CDO/CCO operations within FABEC

FABEC SCO – AOG & CFSPG meeting
Geneva, 16 May 2023

Agenda item 6

José Daenen, LVNL
Gérald Regnaud, DSNA
Wolfram Isselmann, DFS

making the difference

CCO/CDO at LVNL

FABEC SCO – AOG & CFSPG meeting
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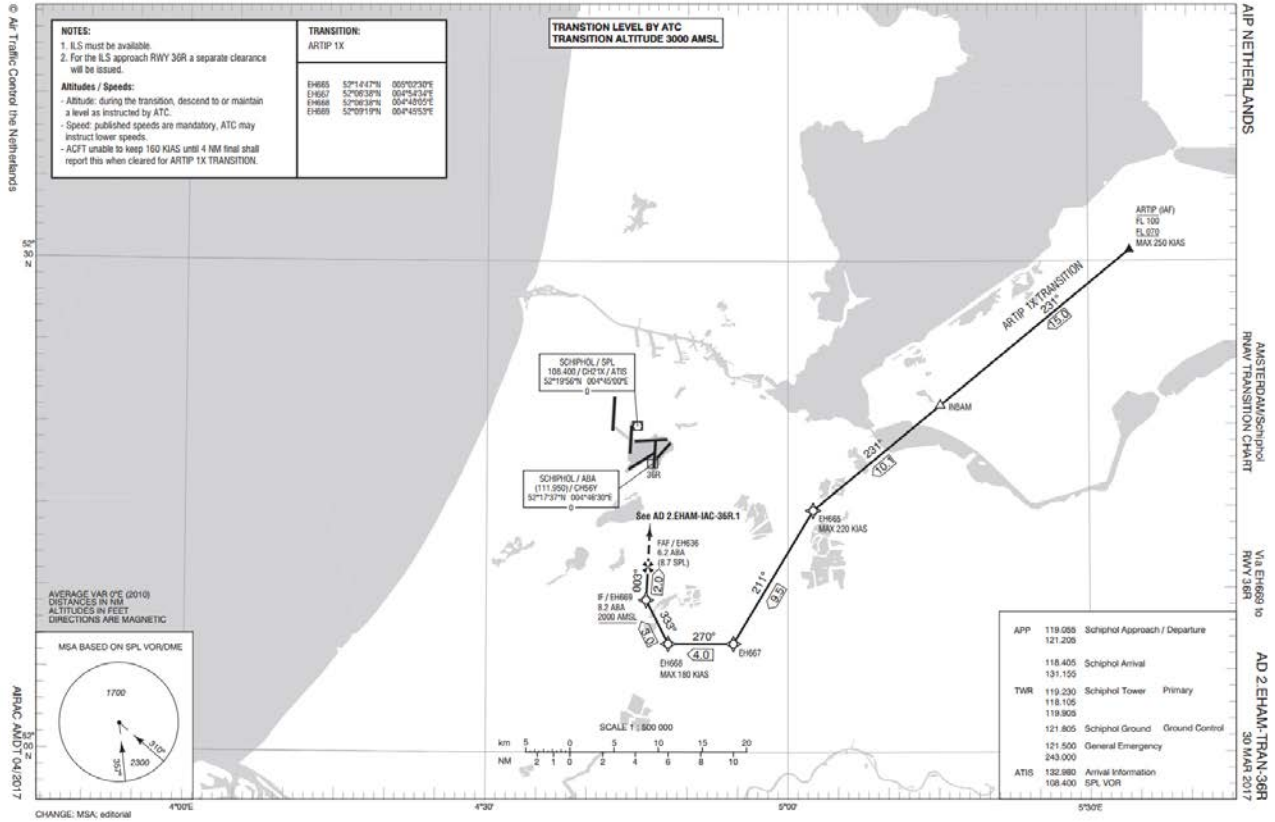
José Daenen, LVNL

Contents

- Fixed Arrival Route implemented in 2010
- Actual Fixed Arrival Routes strategy
  - Fixed Arrival Routes in the Dutch FIR as enabler for CDO/CCO operations
- Current CDO/CCO performance

Fixed Arrival Route implemented in 2010



Schiphol FAR ARTIP1X (for use in daytime operation) exists, but not actually in use.

Stap 1 - Enkelvoudige VNRs

Stap 2 - Meervoudige VNRs

Stap 3 - Optimalisatie hoogteprofielen

Stap 4 - VNRs in nieuwe TMA

Stap 5 - VNR als basis concept

Stap 6 - CDA op convergente banen

Stap 7 - VNRs tijdens landingspieken

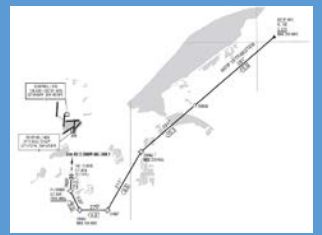
Stap 8 - CDO's op parallelle banen

Actual FAR strategy

4 fases

Leading to 3D separated routes with CDO and CCO operations

ARTIP1X

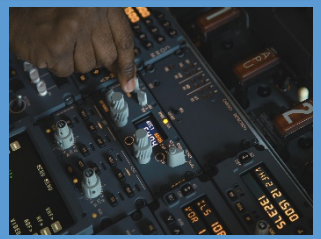


Transition

FAR during the day with high capacity, existing technology

Optimisation

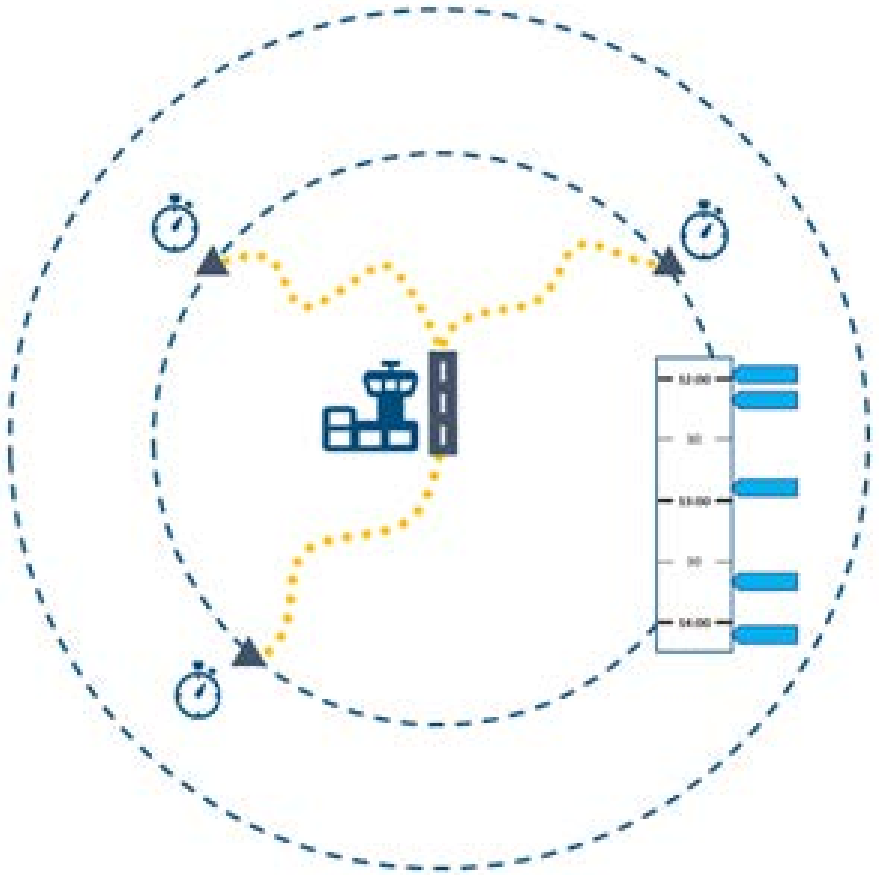
FAR during the day, increased capacity, new technology



