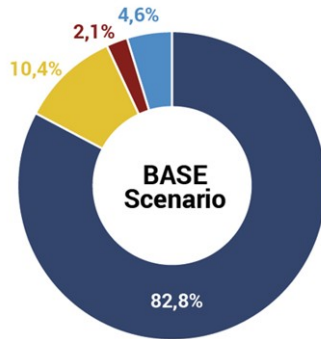
- EU proposing an intermediate target of a 55% CO₂ reduction by **2030** compared to 1990 levels.

● ATM improvements

● Fleet upgrades

● SAF

● MBM (ETS + CORSIA)

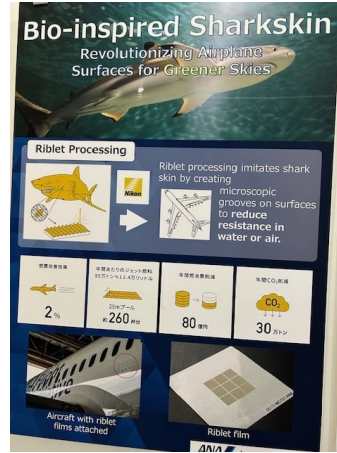


Source - <https://www.eurocontrol.int/publication/objective-skygreen-2022-2030>

ATM



Aircraft operator actions



Airspace design

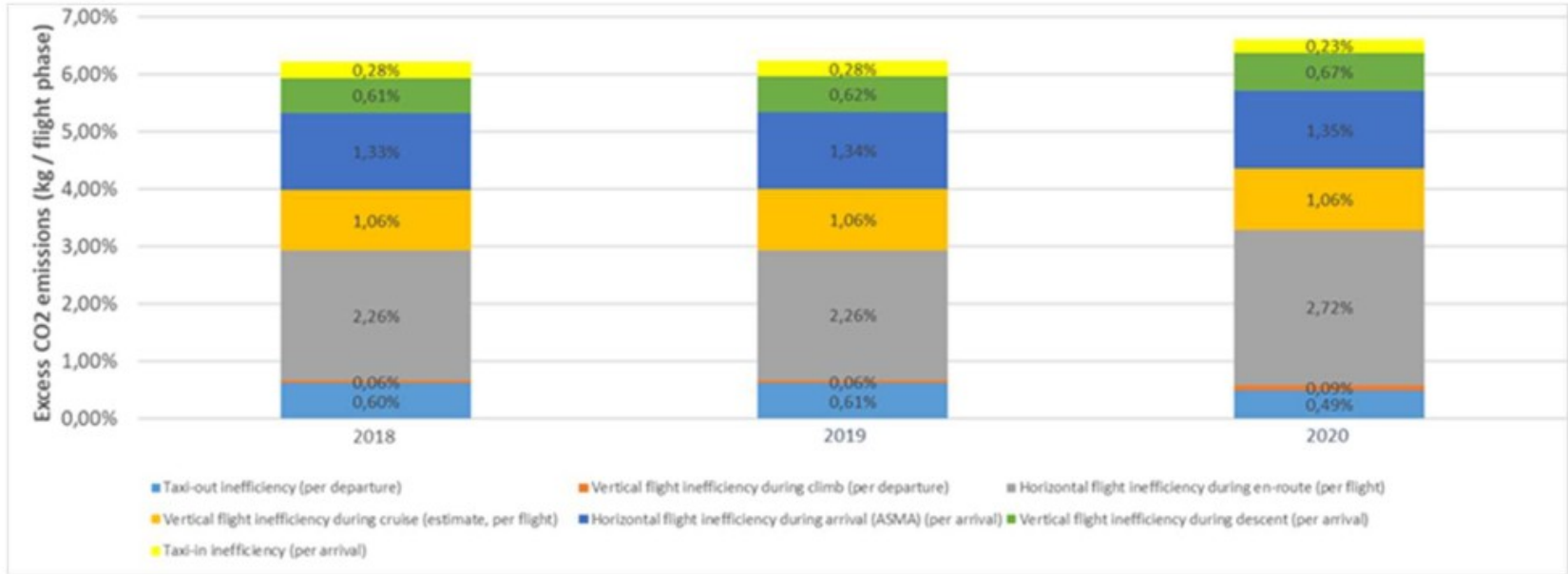


Ground operations



Flight planning activities

How much inefficiency is in the network?



Source: EUROCONTROL Objective Skygreen report



Excess fuel burn in the network - intra-NM flights



Excess fuel burn

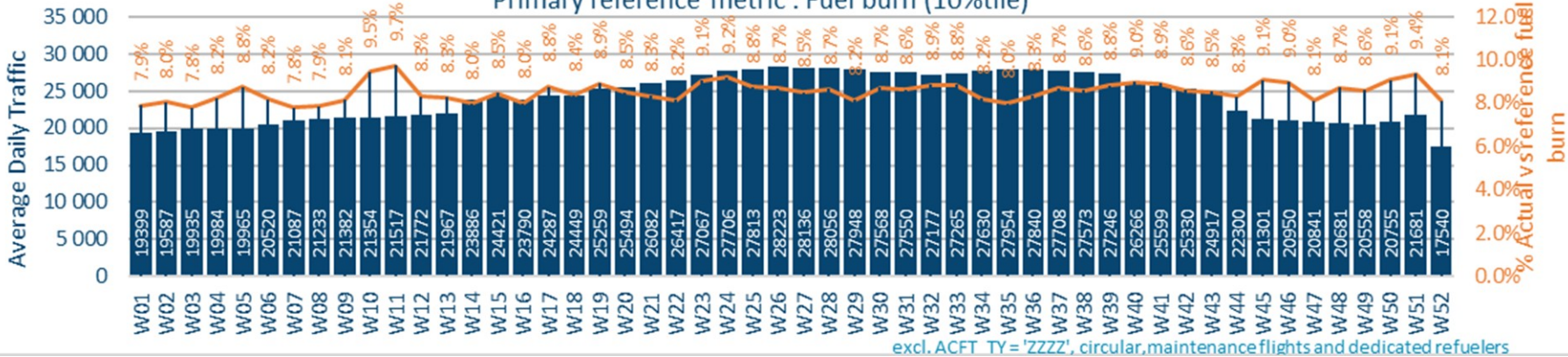
2019
10th percentile: 8.6%
percentile: 11.2%

5th

2020
10th percentile: 3.5%

2019 | Intra-NM Actual vs reference fuel burn (kg)

Primary reference metric : Fuel burn (10%tile)



excl. ACFT TY = 'ZZZZ', circular, maintenance flights and dedicated refuelers



ATM / Operations – no silver bullet



Bio-inspired Sharkskin

Revolutionizing Airplane Surfaces for Greener Skies

Riblet Processing

Riblet processing imitates shark skin by creating microscopic grooves on surfaces to reduce resistance in water or air.

