

Supporting
European
Aviation



Operational Improvements / Fuel and emissions savings ICAO EUR ENV TF/2

David Brain
EUROCONTROL
17th October 2023



The Challenge Ahead for Sustainable Growth

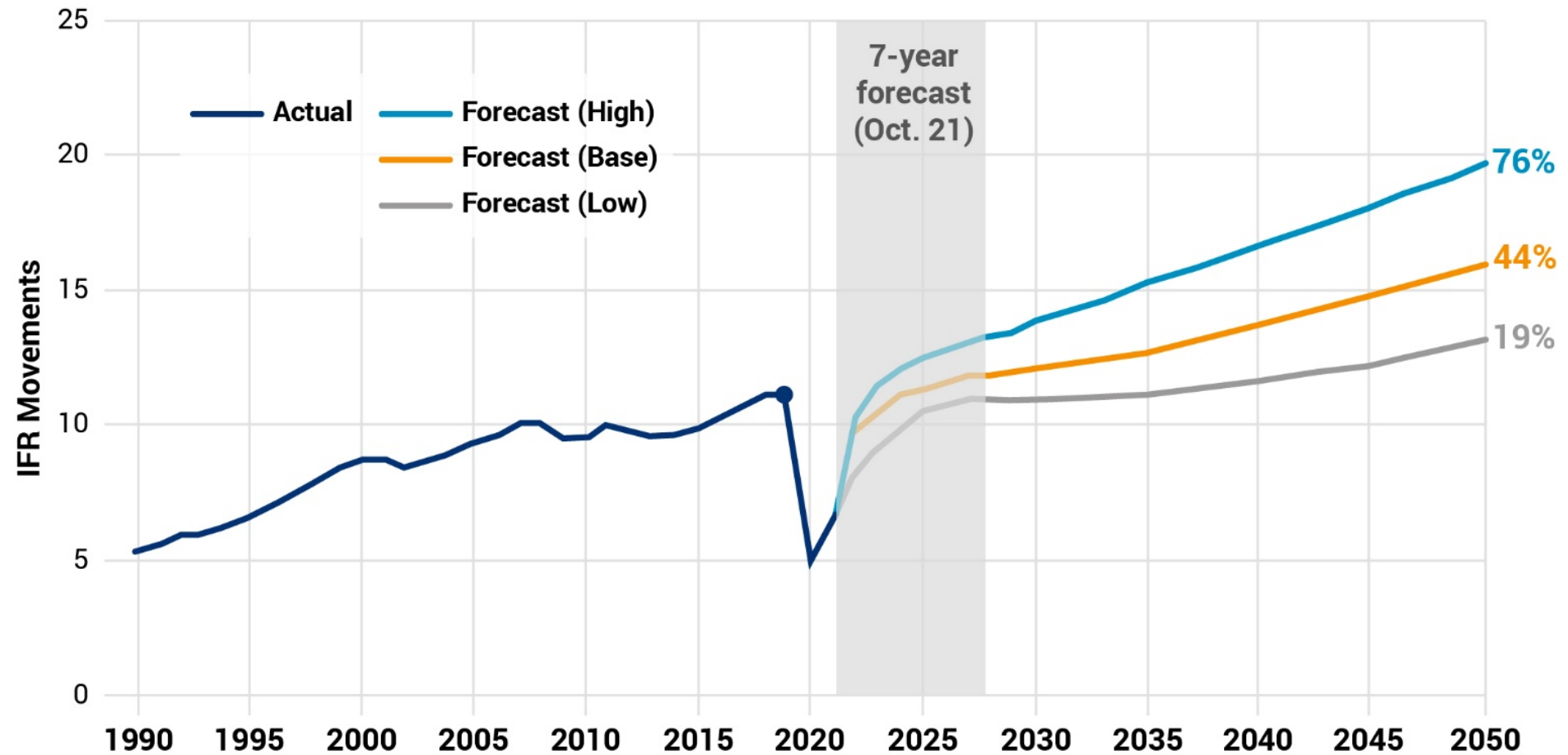
2050
IFR Movements

16 million flights
ECAC

+44%

vs. 2019

Source: Eurocontrol



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Excess fuel burn in the network (intra-NM flights)

Excess fuel burn

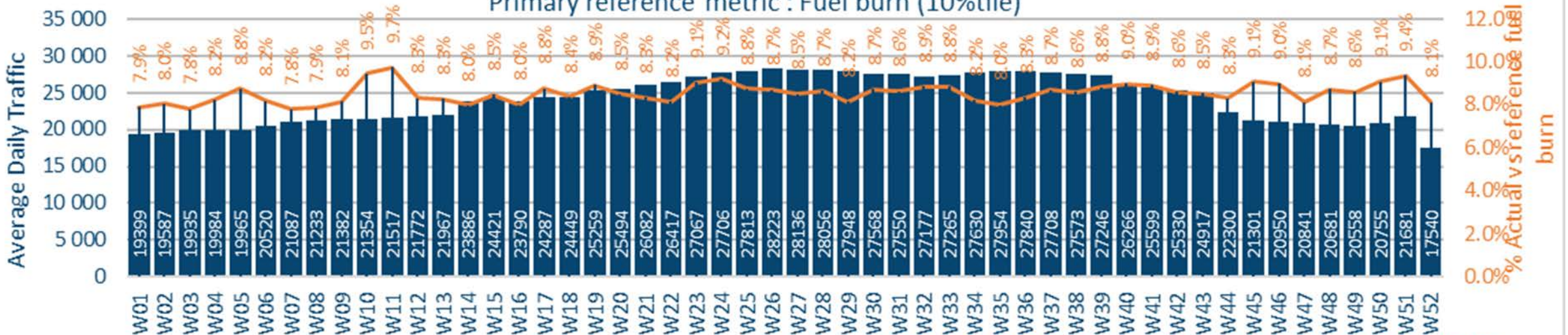
2019
 10th percentile: 8.6%
 5th percentile: 11.2%

2020
 10th percentile: 3.5%

2023
 YTD: 9.6% (10th perc.)

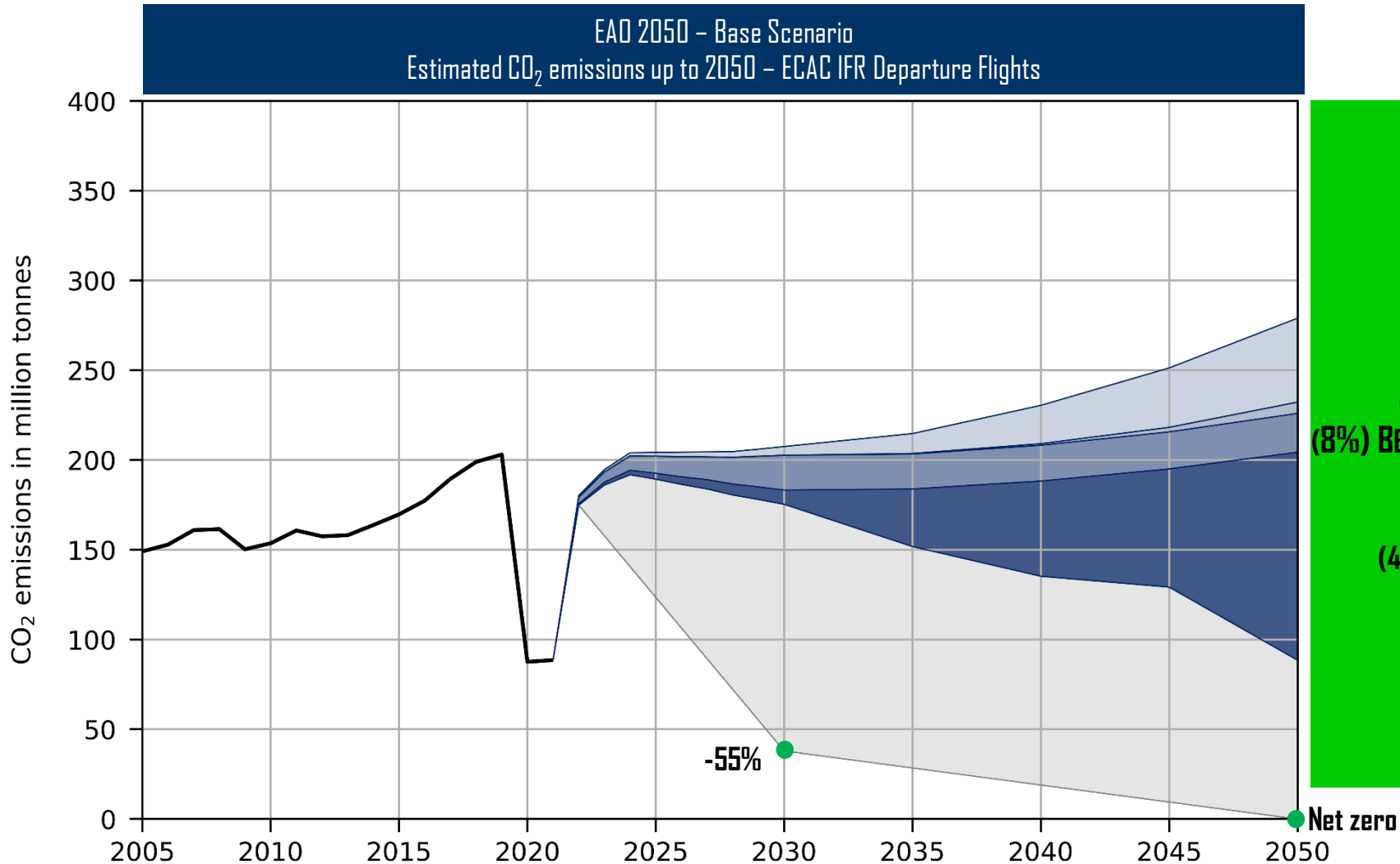
2019 | Intra-NM Actual vs reference fuel burn (kg)