Optimisation

3D separated routes, with CCO and CDO (main runway configurations)

Fase 1
First step



knowledge & development centre
Mainport Schiphol

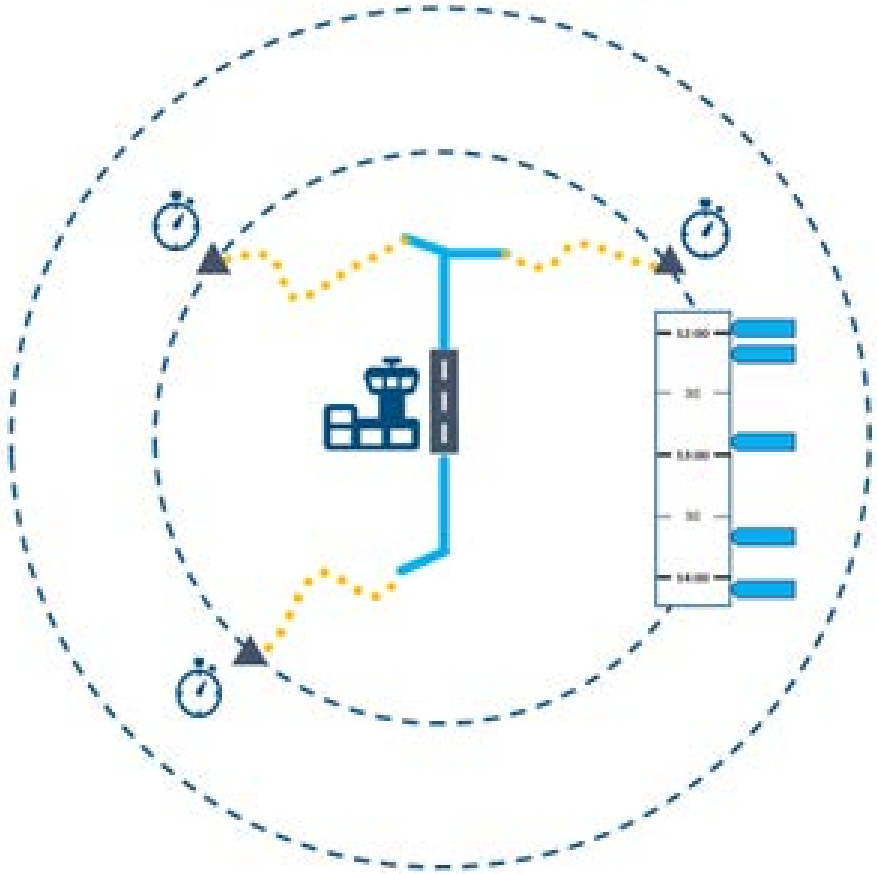
Characteristics

- No FAR during the day.
- Planning stability and EAT adherence need to be improved
- Active monitoring of these parameters
- 3 IAF's

Essential actions/research

- Improve chain-thinking and working to plan
- Implement technological solutions
- Determine success criteria for the phase transitions
- Determine when to set FAR ON/OFF
- Determine workload
- Safety case analysis

Fase 2
Structural use of FAR during the day



knowledge & development centre
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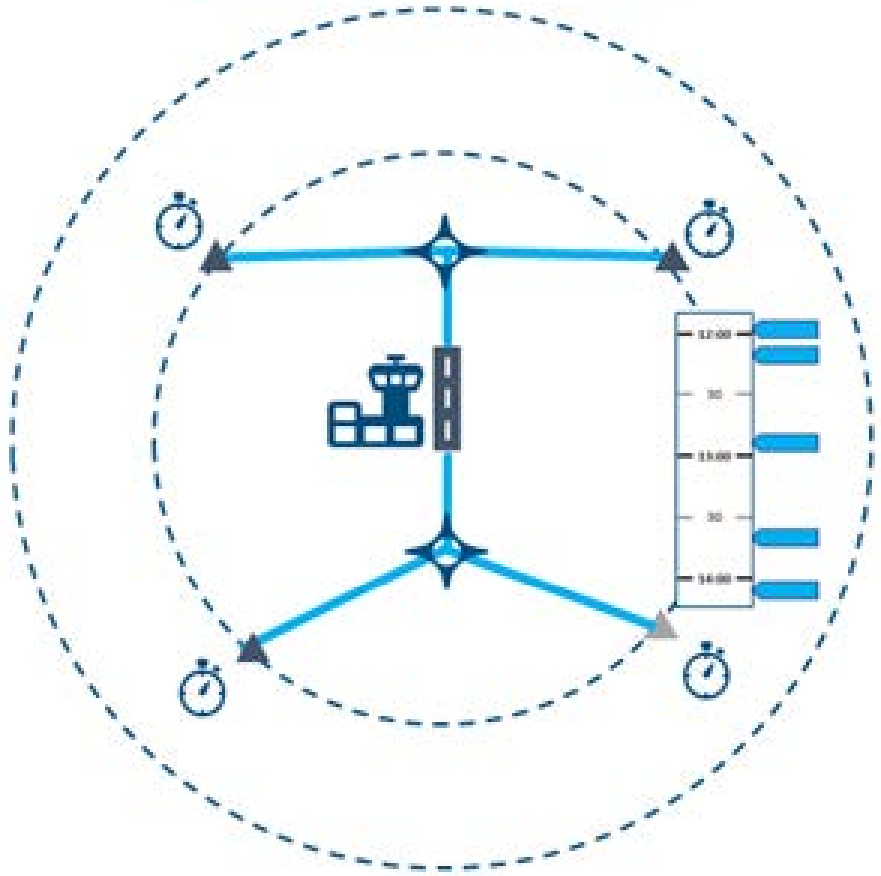
Characteristics

- Use “short” FAR's with high capacity during the day.
- Further improve planning stability and EAT adherance
- Starting point of FAR is not on the TMA boundary
- Vectoring between TMA boundary and FAR starting point.

Essential actions/research

- Collaborative planning ACC+APP with integral AMAN
- Implement merge support
- Develop training plan to maintain vectoring proficiency