 2% FUEL	 260 HOURS	 80 HRS	 30 TONS
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Aircraft with riblet films attached

Riblet film

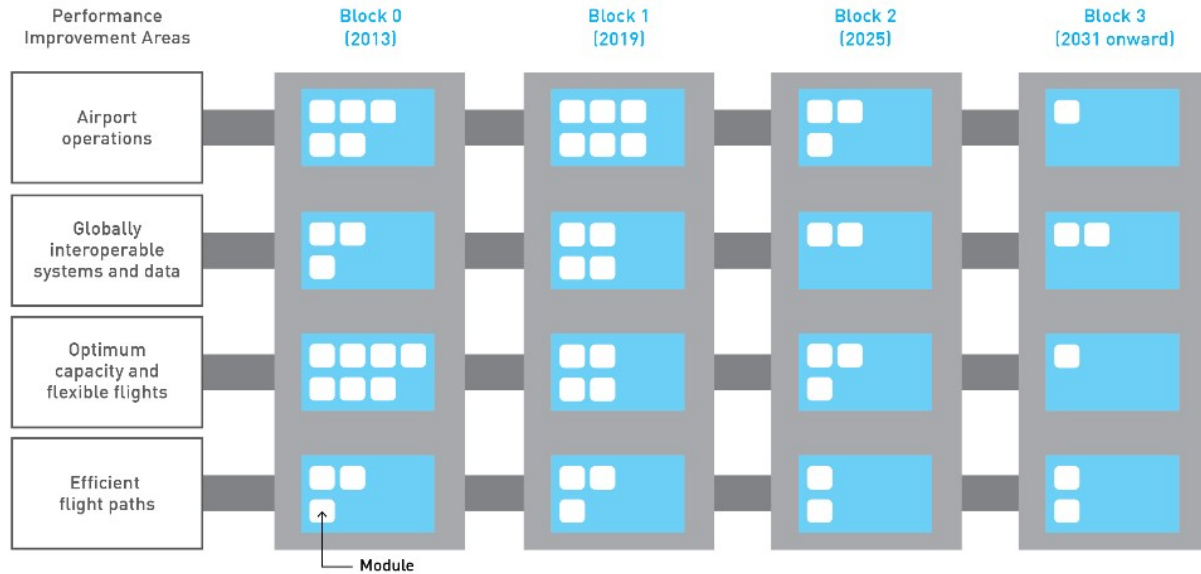




ICAO initiated the Aviation System Block Upgrade (ASBU) initiative as a programmatic framework that:

- Develops a set of Air Traffic Management (ATM) solutions or upgrades
- Takes advantage of current equipage
- Establishes a transition plan, and
- Enables global interoperability

Outlined in *ICAO Global Air Navigation Plan (Doc. 9750)*





ASBU analysis - ENV benefits rules of thumb



53 rules of thumb (RoT) were developed for ASBU B0 / B1 generic implementations

AC Class	High Ave Kg Saved per taxi min Taxi-out	Low Ave Kg Saved per taxi min Taxi-in**	Fleet %
RJ	7	4.9	6,0
SA	14,4	10.1	71,0
Small TA	20,5	14,4	12,9
Med TA	34	23,8	8,8
Large TA	70	49	1,3

AC Class	High	Low	RoT Class
Composite	17,2	12,0	1,3

Now from the AIAA and Mitre papers and more realisation

Baseline arrivals/hr: 24 Single Runway

Assume 80% ADS-B QUT and 20% ADS-B in FIM-S

So given realistic example of on 20% FIM-S capable in Block 1 you only gain 1 arrival/hr

Rule of Thumb: Likely requires more equipment

FIM-S Runway Arrival Rate	22	24	26	28	30	32
Assume 80/20 Equipage	23	25	28	31	34	37
Additional arrivals	1	1	2	3	4	5
Time saving - min/airplane seconds saved per A/C	0.12	0.10	0.16	0.21	0.24	0.25
	7.1	6.0	9.9	12.4	14.1	15.2

Pounds saved per arrival

Low Fuel benefit B737/A320	6.1	5.1	8.4	10.6	12.0	13.0
High Fuel benefit B737/A321	7.6	6.4	10.5	13.3	15.0	16.2
Low Fuel benefit B777/A351	26.2	22.1	36.4	45.8	52.0	56.0
High Fuel benefit B777/A351	28.6	24.1	39.8	50.1	56.8	61.2
Low Fuel benefit B747/A380	31.3	26.4	43.6	54.8	62.2	67.0
High Fuel benefit B747/A381	35.4	29.9	49.3	62.0	70.3	75.7

Kg saved per arrival For 2020s and not much equipage

Low Fuel benefit B737/A320	2.8	2.3	3.8	4.8	5.5	5.9
High Fuel benefit B737/A321	3.4	2.9	4.8	6.0	6.8	7.4

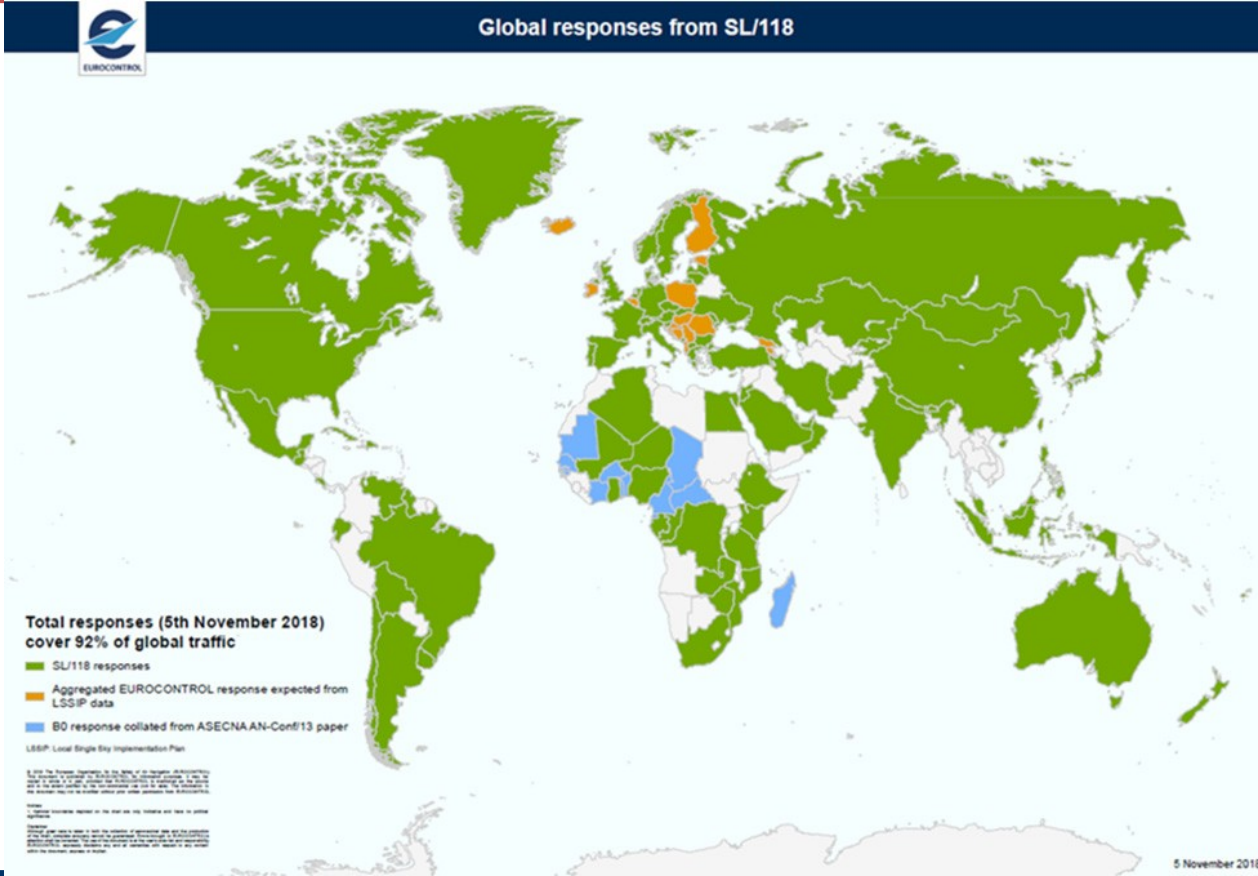
AC Class	Low kg/dep	Low kg/arr	High kg/arr	Low kg/dep	High kg/dep
RJ	0.5	2,2	4,8	7,1	16,4
SA	0,68	2,9	6,4	9,4	21,9
Small TA	1,11	4,8	10,5	15,4	35,7
Med TA	1,57	6,8	14,9	21,7	50,5
Large TA	2,47	10,7	23,4	34,2	79,4
Composite	0,829	3,6	7,8	11,5	26,7