Primary reference metric : Fuel burn (10%tile)



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

2050 – (CO₂ emissions forecast results – base scenario)

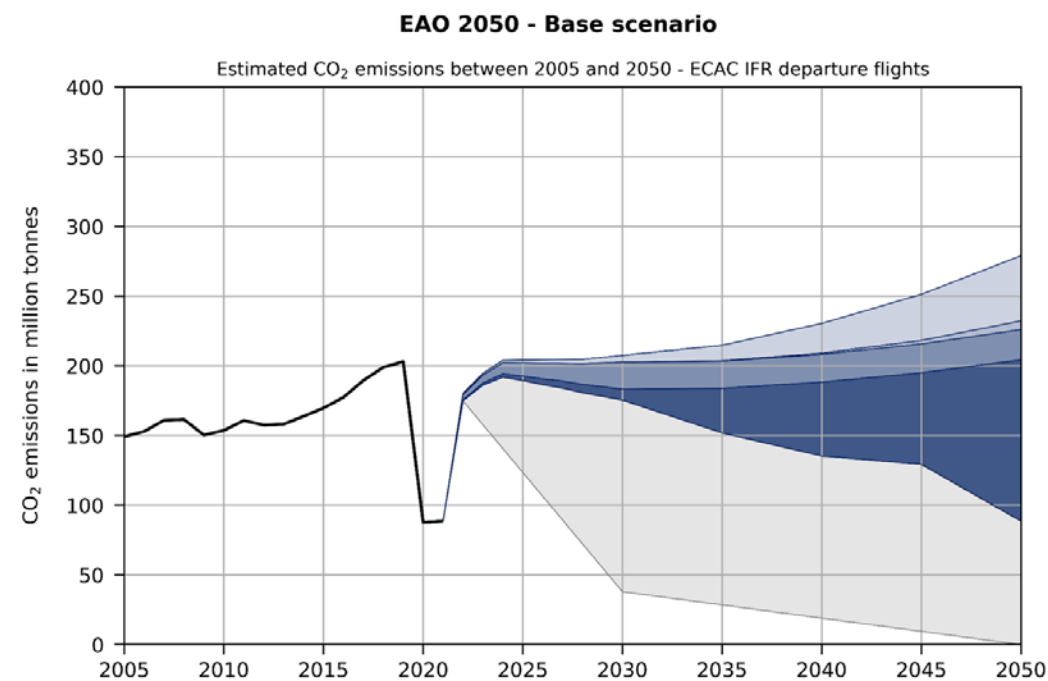
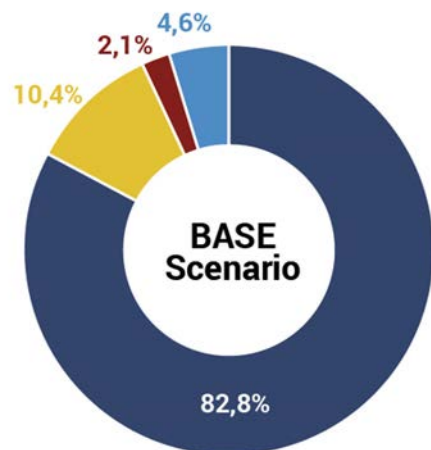


**NET ZERO CO₂ TO BE ACHIEVED
BY CUTTING
279 MILLION TONNES WITH:**

- (17%) MORE EFFICIENT CONVENTIONAL AIRCRAFT
- (2%) ELECTRIC & HYDROGEN POWERED AIRCRAFT
- (8%) BETTER AIR TRAFFIC MANAGEMENT & OPERATIONS
- (41%) SUSTAINABLE AVIATION FUEL
- (32%) OTHER MEASURES (MBM, CARBON CAPTURE)

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

- ATM improvements
- Fleet upgrades
- SAF
- MBM (ETS + CORSIA)

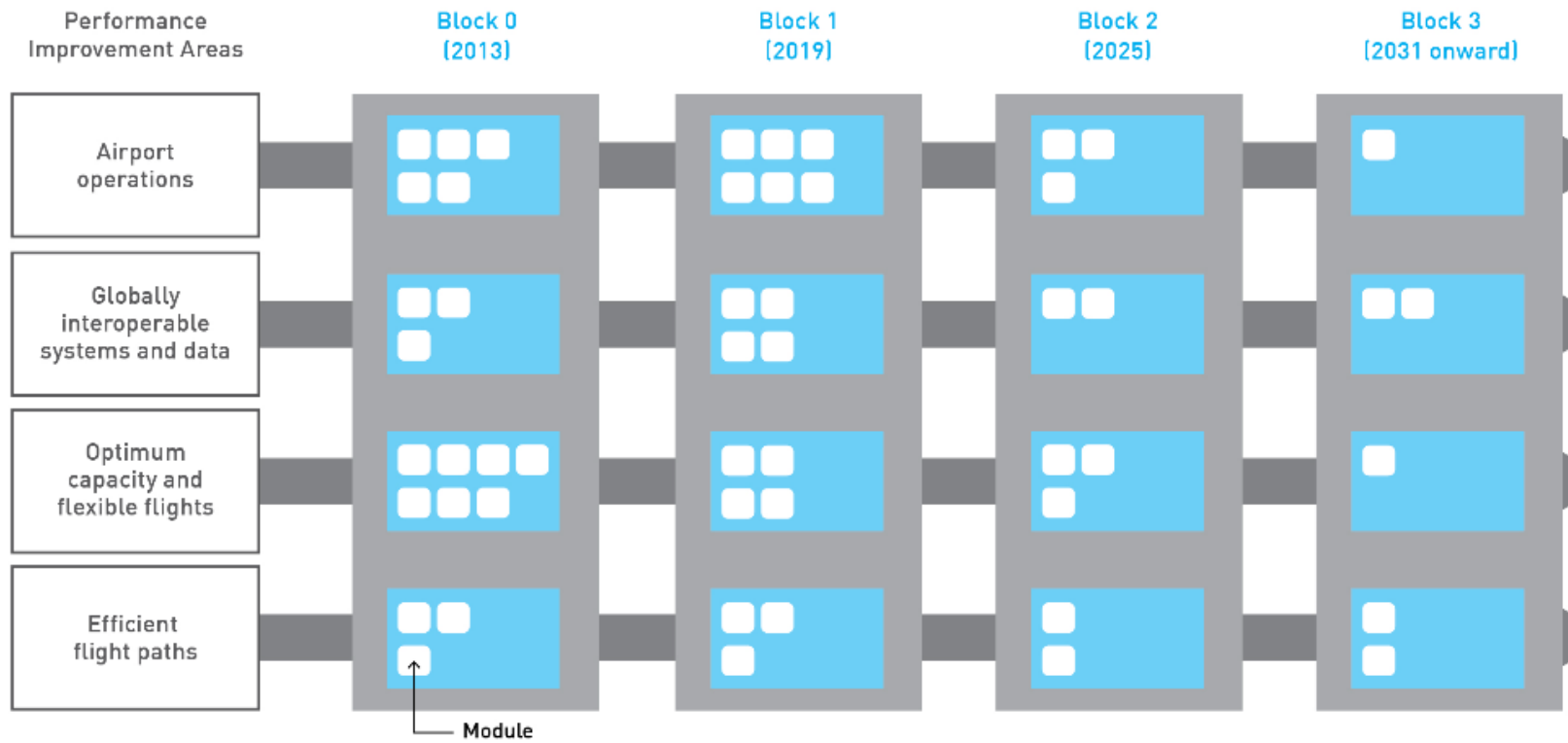


Reference - <https://www.eurocontrol.int/publication/objective-skygreen-2022-2030>