Fase 3
Long FAR's starting from TMA boundary



knowledge & development centre
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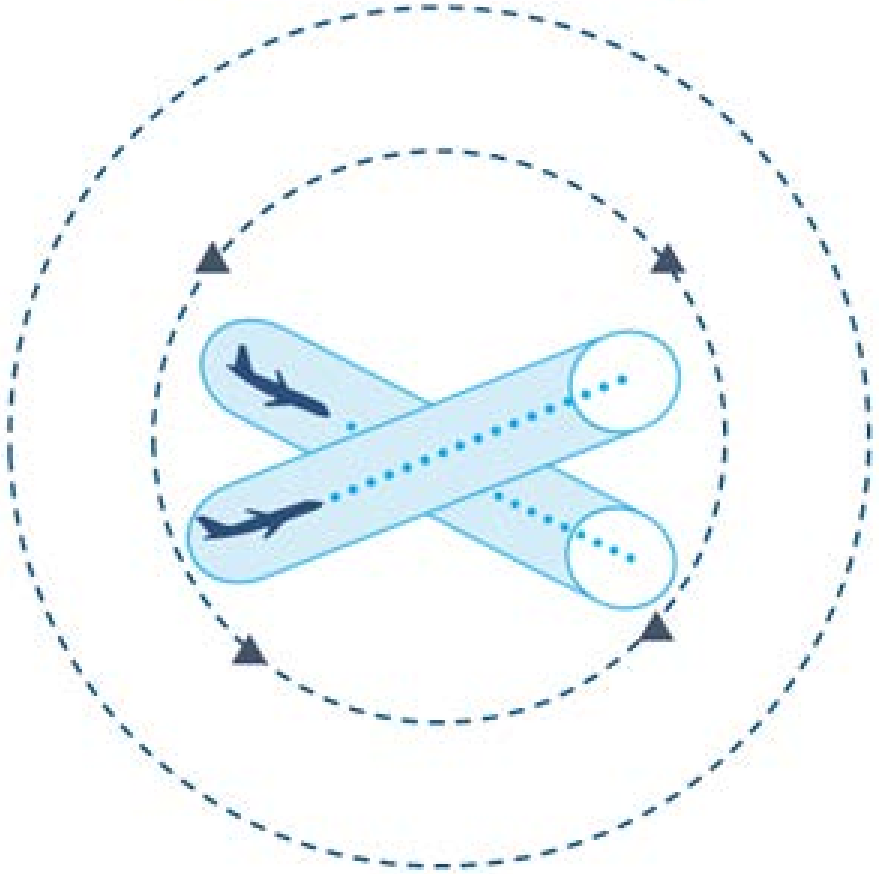
Characteristics

- Use FAR's with high capacity during the day, FAR start on TMA boundary.
- No longer vectoring under nominal conditions for the main runway configurations.
- Merge FAR's in the TMA
- 4th IAF potentially implemented

Essential actions/research

- Investigate techniques to further increase the capacity of the FAR ATM system

Fase 4
3D separated routes
(requires airspace redesign
“luchtruimherziening”)



Characteristics

- 3D separated routes with CDO and CCO
- FAR’s from TMA boundary are fixed laterally and vertically
- Increased capacity
- 4 IAF’s
- Airspace redesign (in Dutch): https://www.luchtvaartindetoekomst.nl/onderwerpen/nieuwe-indeling-luchtruim

Conclusions & recommendations

knowledge & development centre
Mainport Schiphol

Conclusions

- The transition towards a FAR ATM system requires small steps
- FAR with high capacity is a big change, especially in the collaboration between ACC and APP
- Smaller control space in the TMA requires higher EAT adherance at the TMA boundary
- No performance improvement without system improvement
- The FAR ATM system needs to be robust against disturbances
- Maintaining flexibility during the operation is preferred, vectoring remains part of the FAR ATM system

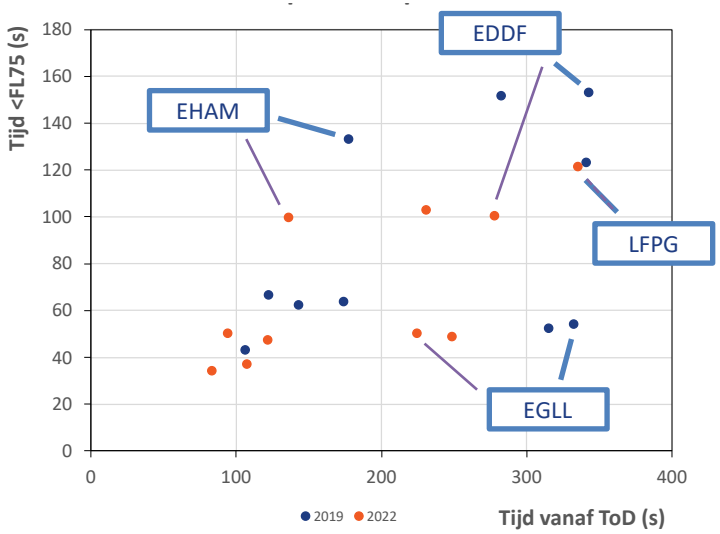
Recommendations

- Establish success criteria for the phase transitions
- Establish criteria to set the FAR system ON/OFF
- Further develop technological solutions
- Workload assessment
- Safety assessment

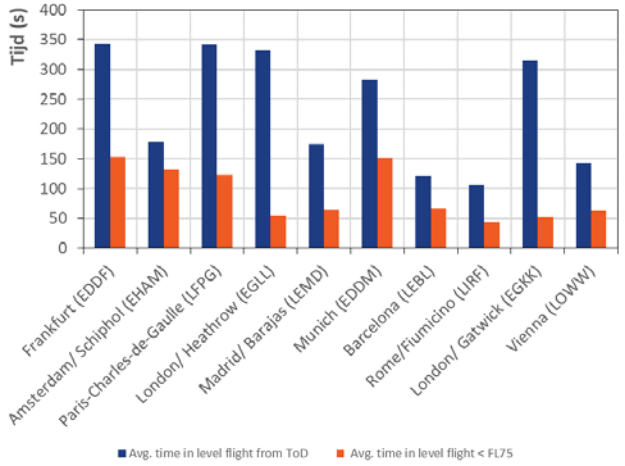
Current EHAM CDO performance

- Very efficient arrivals from top of descend (ToD).
- Heathrow's performance below FL75 is better (no parrallel approaches / focus on CDO's for noise abatement)

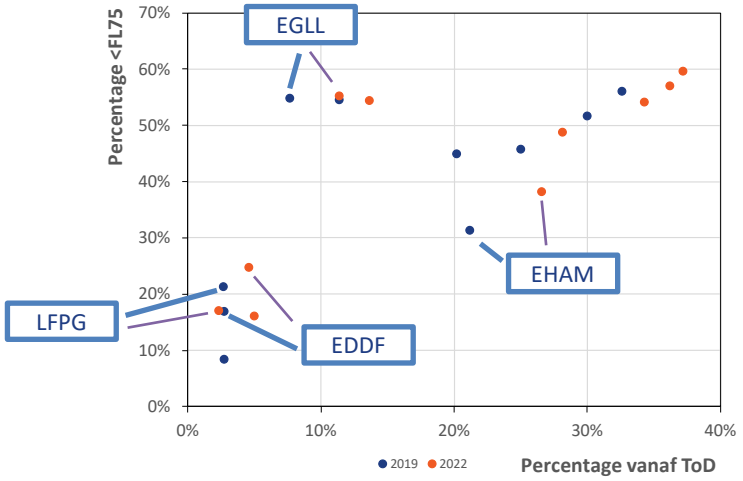
Average time of level flight during descent, 2019



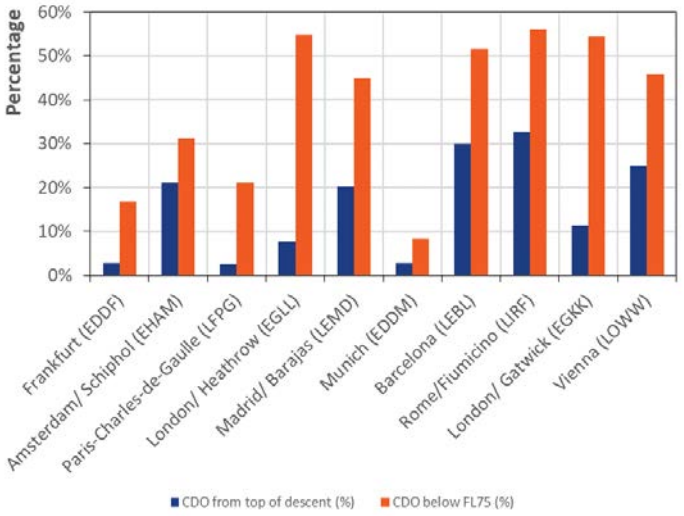
Average time of level flight during descent, 2019