Fuel Savings (kgs) per Flight from RoT Setting Enabled by Performance

Range:	Aircraft Class >>>	Savings (kgs)
RoT low		11-95
RoT high		40-187

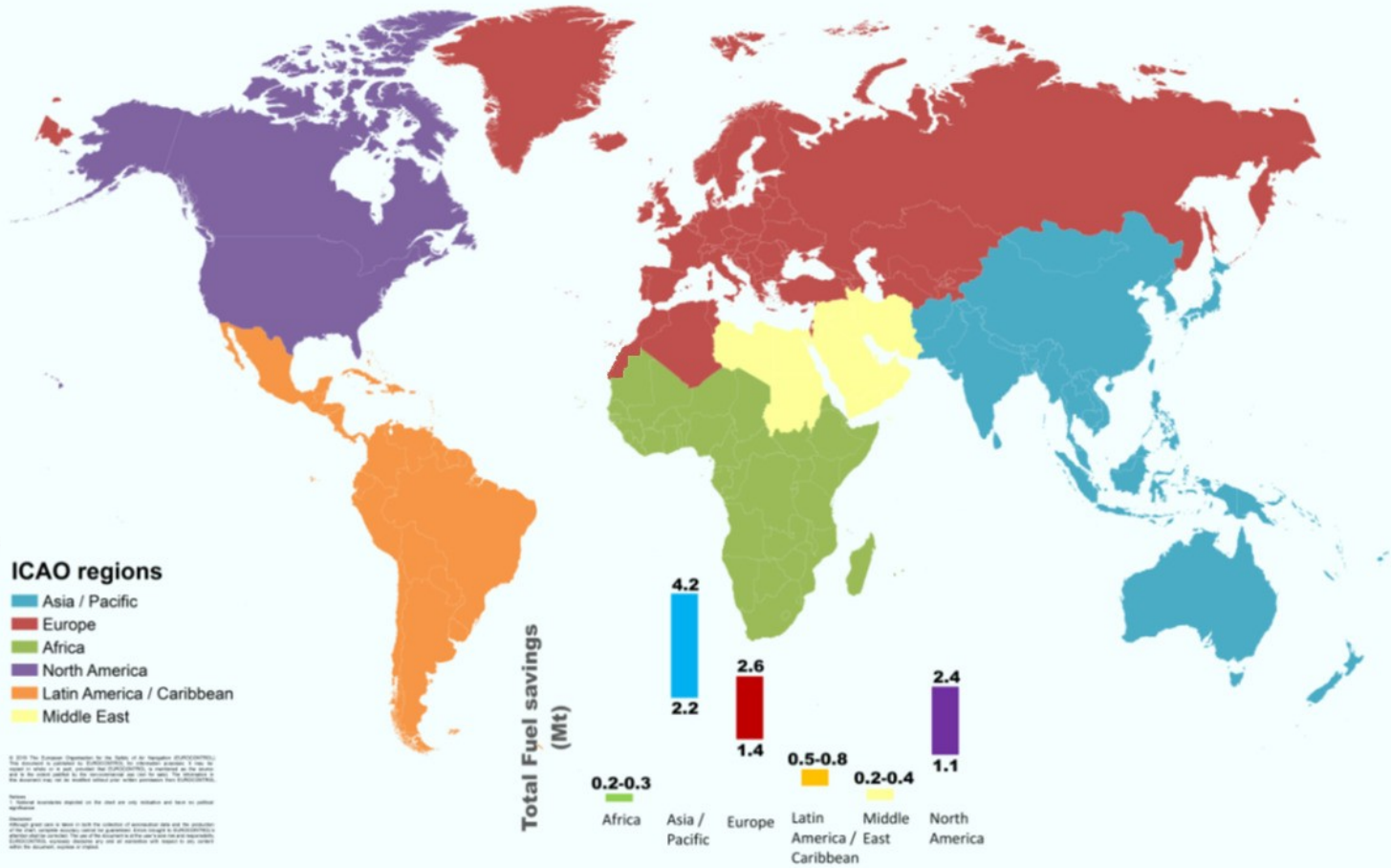
AC Class	Ave Kg Saved per flight	Modified Fleet %
SA	21,0	74,0
Small TA	89,3	13,4