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 Ave Kg Saved per taxi min Taxi-out	Low Ave Kg Saved per taxi min Taxi-in**	Fleet %
Composite	17,2	12,0	0,68

Now from the AIAA and Mitre papers and more realism

Baseline arrivals/hr	24	Single Runway
Assume 80% ADS-B OUT and 20% ADS-B In FIM-S	25	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
Assume 80/20 Equipment	23	25
Additional arrivals	1	1
Time saving - min/airplane seconds saved per A/C	0.12	0.10
Pounds saved per arrival	7.1	6.0
Low Fuel benefit B737/A320	6.1	5.1
High Fuel benefit B737/A321	7.6	6.4
Low Fuel benefit B777/A350	26.2	22.1
High Fuel benefit B777/A351	28.6	24.1
Low Fuel benefit B747/A380	31.3	26.4
High Fuel benefit B747/A381	35.4	29.9
Low Fuel benefit B737/A320	2.8	2.3
High Fuel benefit B737/A321	3.4	2.9

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

AC Class	Ave Kg Saved per flight	Modified Fleet %
RJ	7	6,0
SA	14,4	71,0
Small TA	20,5	12,9
Med TA	34	8,8
Large TA	70	1,3
Small WB-1 B57/67-A33/34	17,2	0,68
Small WB-1 B57/67-A33/34	12,0	0,68
Small WB-2 B57/67/87-A33/34	17,2	0,68
Medium WB B777-A340/350	17,2	0,68
Medium WB B777-A340/350	17,2	0,68
Large WB 747/A380	17,2	0,68
Large WB 747/A380	17,2	0,68

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

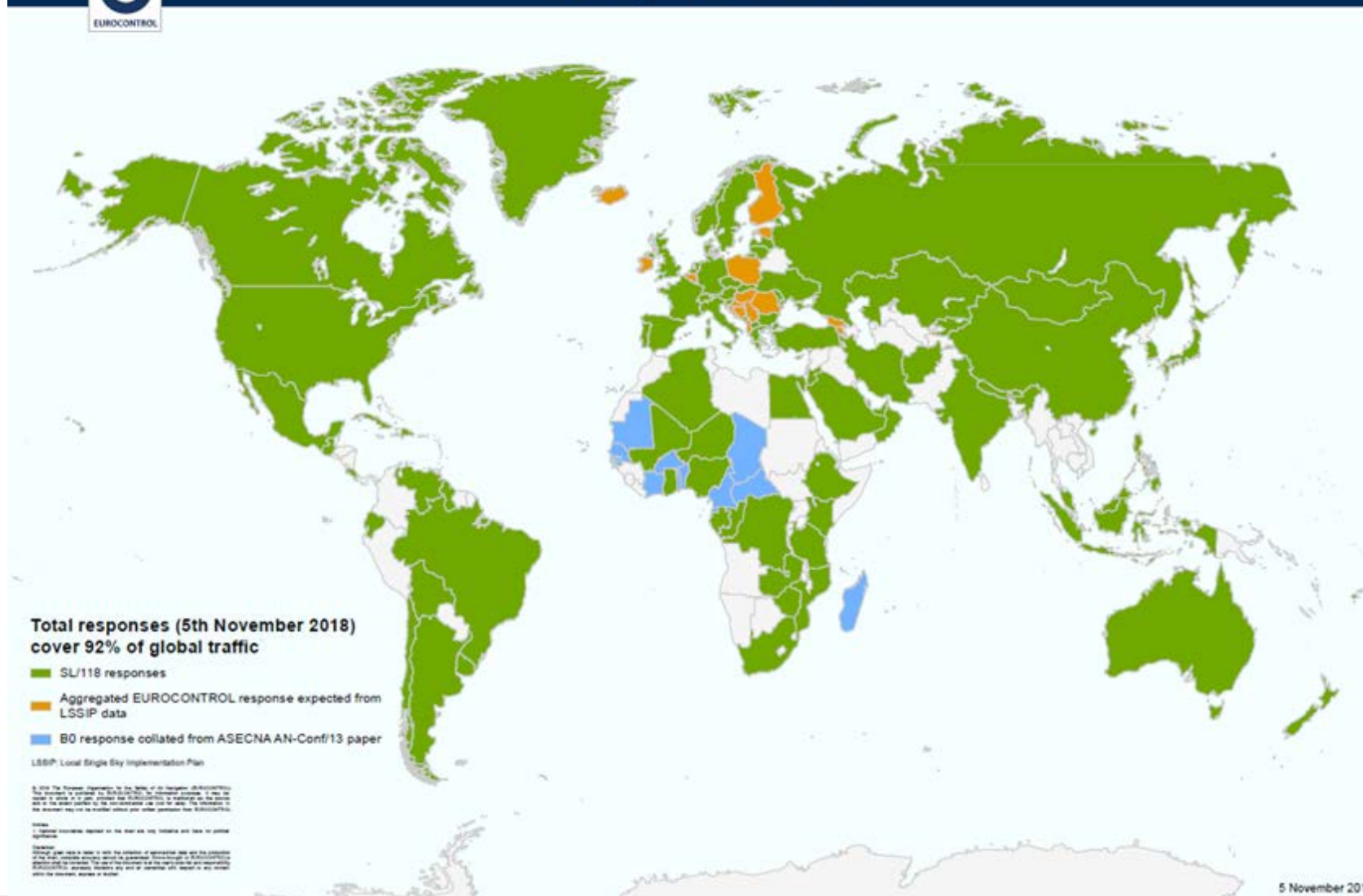
Fuel Savings (kgs) per Flight from RoT Setting Enabled by Performance