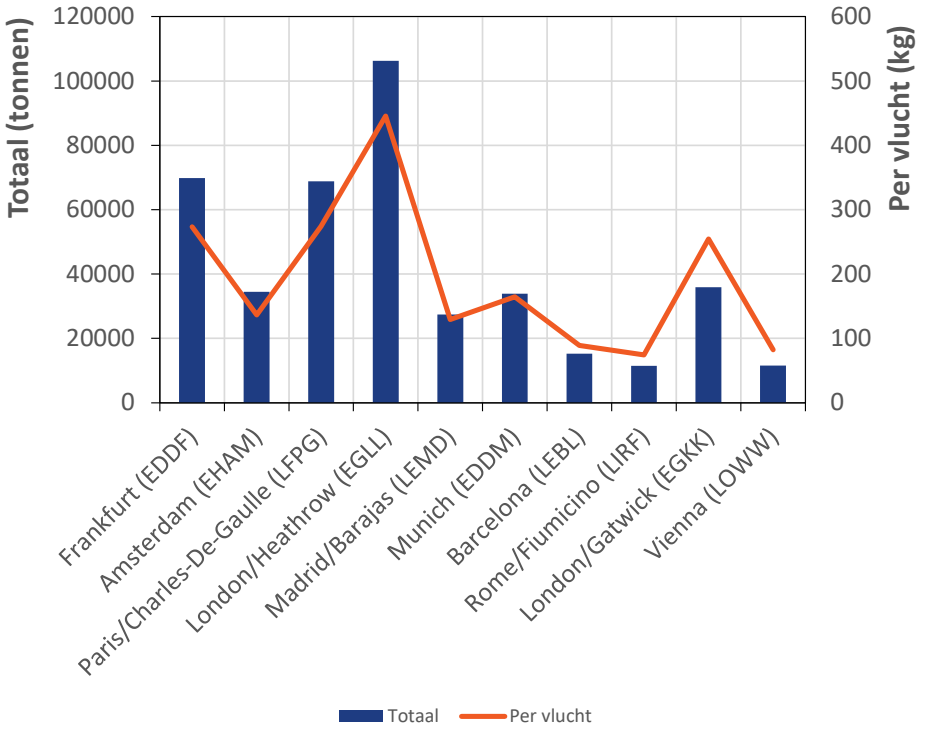
Percentage of flights without level flight during descent



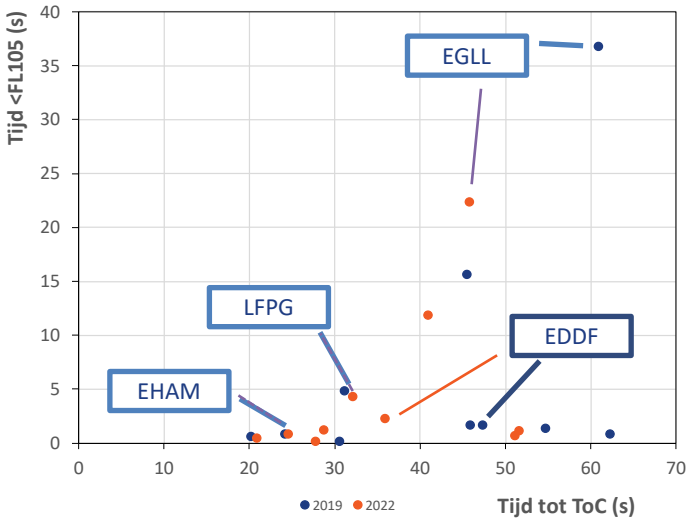
Percentage of flights without level flight during descent



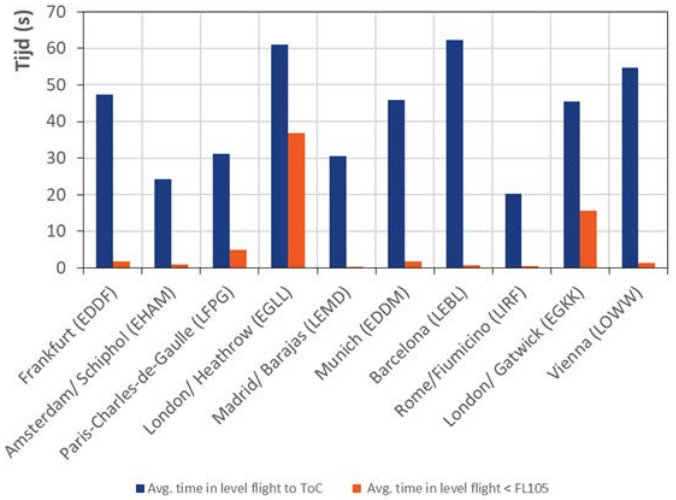
Extra CO2 emission by level flight during descent, 2019



Average time of level flight during climb



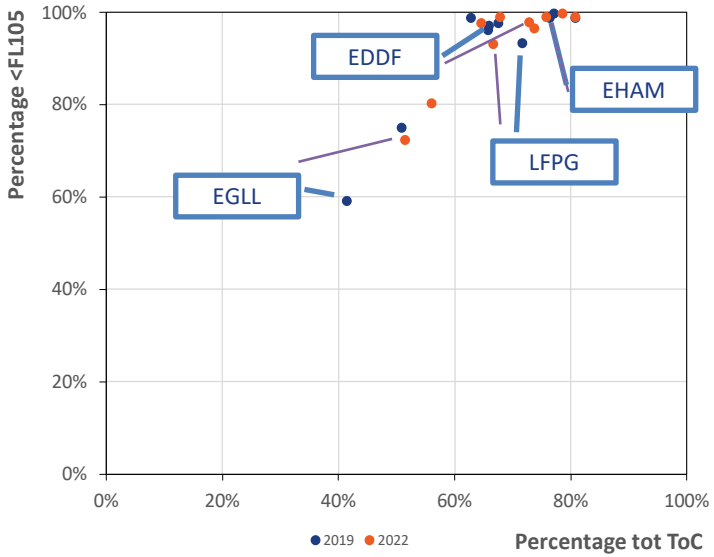
Average time of level flight during climb, 2019



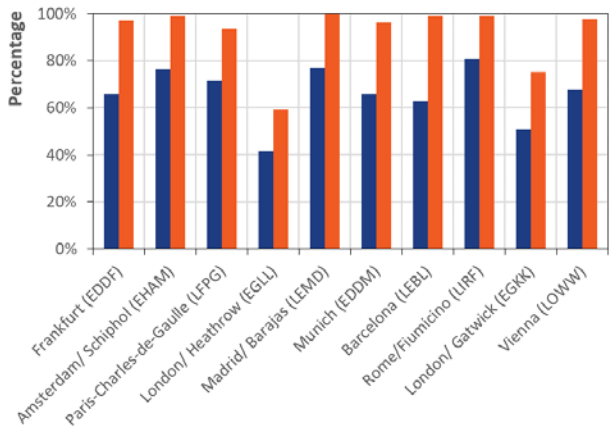
Current EHAM CCO performance

- Very efficient CCO at Schiphol, till Top of Climb (ToC) as well as till FL105
- Small differences with Frankfurt and Paris-CDG. Heathrow performance is worse.