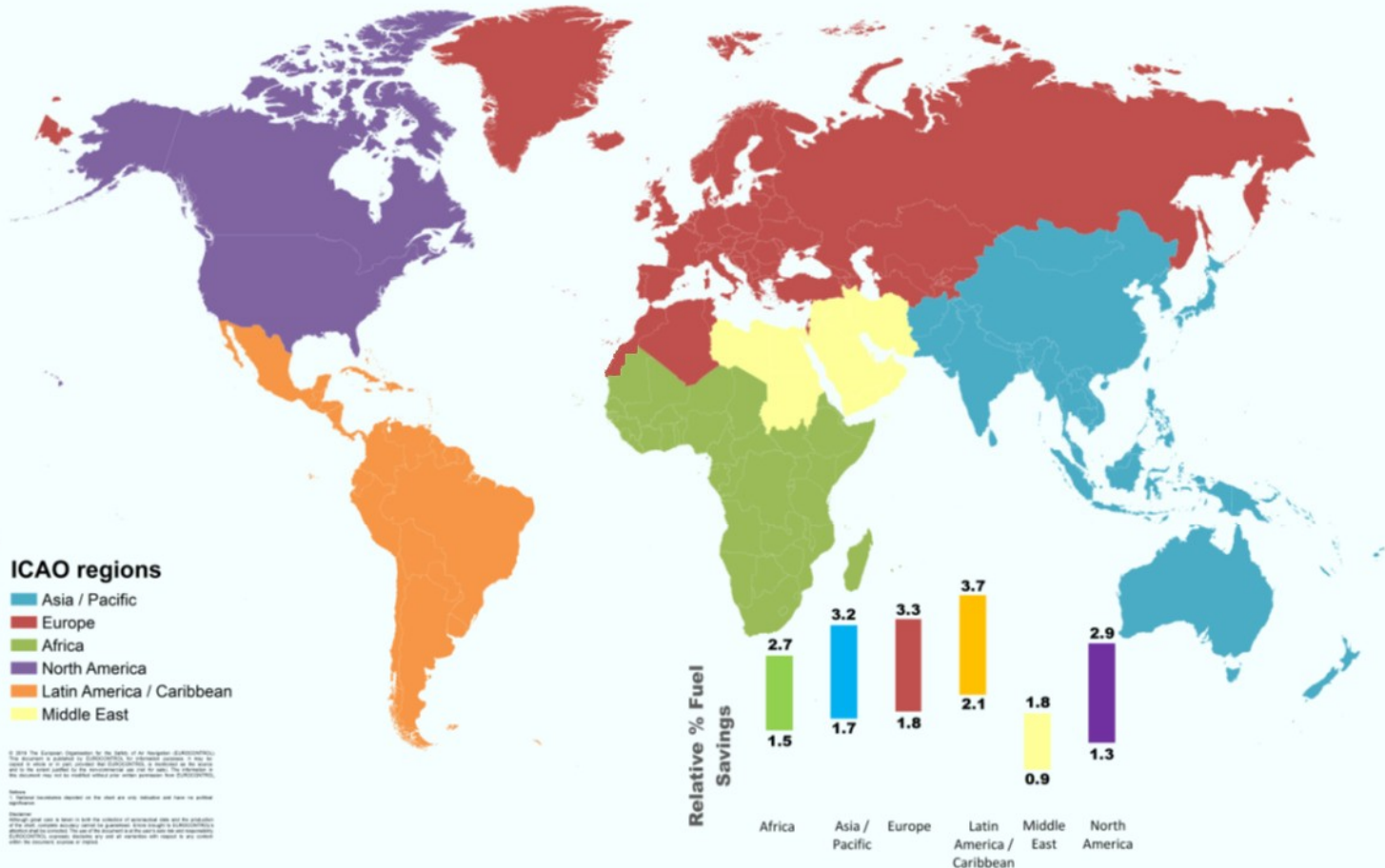
AC Class	900-1220	4030	1832	30,53	0,509	1832	31	0,51
RJ	900-1220	4030	1832	30,53	0,509	1832	31	0,51
SA	900-1220	5815	2643	44,05	0,734	2460	41,0	0,68
SA	1900	5357	2435	40,58	0,676	2460	41,0	0,68
SA	4000-5500	5060	2300	38,33	0,639	2460	41,0	0,68
Small WB-1 B57/67-A33/34	1220	8580	3900	65,00	1,083	4009	66,8	1,11
Small WB-1 B57/67-A33/34	1900	7883	3583	59,72	0,995	4009	66,8	1,11
Small WB-2 B57/67/87-A33/34	4000-5500	9995	4543	75,72	1,262	4009	66,8	1,11
Medium WB B777-A340/350	4000-5500	11865	5393	89,88	1,498	5642	94,0	1,57
Medium WB B777-A340/350	9000-14000	12960	5891	98,18	1,636	5642	94,0	1,57
Large WB 747/A380	4000-5500	17279	7854	130,90	2,182	8887	148,1	2,47
Large WB 747/A380	9000-14000	21824	9920	165,33	2,756	8887	148,1	2,47





Range of estimated block 0/1 fuel savings (from 2015-2025 implementation) per ICAO region (Mt)







Globally, 4 ASBU modules (CDO, ASUR, TBO and CCO) provide close to 60% of the higher range of fuel and CO₂ savings;

CDO – Continuous Descent Operations
ASUR – Space-based ADS-B

surveillance

TBO – Trajectory-Based Operations
CCO – Continuous Climb Operations



ASBU ENV analysis - key findings (2)



further 6 ASBU modules (RSEQ, ACDM, APTA, FRTTO, AMET and NOPS) provide an additional 37% of savings;

- RSEQ – Runway sequencing (AMAN / DMAN)
- ACDM – Airport Collaborative Decision Making**
- APTA – Performance Based Navigation
- FRTTO – Free Route Airspace / FUA**
- AMET - enhanced MET information
- NOPS – Air Traffic Flow Management

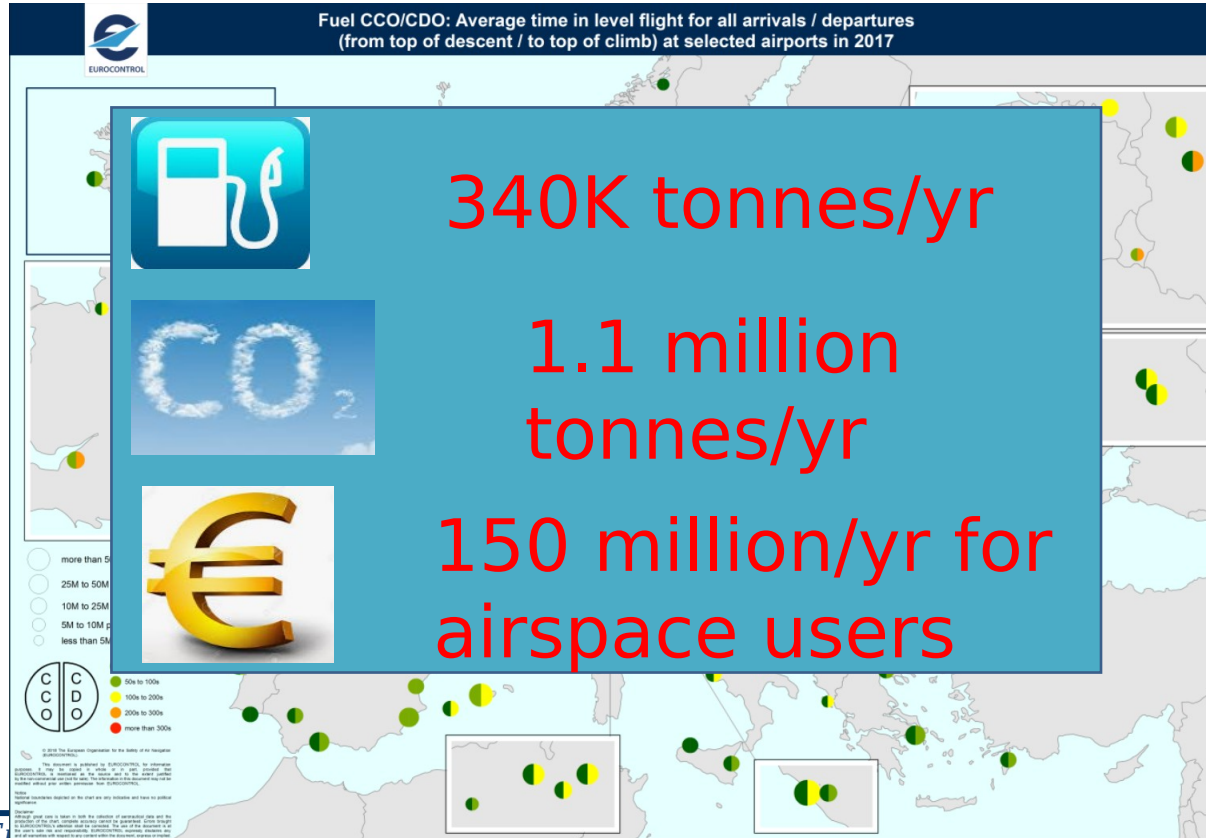
any local initiatives that can be highlighted e.g. flex routes?