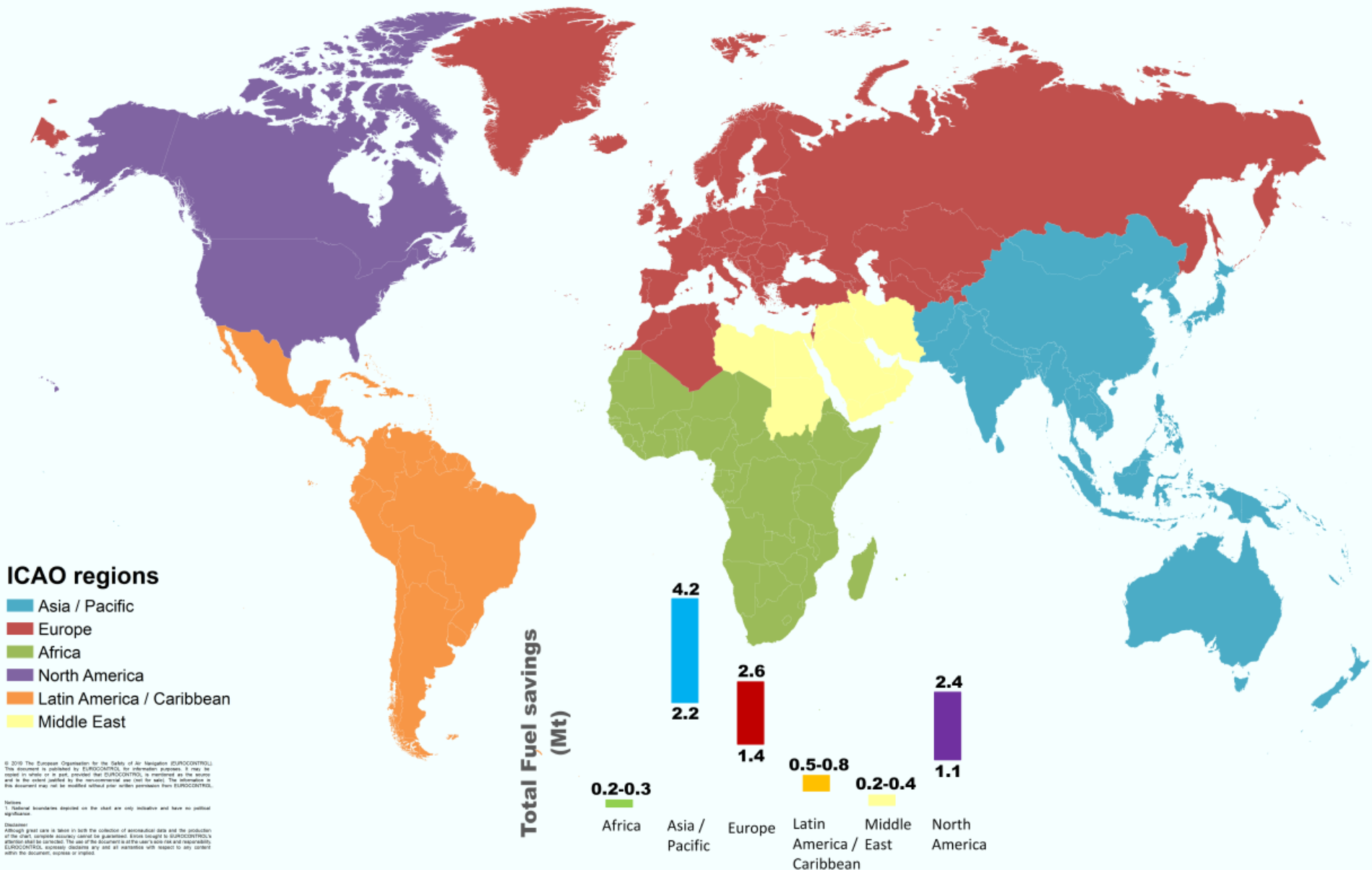
Aircraft Class >>>	Savings (kgs)	Distance Savings (NM)
RoT low	11-95	1-5
RoT high	40-187	17-27

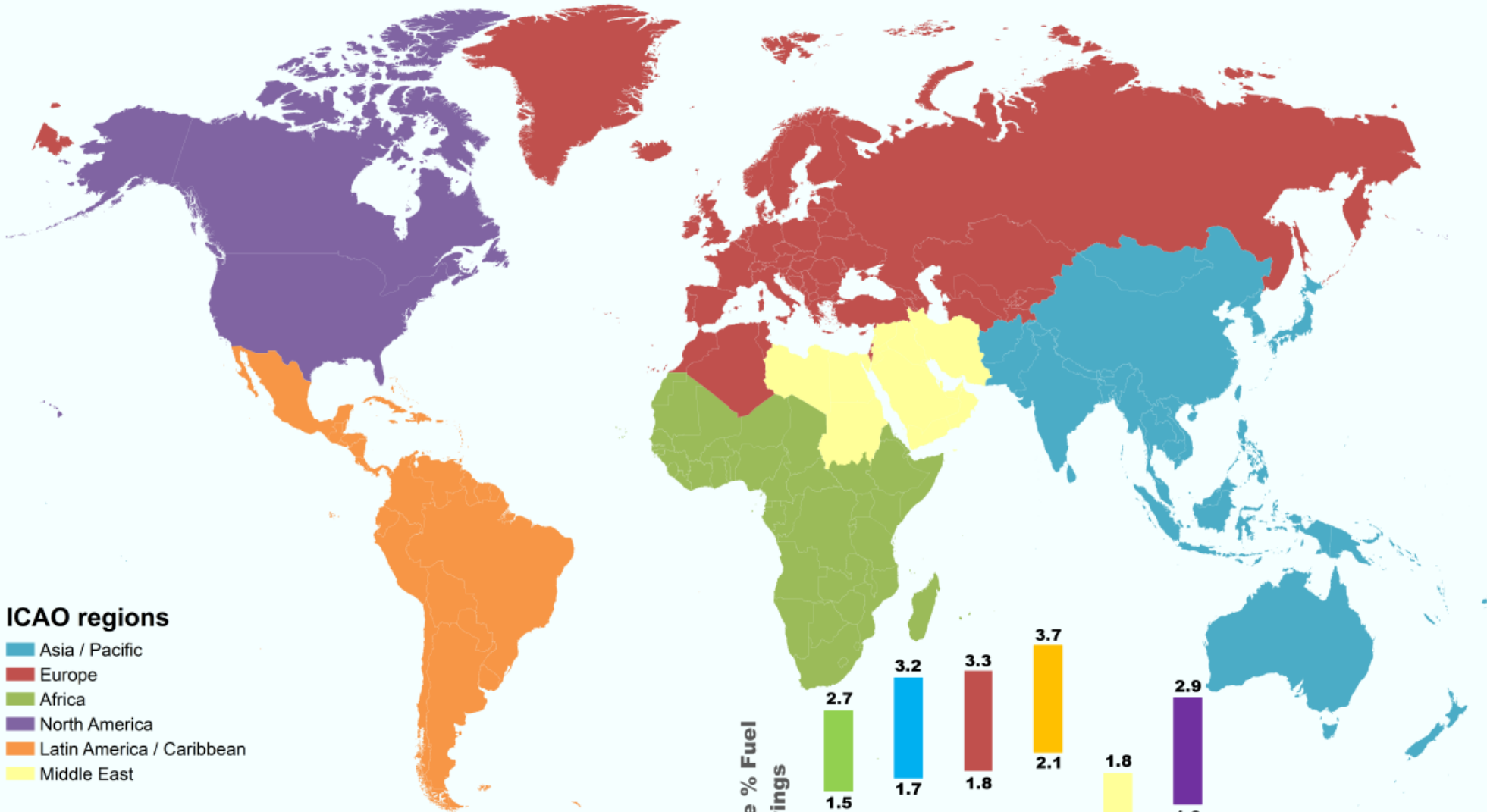
ASBU analysis – State Letter response from SL118



Global responses from SL/118







ICAO regions

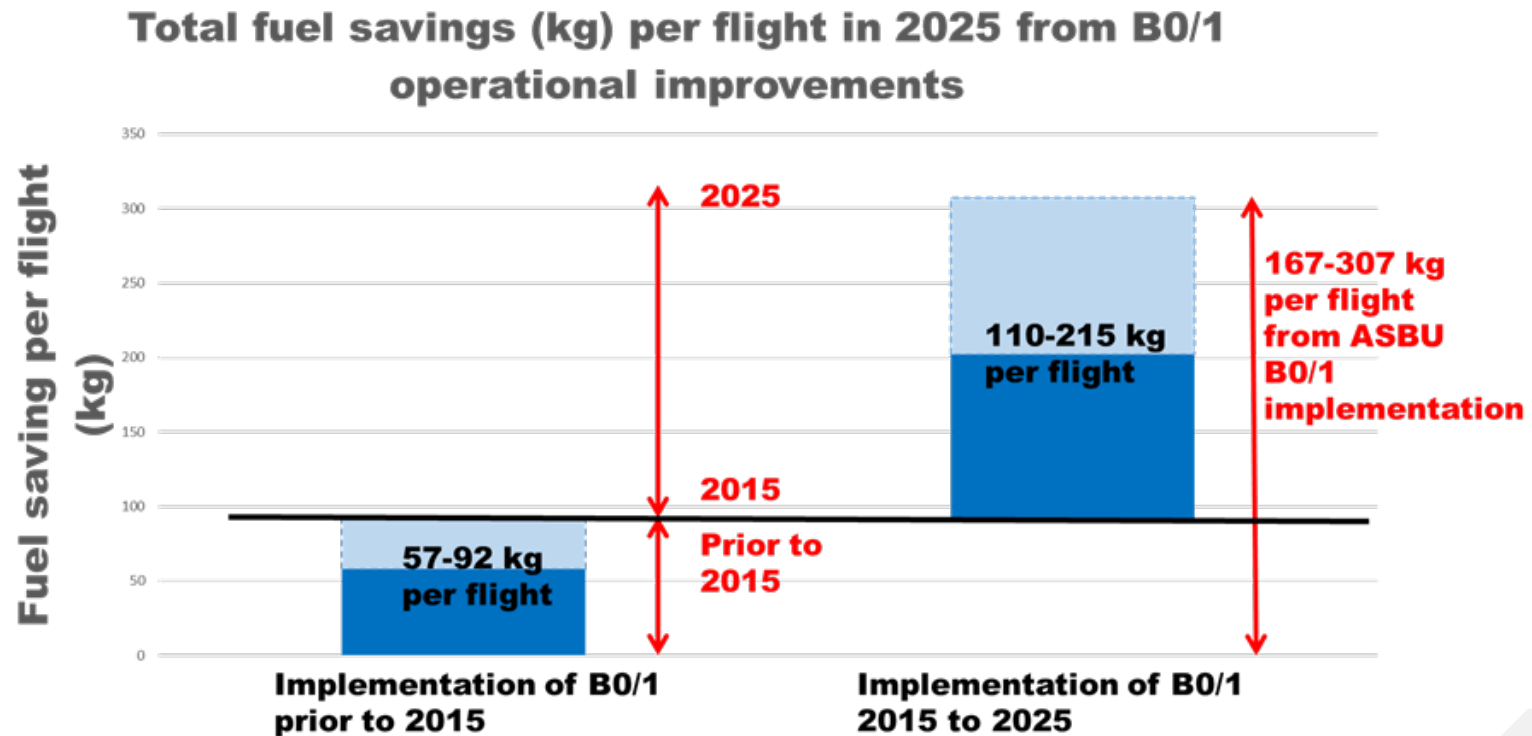
- Asia / Pacific
- Europe
- Africa
- North America
- Latin America / Caribbean
- Middle East