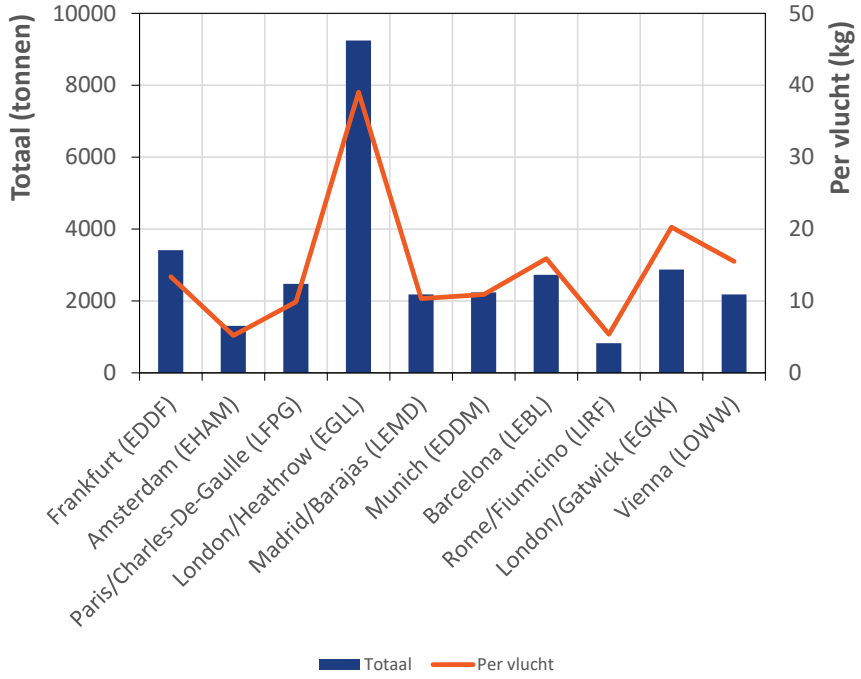
Percentage of flights without level flight during climb, 2019



Percentage of flights without level flight during climb, 2019



Extra CO2 emission by level flight during climb, 2019



GREEN OPERATIONS at DSNA,
A COLLABORATIVE IMPLEMENTATION

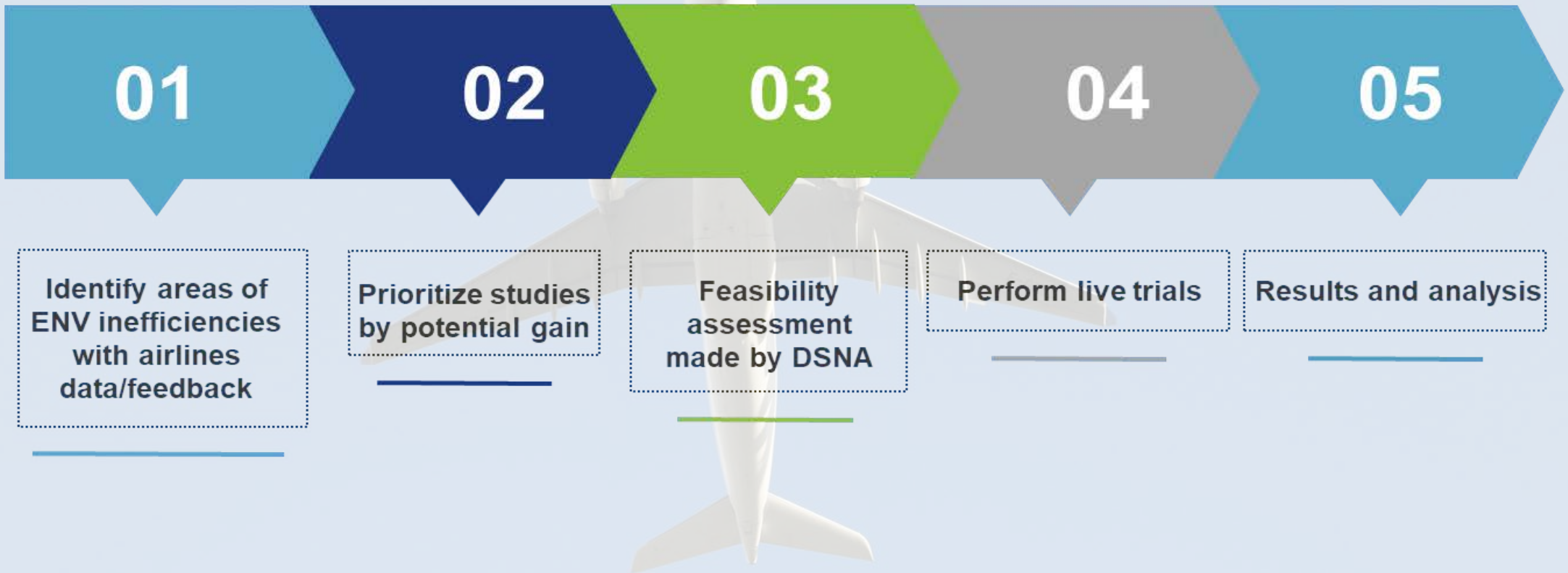
Gérald REGNIAUD, DSNA
Advisor to the Director of Operations

HOW EFFICIENTLY TO IMPROVE ENV PERFORMANCE?

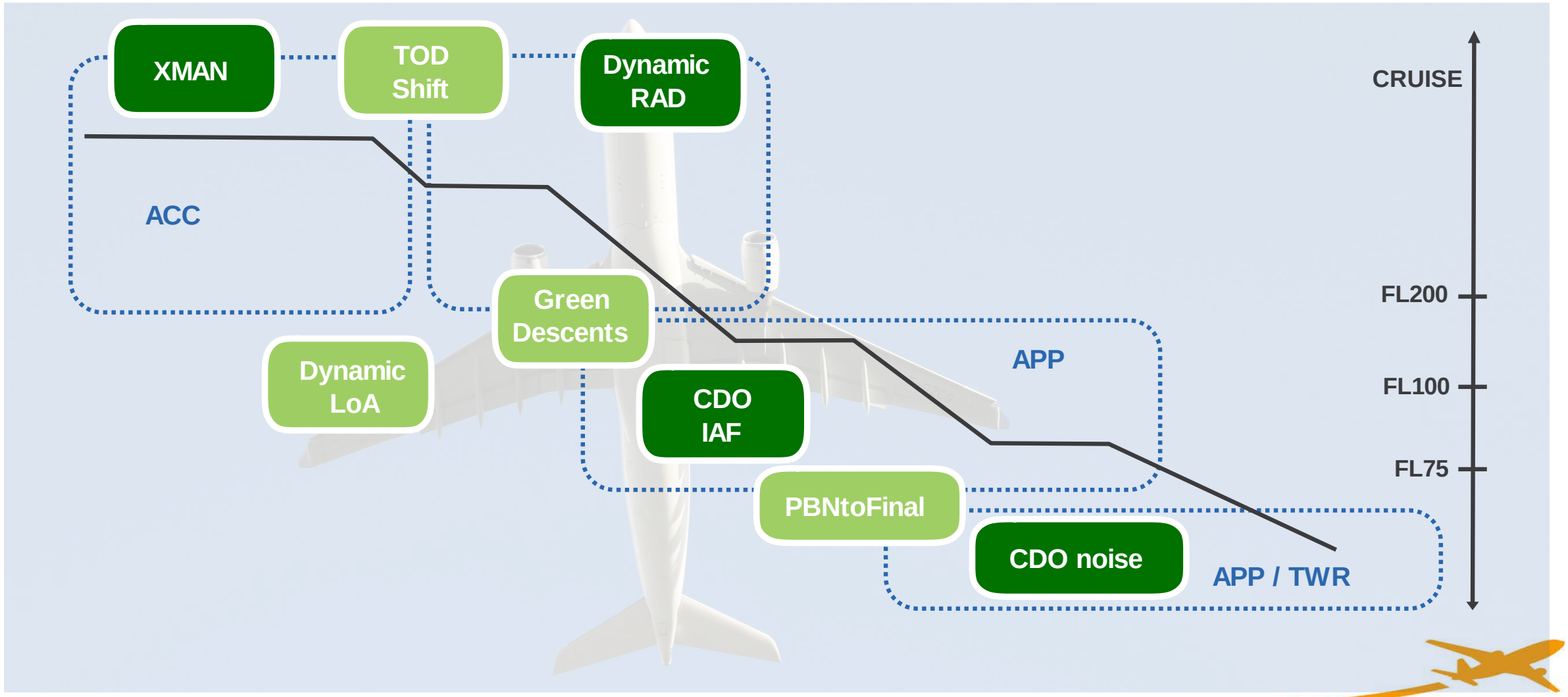
A dedicated Task Force « Green Operations » with DSNA & Airspace Users set up in June 2022