Average time in level flight for all DEPS / ARRS in Europe in 2017



European COO / CDO TF





APPENDICES:

A. CCO / CDO EXECUTION – LIST OF IDENTIFIED CONTRIBUTORY FACTORS	33
B. HARMONISED METRICS FOR CCO / CDO MEASUREMENT	63
C. CCO / CDO MONITORING AND FEEDBACK ON PERFORMANCE	67
D. NOISE OPTIMISATION	73
E. AIP PUBLICATION	77
F. AIRSPACE / PROCEDURE DESIGN	85
G. LoA / RAD	95
H. CCO / CDO FACILITATION	99
H.1 Facilitate Track Miles (Distance to Go (DTG))	100
H.2 Speed and Energy Management	103
H.3 Horizontal versus Vertical CCO / CDO Facilitation	106
I. TRAINING FOR ATCOS	115
J. AIRLINE STANDARD OPERATIONAL PROCEDURES AND GOOD PRACTICE MATERIAL	119
K. FLIGHT CREW TRAINING	125
K.1 General Principles	125
K.2 Initial Training	126
K.3 Recurrent Training	128
L. AIRLINE PERFORMANCE MONITORING AND FLIGHT CREW FEEDBACK	133
M. PHRASEOLOGY	143
N. COLLABORATION	147
O. FUTURE DEVELOPMENTS	151
P. TOOL KIT FOR IMPLEMENTING AND OPTIMISING CCO / CDO	169
Q. CASE STUDIES	173



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

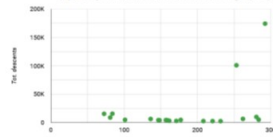
Deliverables (2) - **CCO / CDO performance dashboard**

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

CCO - Continuous descent operations by airlines in the EUROCONTROL area

Airport Name	State	Tot. descents	Tot. level time CDO (descents * sec.)	FUEL - Avg. time in level flight from ToD (sec)	FUEL - CDO from time of descent (%)	NOISE - Avg. time in level flight from ToD (sec)	NOISE - CDO from time of descent (%)
1. Frankfurt (EDDF)	Germany	173.3K	39.5M	262.3	5.9%	149.8	20.4%
2. Paris/Charles de Gaulle (LFPG)	France	169.9K	25.5M	202.0	5.2%	142.9	19.9%
3. Heathrow (EGLL)	United Kingdom	9.9K	2.7M	282.0	13.2%	91.9	54.4%
4. Charles de Gaulle (LFPF)	France	6.3K	1.7M	262.1	7.3%	89.0	28.2%
5. Newand (EDNW)	Germany	5.9K	1.4M	283.4	17.7%	203.2	23.8%
6. Hamburg (EDDH)	Germany	15.8K	1.3M	83.8	31.8%	38.4	39.2%
7. Tegel (EDDT)	Germany	13.8K	1.1M	72.8	36.4%	31.7	40.9%
8. Barcelona (LEBL)	Spain	6.3K	842.9K	196.1	26.8%	72.4	48.9%
9. Brussels Intl (EBBR)	Belgium	4.8K	808.9K	177.3	22.8%	88.1	31.7%
10. Düsseldorf (EDDL)	Germany	8.7K	707.8K	81.0	35.9%	37.1	53.4%
Grand total		492.8K	104.9M	211.2	13.2%	108.2	28.1%

Top 20 airports in terms of total time in level flight (CDO)



Avg. time in level flight by month (sec.) - CDO



Overview

Airport View -1

Airport View -2

Airline View

Jaar (2019)

2019

2020

Maand

januari

februari

maart

april

mei

juni

juli

augustus

september

oktober

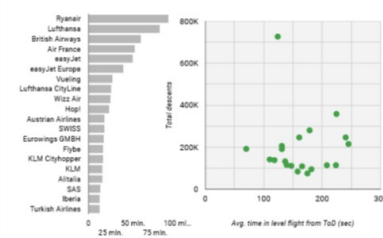
november

december

CDO - Continuous descent operations in the EUROCONTROL area



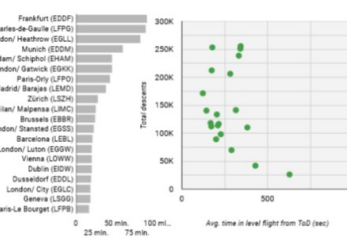
Top 20 airlines in terms of total time in level flight (descents * sec)



Avg. time in level flight by month (sec.) - CDO



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



* Subject to data availability -

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

Deliverable (3) - **CCO / CDO Tool Kit**

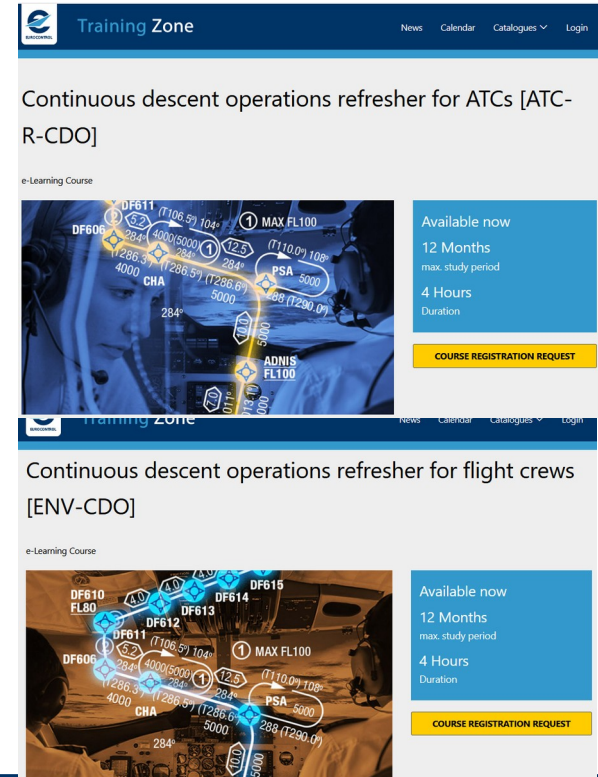
- <https://www.eurocontrol.int/concept/continuous-climb-and-descent-operations>

Deliverable (4) - **ATCO refresher training on aircraft energy management**

- <https://trainingzone.eurocontrol.int/ilp/pages/coursedescription.jsf?courseId=8619678&catalogId=232380>

Deliverable (5) - **Flight Crew CBT on CCO / CDO**


- <https://trainingzone.eurocontrol.int/ilp/pages/coursedescription.jsf?courseId=9178064&catalogId=896425>



Training Zone News Calendar Catalogues Login

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

e-Learning Course



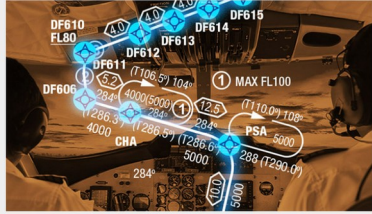
Available now
12 Months
max. study period
4 Hours
Duration