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Notes:
1. National boundaries depicted on the chart are only indicative and have no political significance.

Disclaimer:
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- ASBU B0 / B1 modules implemented prior to 2015: 57-92kg fuel per flight (180-289 kg CO₂)
- The implementation of ASBU is estimated to provide a total annual global fuel savings in 2025 of between 167-307kg per flight (528-970kg CO₂)



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

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

RSEQ – Runway sequencing (AMAN / DMAN)

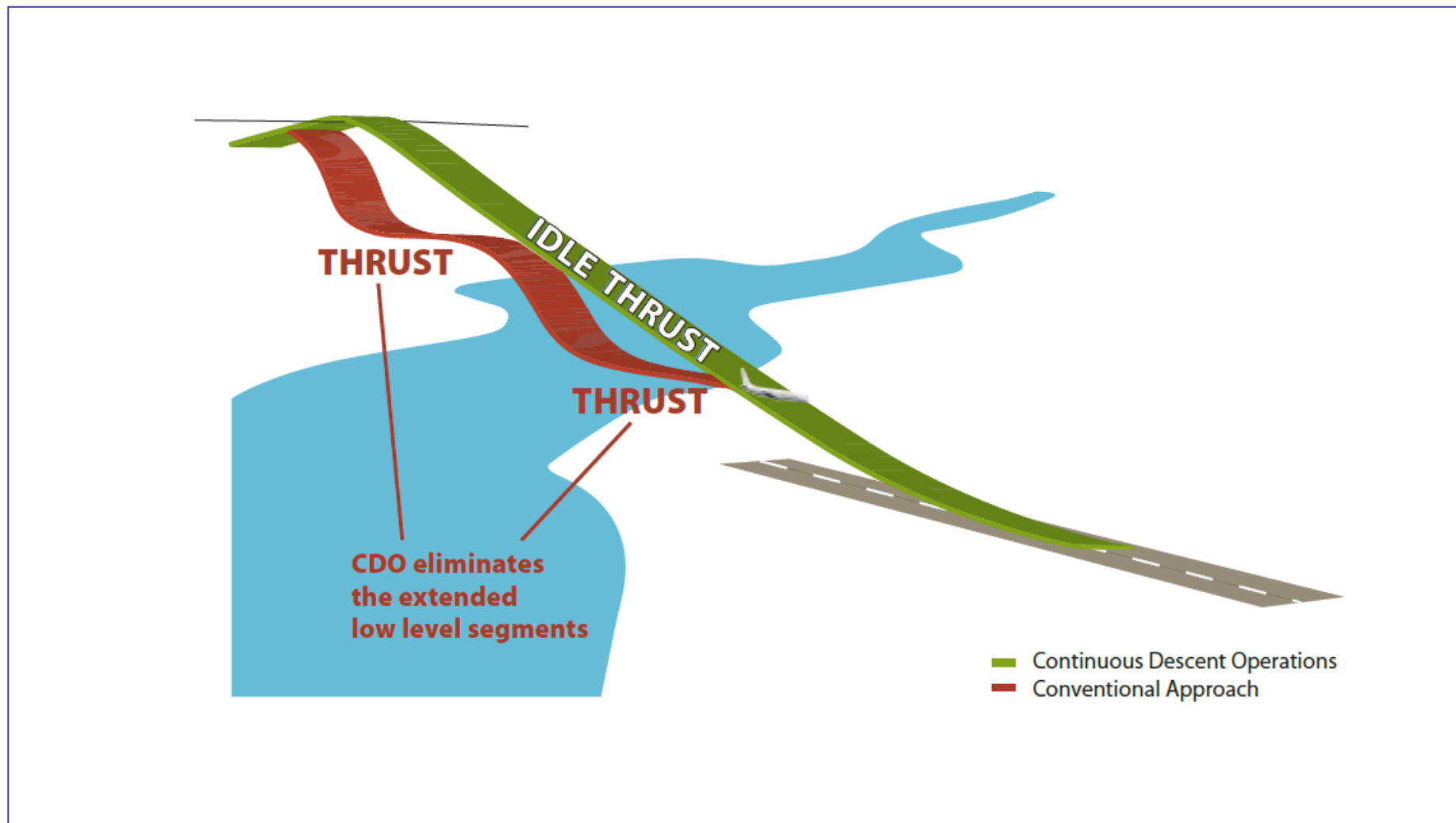
ACDM – Airport Collaborative Decision Making