- Developing a “customer-centric” approach
- Implementing green operations concepts
- Addressing short term environmental benefits (quick wins) in terms of CO_2 reduction at high altitude and noise reduction at low altitude

METHODOLOGY OF THIS NEW APPROACH

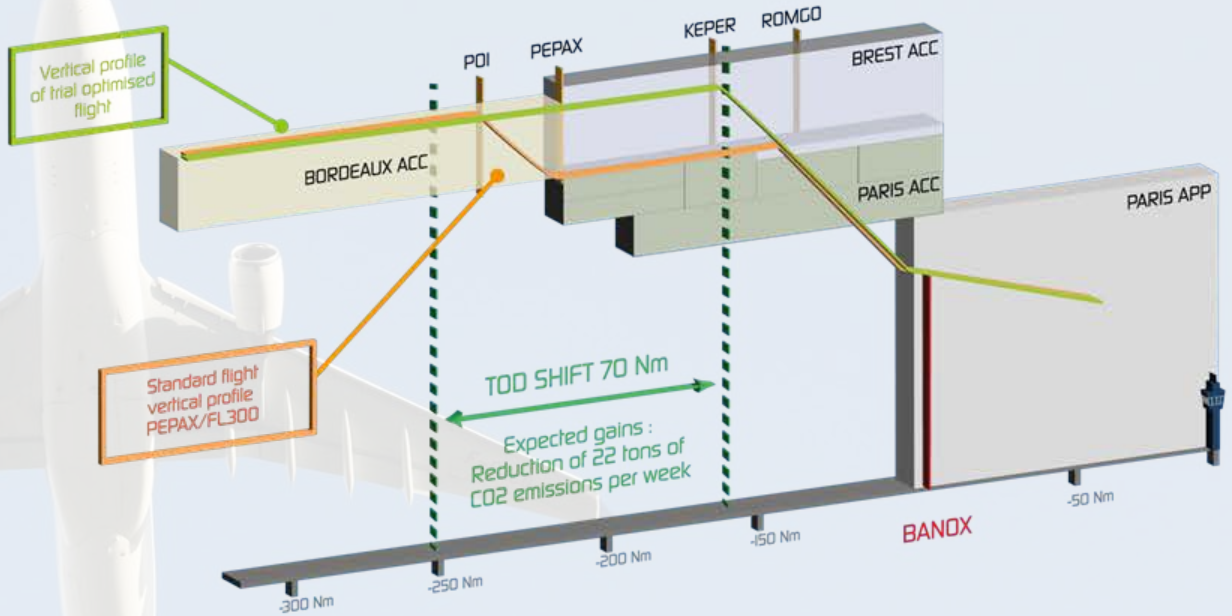


ATC SOLUTIONS FOR MORE ECO-RESPONSIBLE FLIGHTS



DYNAMIC LOA BETWEEN 3 ACCS / TOD SHIFT

« AFR782, expect descent to cross BANOX FL150, maintain FL380, report ready for descent »

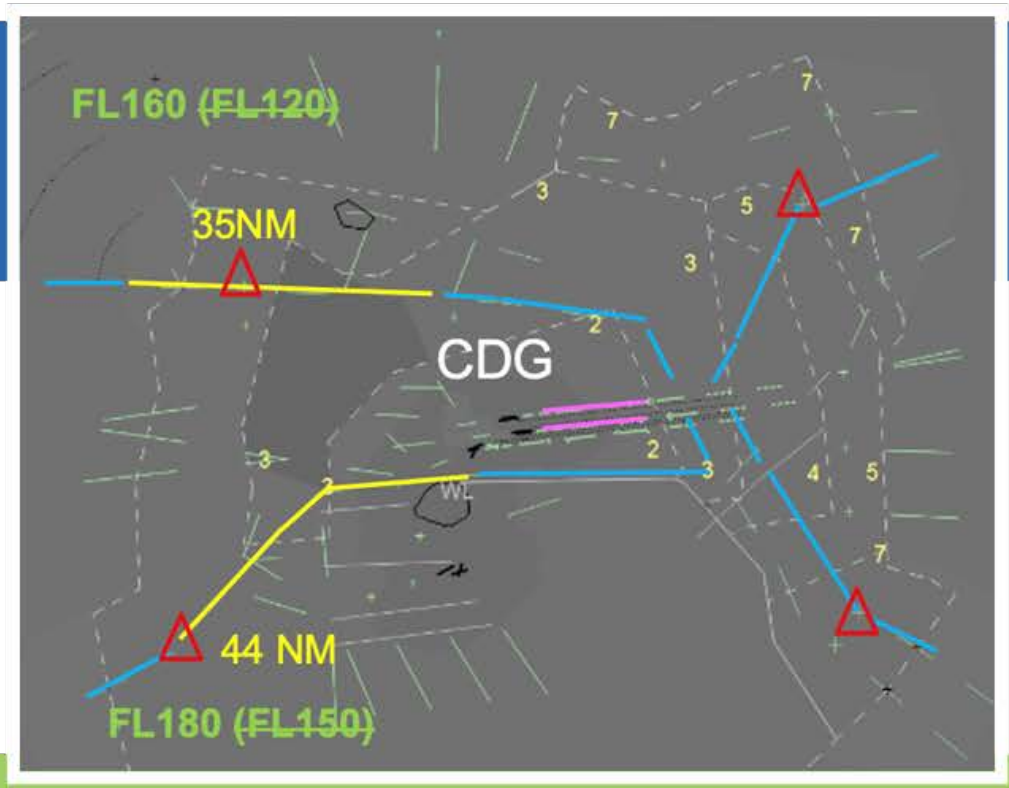


Estimated CO_2 reduction: 22 tons per week = 2 Paris-Nice flights / per week

DYNAMIC LOA BETWEEN CDG-APP AND PARIS-ACC

15% of arrivals can fly Green Descent to airport

- Coordination on Green Slots: increase Transfer Altitude from ACC to APP
- Test phases: no procedures modification, low trafic, sup AIP
- **Final Phase (April 2023): additional Green Procedures with low and medium traffic**