COURSE REGISTRATION REQUEST

Training Zone News Calendar Catalogues Login

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

e-Learning Course



Available now
12 Months
max. study period
4 Hours
Duration

COURSE REGISTRATION REQUEST

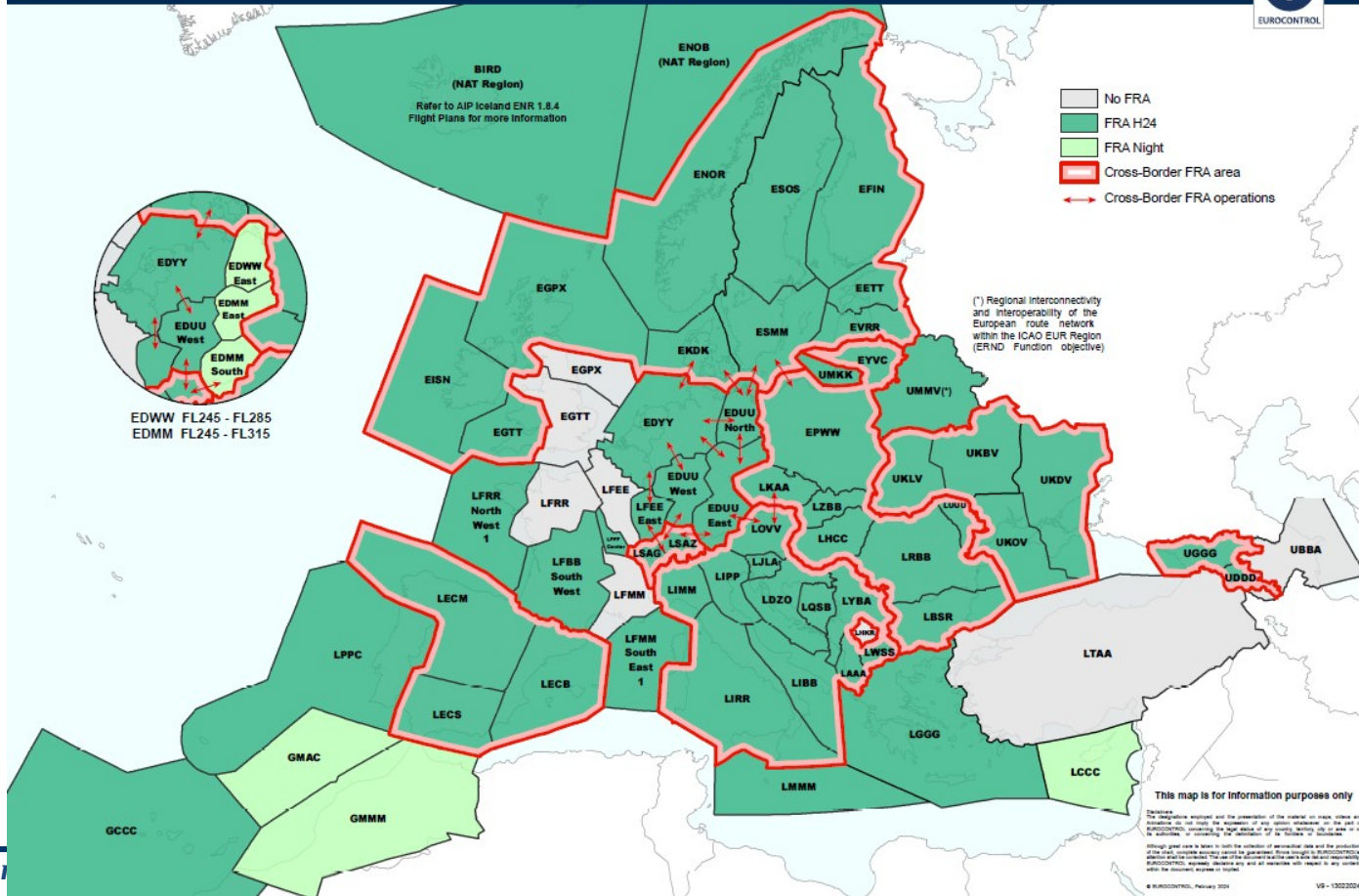


Free route airspace (FRA) – Europe status end



Co-financed by the Connecting Europe Facility of the European Union

Free Route Airspace Implementation - End 2024



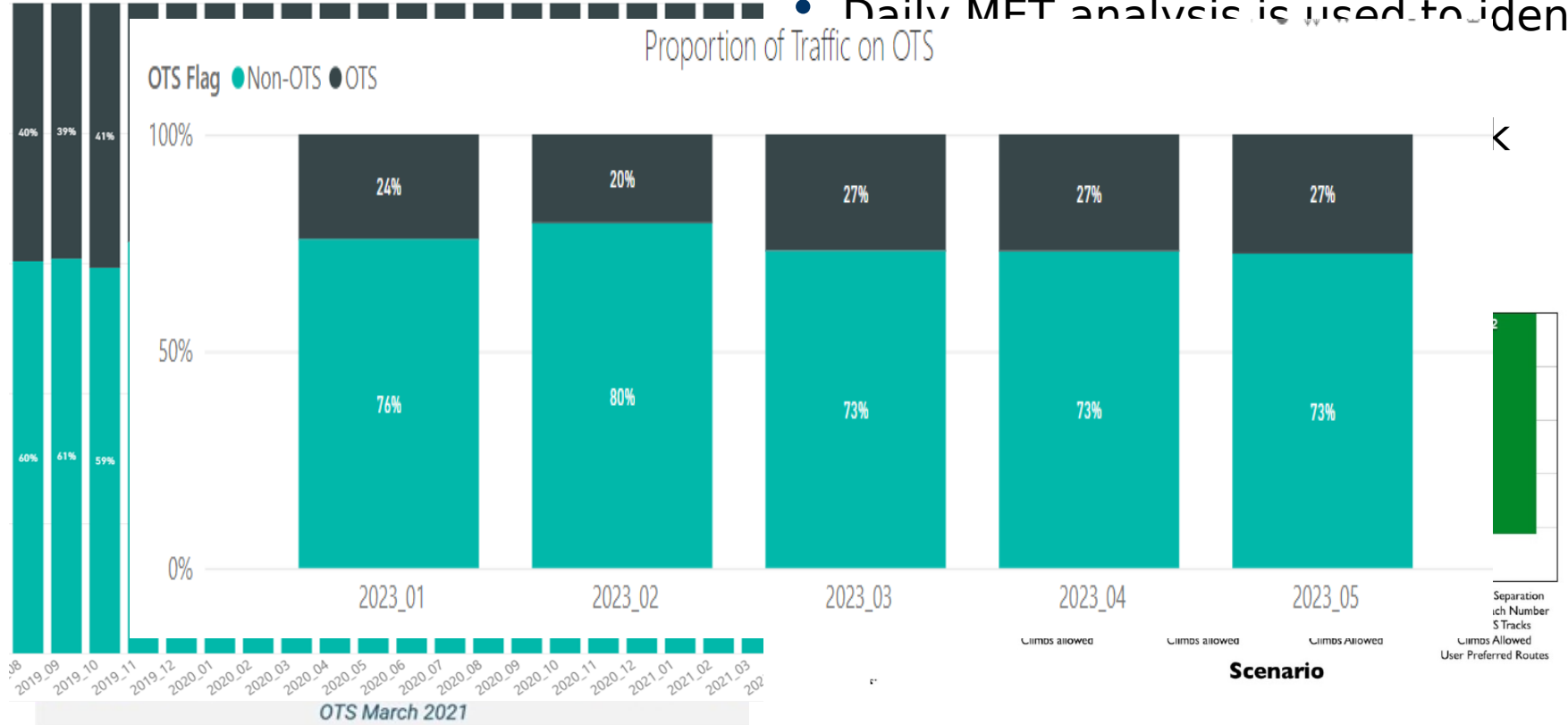


North Atlantic tracks □ UPRs (with SB-ADS-B)