APTA – Performance Based Navigation

FRTO – Free Route Airspace / FUA

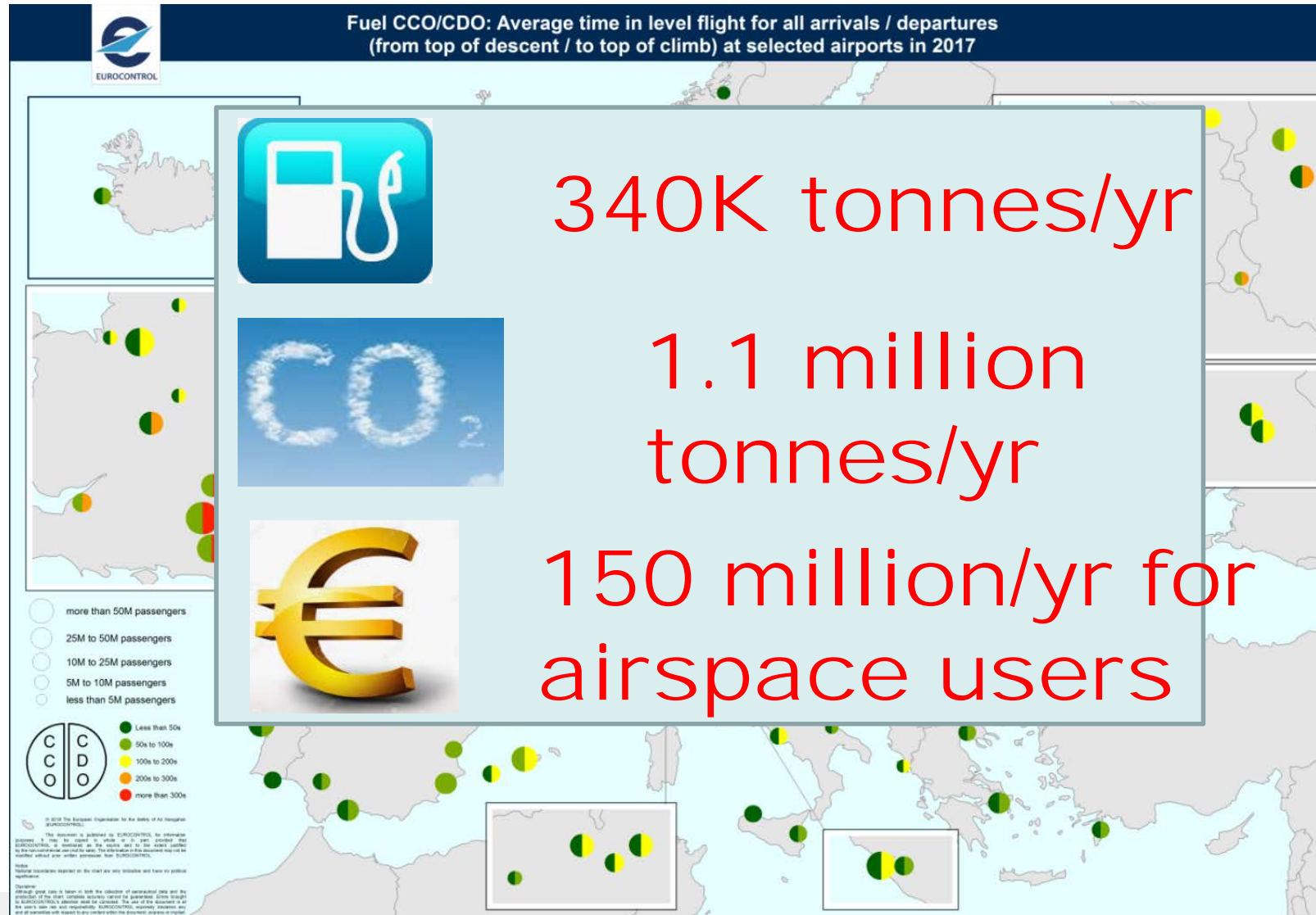
AMET - enhanced MET information

NOPS – Air Traffic Flow Management



Average time in level flight for all arrs / deps in 2017

European CCO / CDO TF





APPENDICES:

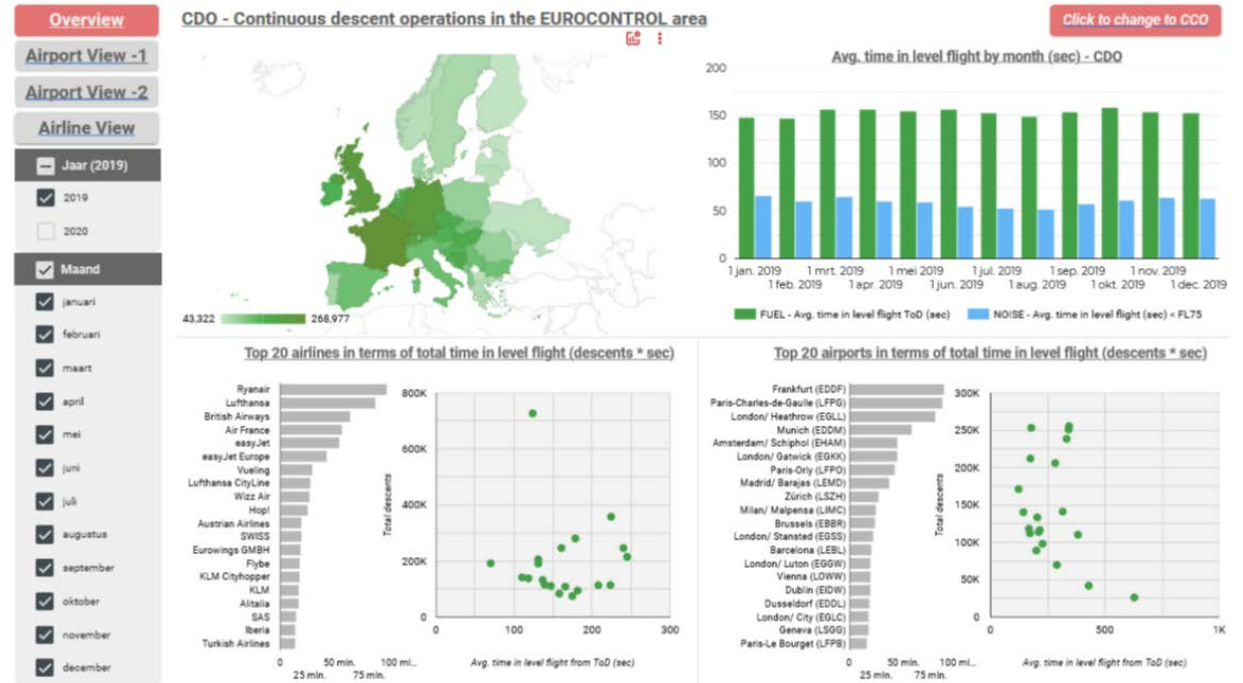
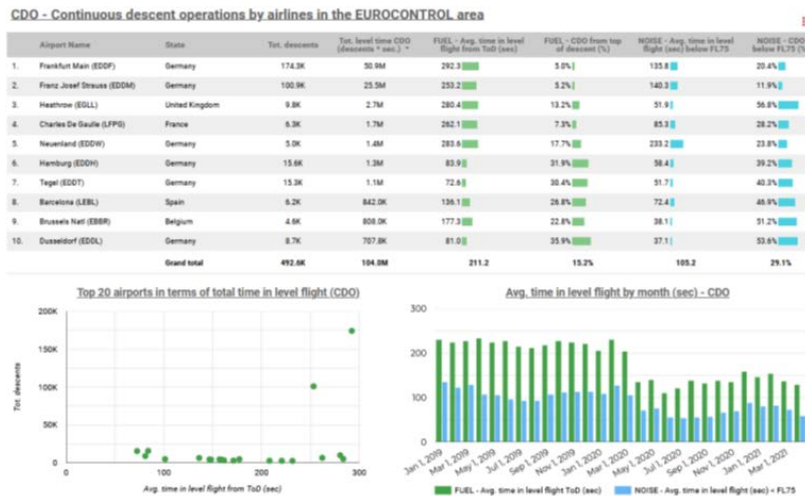
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<https://www.eurocontrol.int/concept/continuous-climb-and-descent-operations#action-plan>

Deliverables (2) - CCO / CDO performance dashboard

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



* 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>

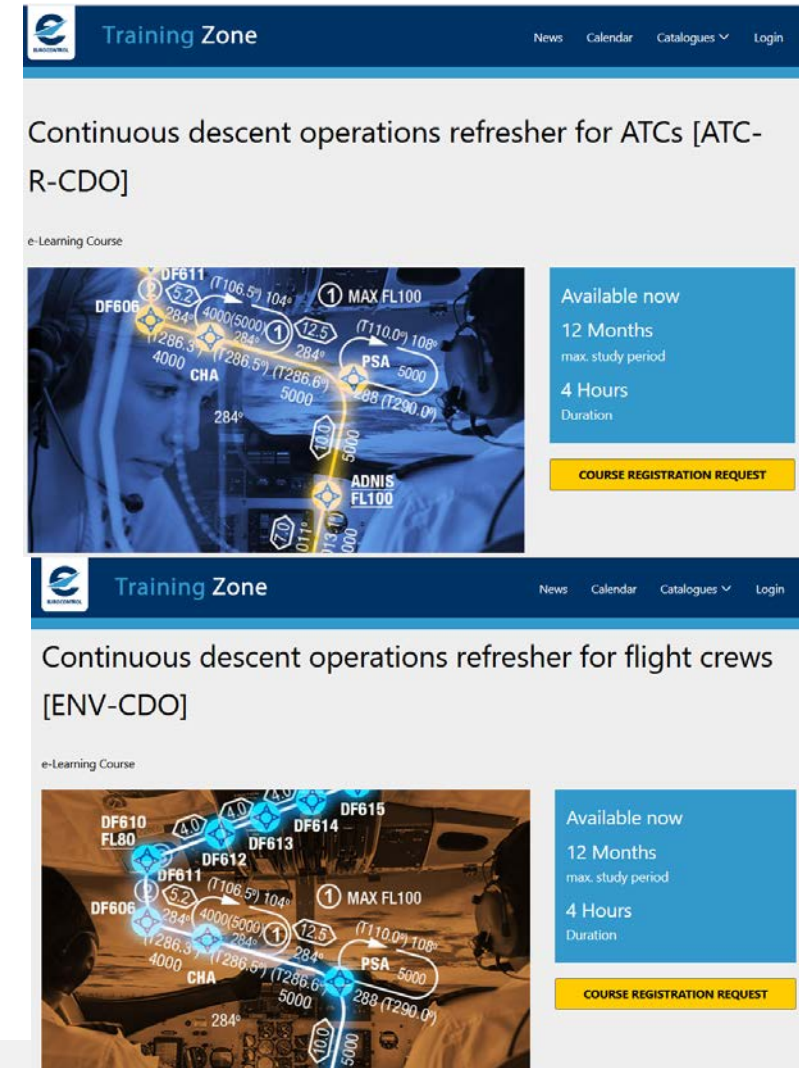
Deliverable (4) - **ATCO refresher training on aircraft energy management**