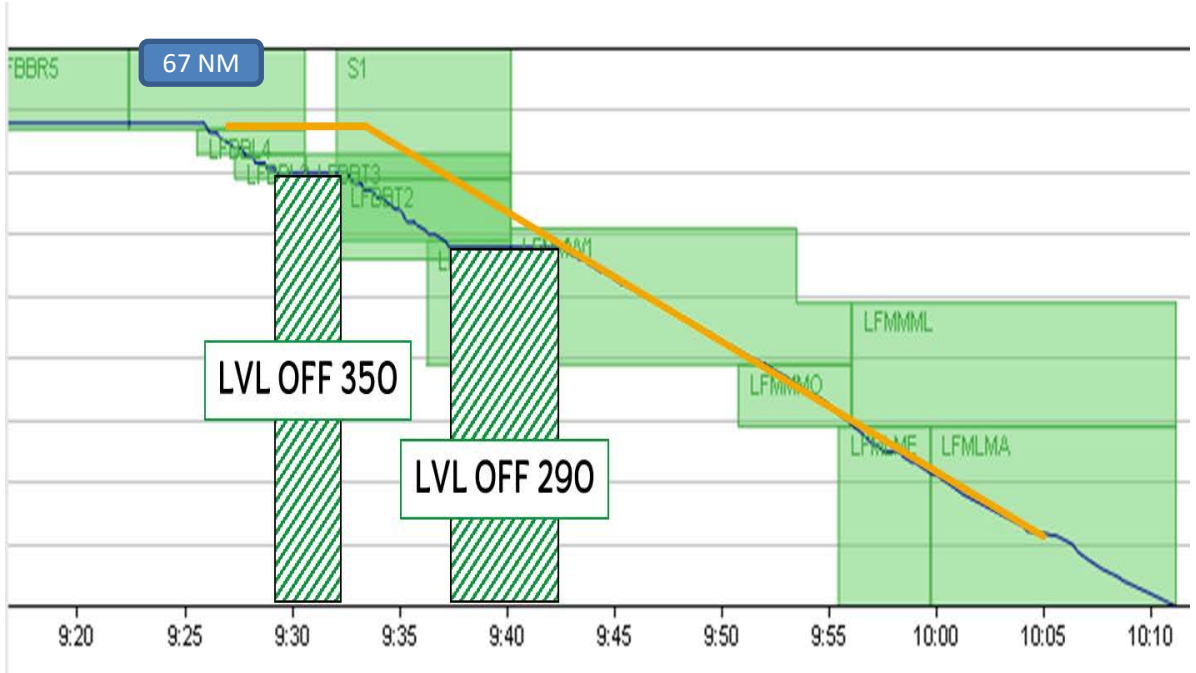


Example of patterns facing West

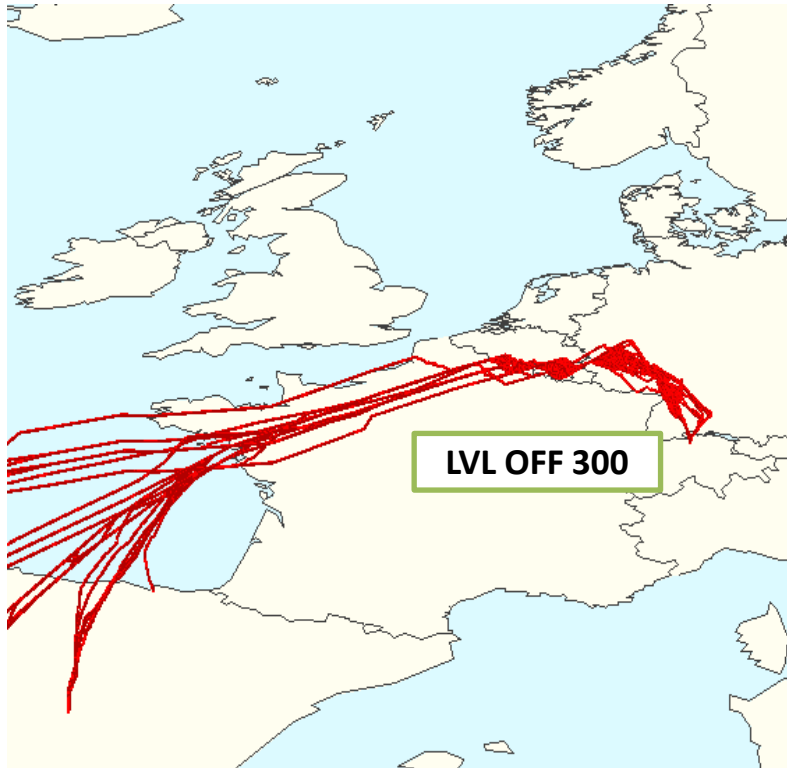
FUEL
50 to 150 kgs of savings per flight

CO_2
150 to 470 kgs of reduction per flight

CROSSBORDER COOPERATIONS AND R&I PROJECTS



LERGA Arrivals to LFML



LSZH Arrivals via OMASI

SESAR: HERON & CONCERTO & CICONIA
State-Funded Project : DECOR

Continuous Descent Operations

Cooperation DFS and Customers to improve VFE

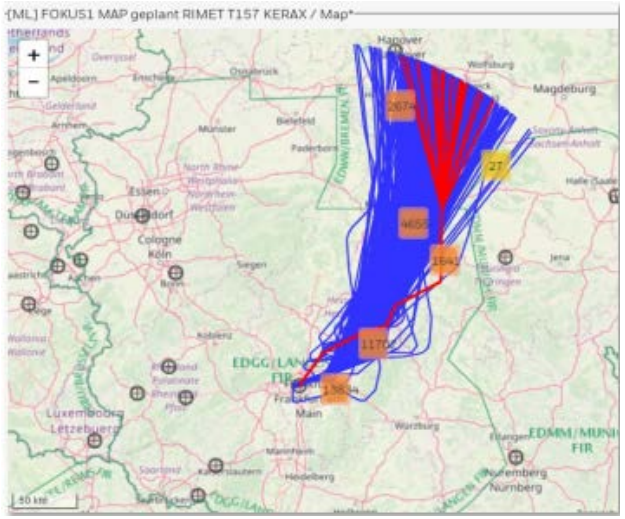
Wolfram Isselmann, DFS

Good Cooperation

- DFS and German airlines very well coordinated in a working structure along „National Airspace Strategy“
- Work is part of DFS Strategic Objective “Green Flying”
- Two operational projects with focus on CDO-CCO aspects:
  - ALBATROSS:
    IA-based analysis of sector geometries and operational habits
  - Optimised Descent Profiles/ HERON:
    SESAR-funded initiative for improved efficiency