• Daily MET analysis is used to identify

Proportion of Traffic on OTS





On the path to TBO: FF-ICE



- FF-ICE: Flight and Flow Information for a Collaborative Environment
- European mandate - CP1 mandates all Airspace Users operating in the European airspace to adopt FF-ICE and start filling eFPL by 31/12/2025
- FF-ICE will facilitate CDM and the sharing / negotiation of the planned trajectory
- Results in better knowledge of aircraft capabilities, operator choices and ATM constraints facilitating efficiency improvements and better planning



On the path to TBO: ADS-C EPP



ADS-C EPP
operational @ MUAC

Showcase flight
efficiency benefits

1. ADS-C can identify whether a flight can exit a non-active military area before it becomes active → shortest route

2. ToC display → direct routing - earlier clearance to RFL
- CCO: 12-35 kg of fuel savings / ft

3. ToD & optimum descent profile display
→ more miles at cruising level -
optimum descent - CDO: 10-24 kg of fuel savings / ft





Next steps – removing emissions: e.g. formation flying



fello'fly
Wake energy retrieval demonstrator

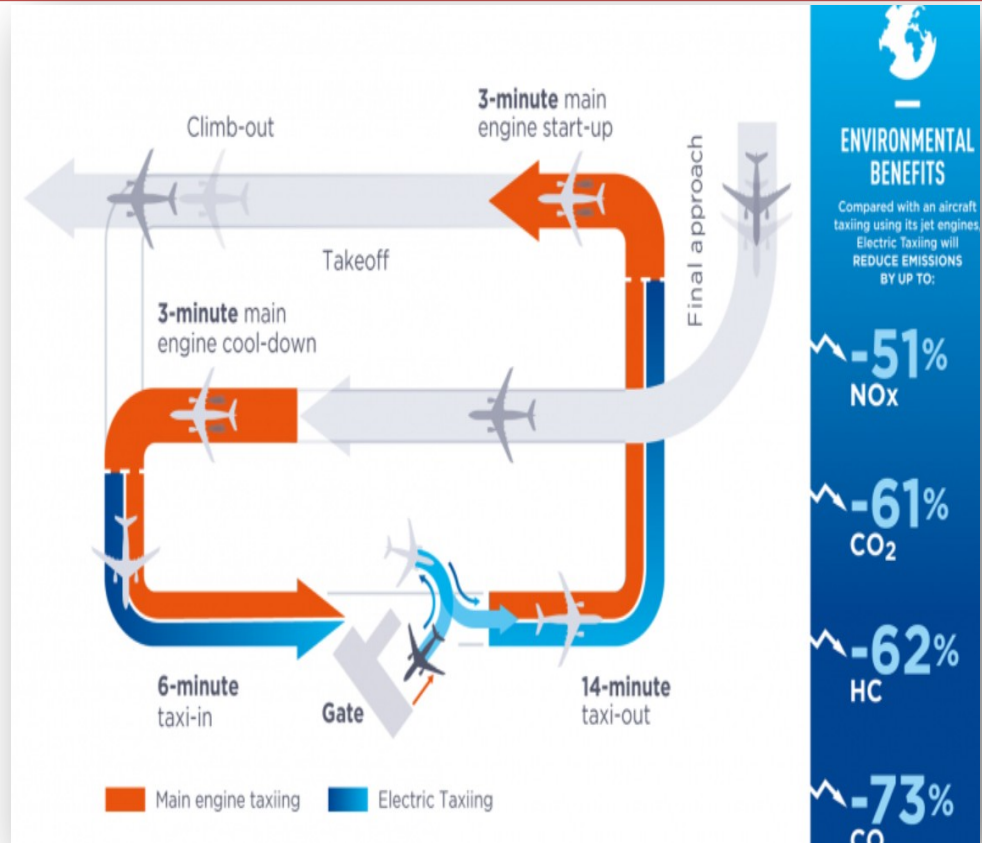
Inspired by the flight technique of migrating birds

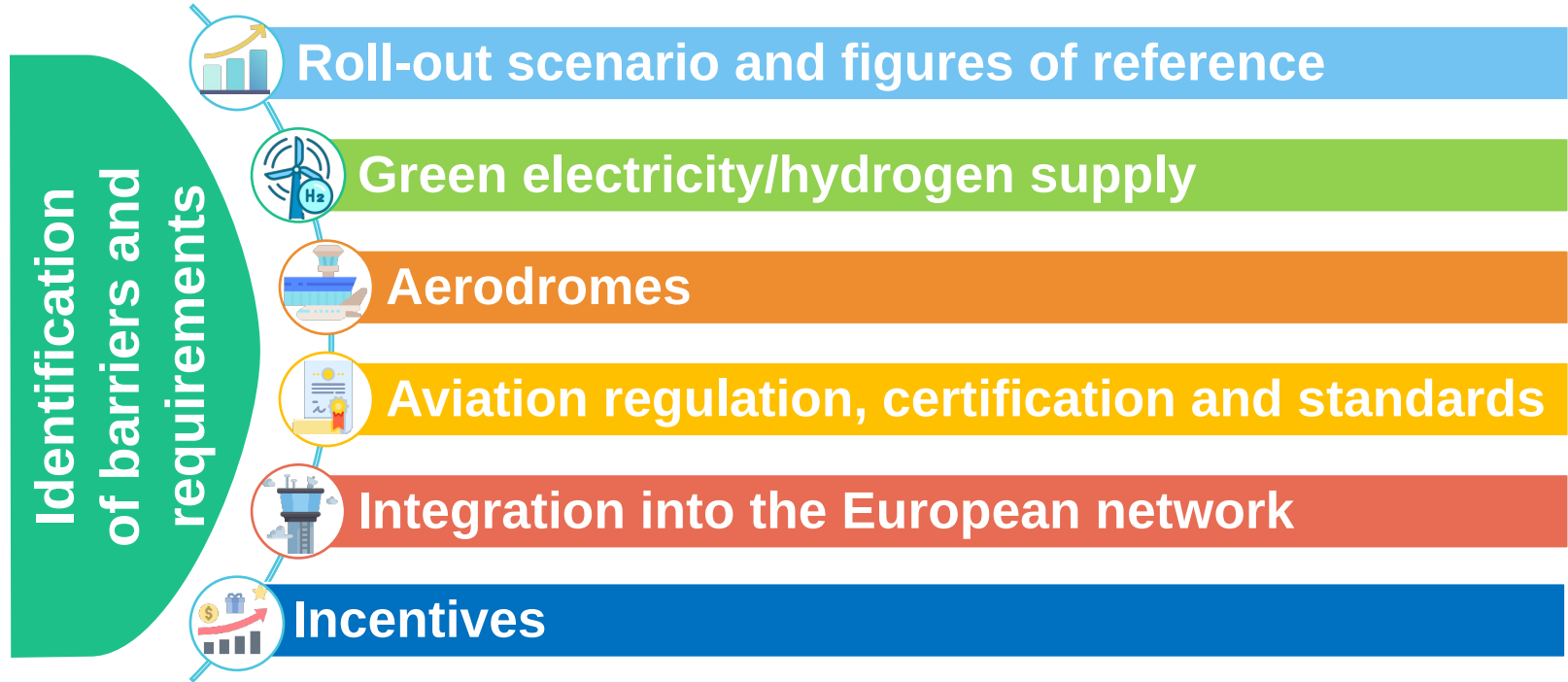
Using air upwash to lift a follower aircraft