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

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

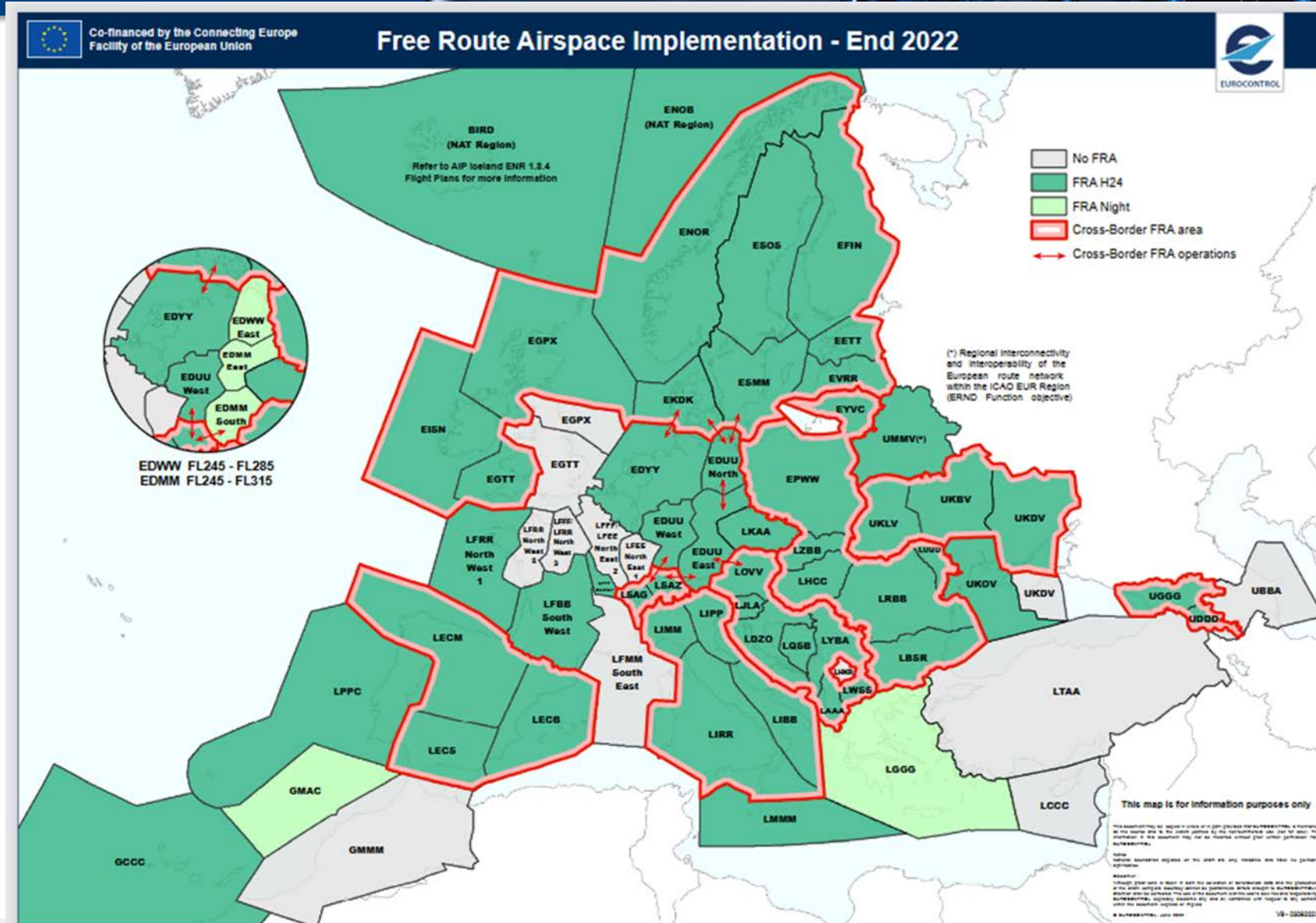
- <https://trainingzone.eurocontrol.int/ilp/pages/coursedescription.jsf?courseId=9178064&catalogId=896425>

Reference -



The screenshot displays two course listings on the Training Zone website. The top listing is for 'Continuous descent operations refresher for ATCs [ATC-R-CDO]', an e-Learning Course available now with a 12-month maximum study period and a 4-hour duration. The bottom listing is for 'Continuous descent operations refresher for flight crews [ENV-CDO]', also an e-Learning Course available now with a 12-month maximum study period and a 4-hour duration. Both listings include a 'COURSE REGISTRATION REQUEST' button. The course images show ATCOs and flight crew members in their respective environments, overlaid with flight data and energy management diagrams.

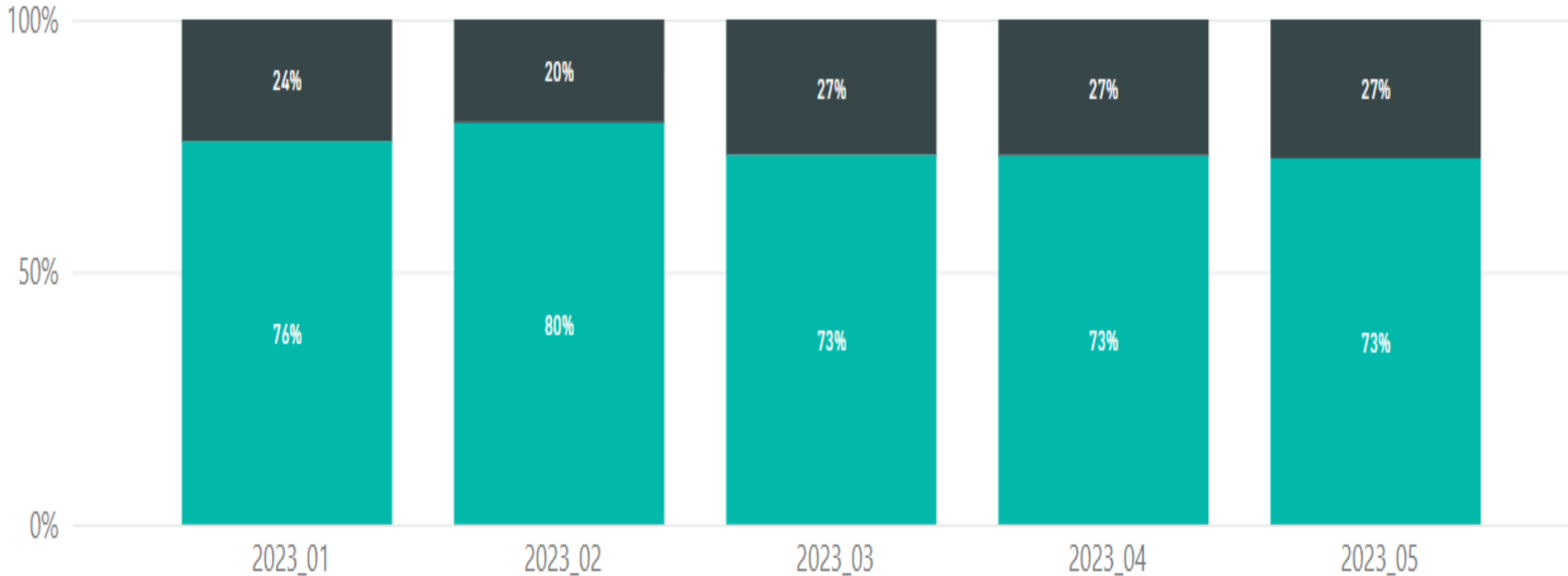
Free Route Airspace - Europe



North Atlantic Tracks → UPRs

Proportion of Traffic on OTS

OTS Flag ● Non-OTS ● OTS





THE MANUAL

Airport CDM Implementation



Boosting Flight Efficiency: 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 → earlier direct routing – earlier clearance to RFL – CCO: 12-35 kg of fuel savings / flt