- Lightbulb icon: fello'fly project to prove safe technical and operational principles
- Handshake icon: Industry collaboration with airlines, Air Traffic Control providers & regulators
- Fuel pump icon: 5% to 10% fuel savings on long-haul trips
- Leaf icon: Significant emissions reduction

AIRBUS

Next steps – removing emissions: e.g. e-taxi solutions







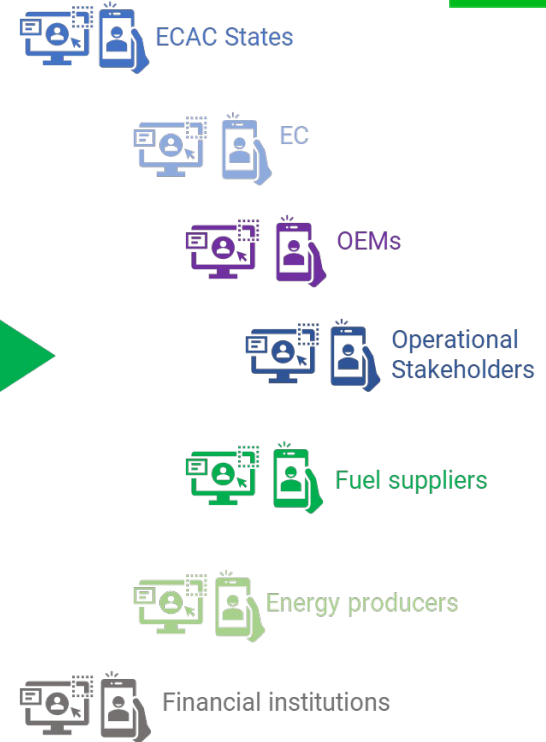
Concept of Operations for the Introduction of Electric, Hybrid-electric and Hydrogen-powered Zero Emission Aircraft

23 January 2024





EUROCONTROL – Flying Green

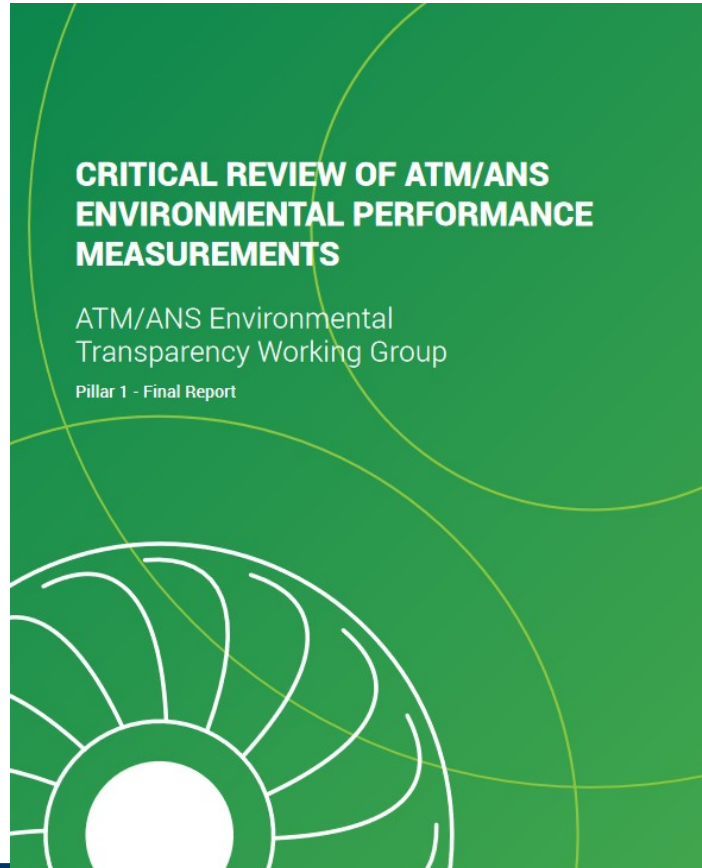


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Performance measurement is vital



CAEP-SG/20232-IP/04
15/09/23
English only

COMMITTEE ON AVIATION ENVIRONMENTAL PROTECTION (CAEP)

STEERING GROUP MEETING

Takamatsu, Japan, 16 to 20 October 2023

Agenda Item 2: Development since the 2022 Steering Group Meeting

UPDATE OF THE ENVIRONMENT KEY PERFORMANCE AREA IN THE GLOBAL AIR NAVIGATION PLAN

(Presented by the ICAO Secretariat)

1. INTRODUCTION

1.1 Since the endorsement of the sixth edition of the GANP during the 40th session of the ICAO Assembly, the GANP is presented in an electronic format available at [Home - ICAO GANP Portal](#) and its content is organized into four levels: two global levels (strategic and technical), a regional level and a national one. The 41st session of the ICAO Assembly endorsed the seventh edition of the Global Air Navigation Plan. The Global Air Navigation Plan is performance-driven and service oriented.

2. PERFORMANCE IN THE GANP

2.1 The Global Air Navigation Plan (GANP) contains, the GANP performance framework, composed of a series of performance ambitions, focus areas, performance objectives and key performance indicators (KPIs) within the eleven key performance areas (KPA¹) matching the global performance expectations outlined in the *Global Air Traffic Management Operational Concept* (Doc 9854).

2.2 The Performance Ambitions, contained in the global strategic level of the GANP, are qualitative statements, defined in the eleven ICAO KPAs, whose goal is to provide global priorities on the performance evolution of the global air navigation system. The performance ambitions should not be regarded as targets to continuously monitor and report performance against, but rather as a catalyst for change.

Note – More information on the GANP Performance Ambitions is available at:
https://www.icao.int/ycapportal/Capac/Document/Issuance/INT-NTW42AW/arg/DwLYarCFhoLUGNX_h?_k=h/str/c

¹ The eleven ICAO KPAs: safety, security, environmental impact, cost effectiveness, capacity, flight efficiency, flexibility, predictability, access and equity, participation by the ATM community and global interoperability.



Collaboration and partnership to deliver the pool of benefits



Network Manager



SUPPORTING EUROPEAN AVIATION