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



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

fello'fly project to prove safe technical and operational principles

Industry collaboration with airlines, Air Traffic Control providers & regulators

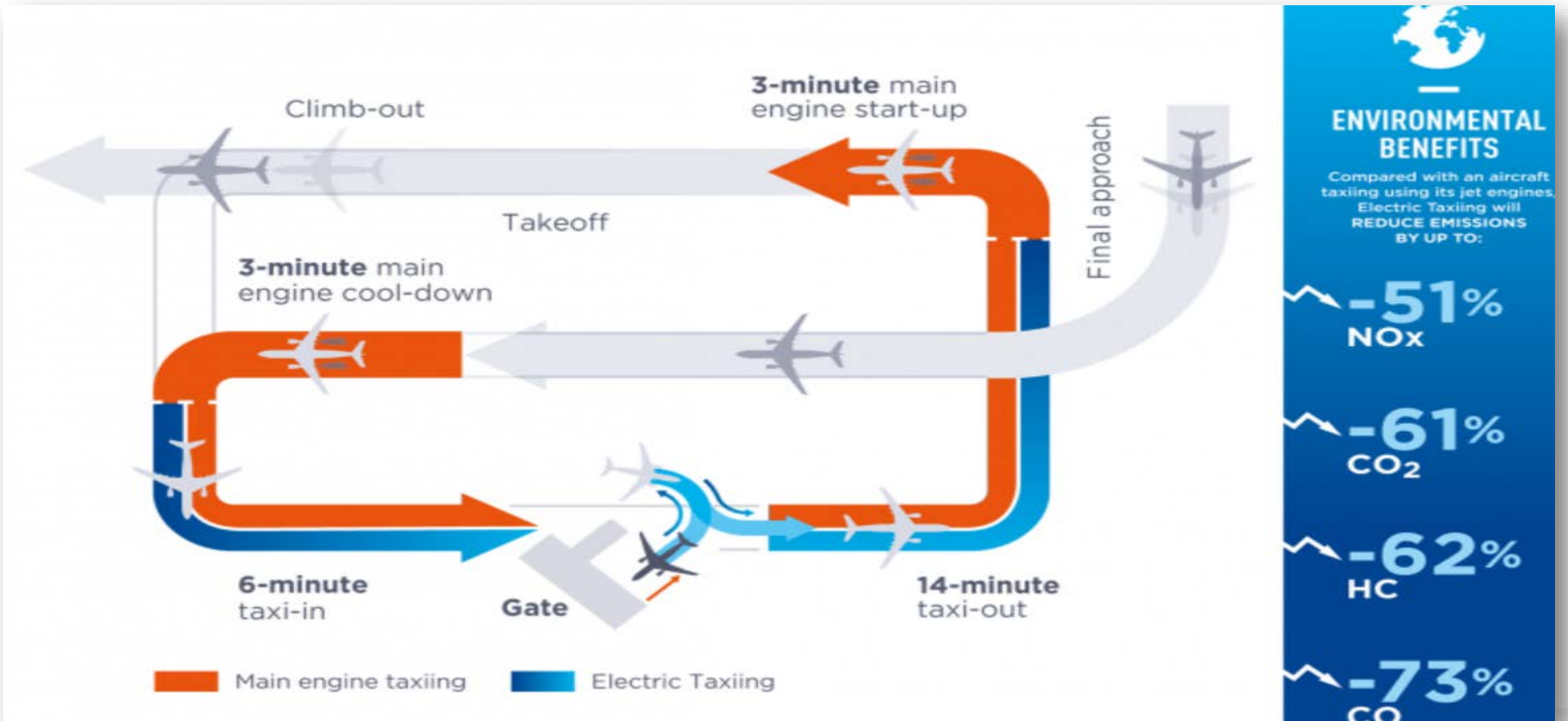
5% to 10% fuel savings on long-haul trips

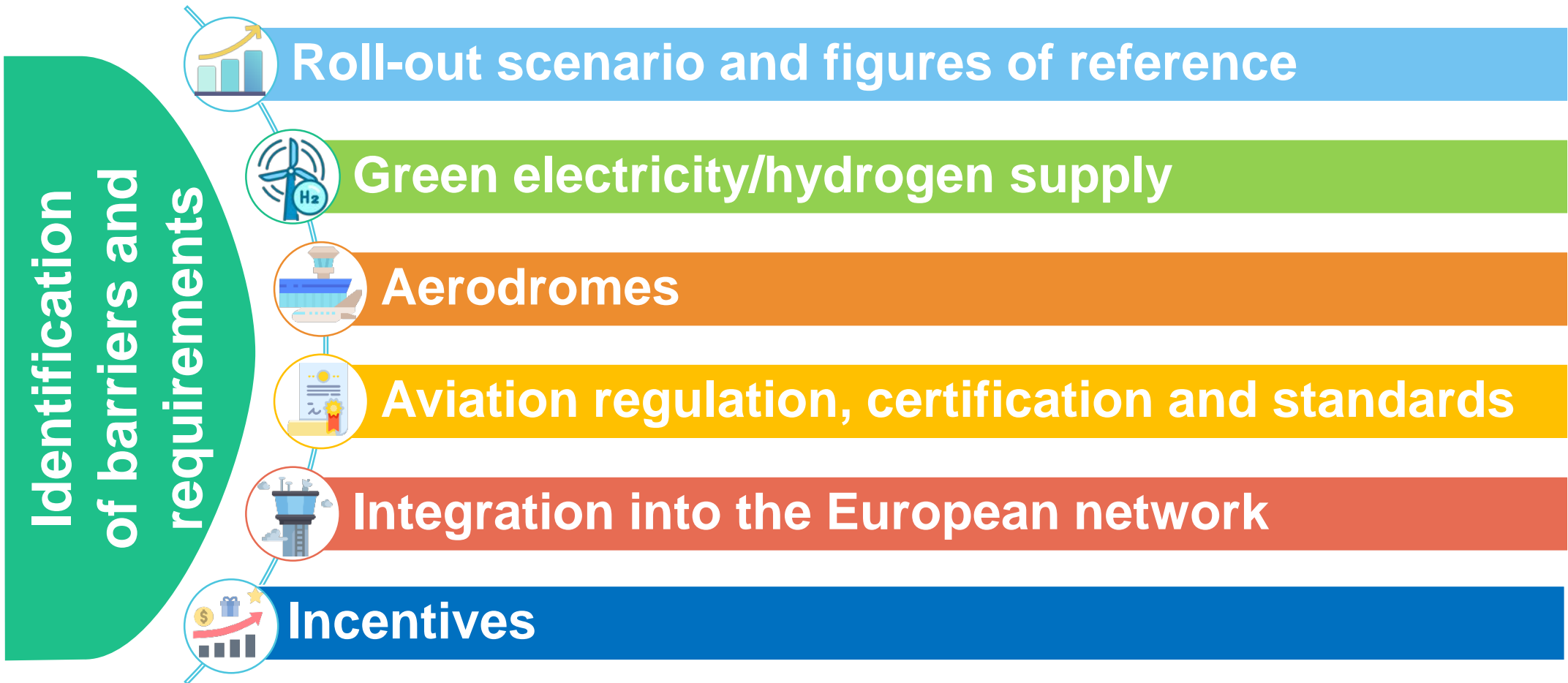
Significant emissions reduction

AIRBUS

The infographic features a teal background with white and yellow text and icons. On the left, a white airplane is shown flying, with a series of white circles representing its wake. A white line connects the wake to a second white airplane flying below it, illustrating the concept of using air upwash. The text is arranged in a clean, modern layout with horizontal lines separating the key points. The Airbus logo is in the bottom right corner.

Next steps – removing emissions e.g. e-Taxi solutions





New challenges - AZEA



CRITICAL REVIEW OF ATM/ANS ENVIRONMENTAL PERFORMANCE MEASUREMENTS

ATM/ANS Environmental Transparency Working Group

Pillar 1 - Final Report



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: Developments 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 (KPAs)¹ 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://www4.icao.int/ganportal/GanpDocument%20sore/m/R-NvTw42AWIArgUwLYarQFkoUGNX_h?_k=h8rv8t

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