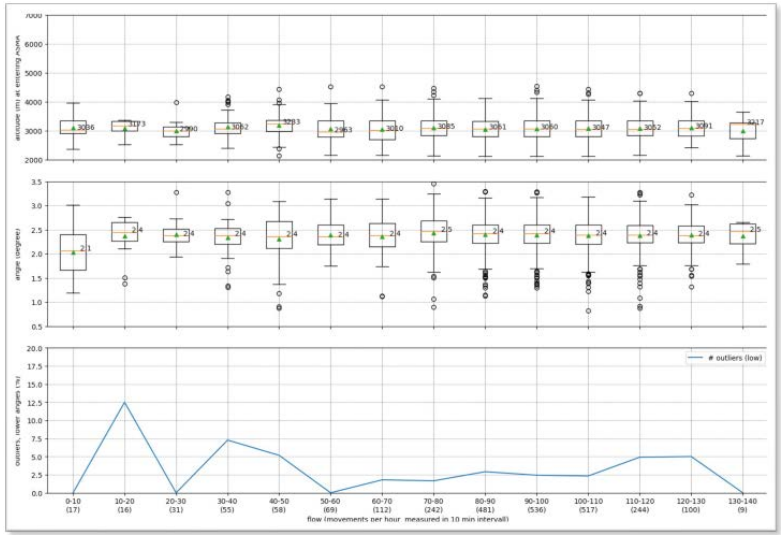
Airspace Analysis by Use of AI

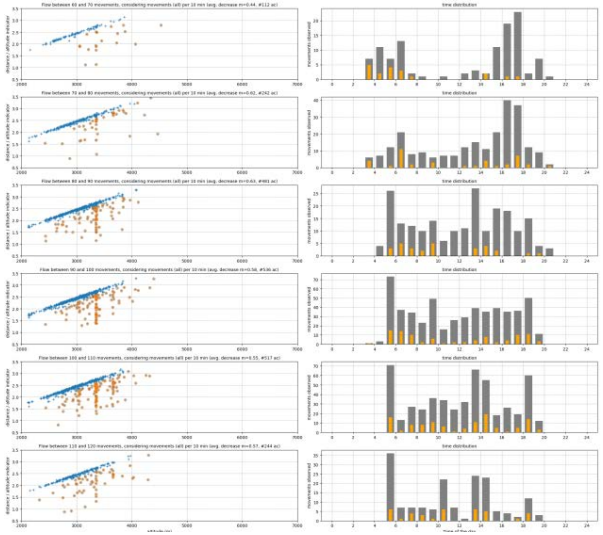
- Traditional approach of trajectory analysis considers all flights in a period
- No distinction is made regarding environmental or operational conditions
- AI-based trajectory analysis can cluster similar flights performed under comparable and similar conditions in terms of weather, sector configuration and traffic flow
- Machine learning algorithms enable identification of contributing factors that were relevant
- Part of ALBATROSS and has received funding from the SESAR Joint Undertaking under the European Union's Horizon 2020 research and innovation programme



Adjustment of Operational Concepts or Working Procedures

- Langen FIR airspace is analyzed regarding landing direction-dependent handover altitudes and possible descending windows
- Discuss with dependent sectors which priorities should be set
- Upstream Centers included in discussion
- Furthermore, the benefit must be assessed overall if other traffic flows would have to be shifted or adapted in order to improve the approach traffic flow





SESAR 3/ HERON Programme

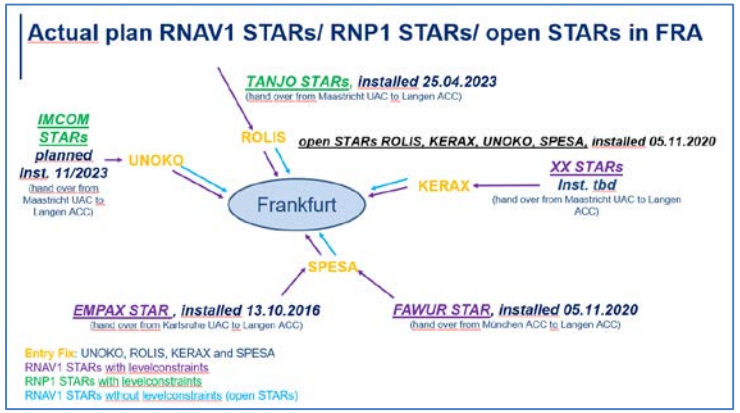
WP2.3 „Flight efficiency improvemements through airspace and procedure design in DFS environment“ DFS/ Lufthansa

- **Optimized descend profiles enabled by navigational procedures utilizing altitude windows for Frankfurt and Düsseldorf/ Cologne**
  - Efforts will be undertaken to increase usage rates of the existing STARs in Frankfurt
  - New STARs including altitude windows to realise optimum descent profiles from cruise level
  - Among other aspects, also the results of ALBATROSS will be considered
- **Analysis of sector geometries and adoption**
  - Main traffic flows will be analyzed, and sector geometries will be adjusted to allow optimum workflows to assure sufficient capacity while reducing environmental impact
- **Improved Flight planning measures**
  - STARS and SIDS will be analyzed according to lateral optimisation potential and if applicable respective AIP publications will be executed to airlines for flight planning purposes

Planning

Optimized descend profiles enabled by navigational procedures utilising altitude windows for Frankfurt and Düsseldorf/ Cologne

1. **Re-Design EDDF FAWUR STAR.**
   Phase 1: Implementation below FL240 in LANGEN FIR incl. necessary adjustment of the LoA's
   Target Date: NOV2023
   Phase 2: Procedural extension to upper airspace in coordination with adjacent centres
2. **Optimization EDDL DOMUX STAR**
3. **Implementation and Optimization EDDF TANJO STAR/ IMKOM STAR. Implementation of procedural STAR also requested by MUAC. Target date: NOV2023**
4. **Optimization EDDF EMPAX STAR. Discussion and agreement of better handover conditions with KARLSRUHE UAC**



Evaluation of Publication

- DFS und DLH made an evaluation of the routes flown and the published route lengths on SIDs and STARs
- In some cases, the planning values for the shorter routes are noted in the AIP on the Aerodrome pages and Enroute pages
- LIDO only partially adopted these values
- Standardised representation in the AIP should take place

2. Flugplanung RNAV STARs

Ab den Übergabepunkten von Langen ACC zu Frankfurt APP bilden die GPS / FMS RNAV Verbindungsstrecken zum Endanflug ein Overlay zur Radarführung mit einer maximalen Flugweglänge ab, einschließlich zusätzlicher Streckenlänge für Sequenzierung und mögliche Verspätungen. Daher ist die Flugentfernung dieser Verbindungsstrecken größer als die Entfernung des durchschnittlichen Anflugs. Zur Flug- und Treibstoffplanung können die folgenden Abstände als zu erwartende Flugentfernung zwischen dem jeweiligen Übergabepunkt und der Landung angenommen werden. Abweichungen davon können als Verspätung betrachtet werden.

Entfernungen für die Flugplanung auf Einflugstrecken nach Frankfurt Main:

2. Flight planning RNAV STARs

Beyond the transfer points from Langen ACC to Frankfurt APP the RNAV STAR including Transition-to final Approach depict an overlay to radar vectoring with a maximum flight track length - including additional track length for sequencing and possible delay. Therefore, the flight distance of these Transitions is longer than the distance of the average approach. For flight and fuel planning purposes the following distances may be regarded as the expected flight distance from the respective transfer point until landing. Any deviation from this may be regarded as a delay situation.

Distances for flight planning on STARs into Frankfurt Main:

Übergabepunkt/ Transfer point	STAR Bezeichnung/ STAR ID	Durchschnittliche Flugentfernung ab Übergabepunkt/ Average flight distance (NM) from transition point
KERAX	KERAX *A	55
KERAX	KERAX *B	59
KERAX	KERAX *C	103
KERAX	KERAX *D	98
SPESA	SPESA *A, EMPAX *A, FAWUR *A	by ATC only
SPESA	SPESA *B, EMPAX *B, FAWUR *B	55
SPESA	SPESA *C, EMPAX *C, FAWUR *C	83
SPESA	SPESA *D, EMPAX *D, FAWUR *D	by ATC only
ROLIS	ROLIS *A	81
ROLIS	ROLIS *B	89
ROLIS	ROLIS *C	73
ROLIS	ROLIS *D	68
UNOKO	UNOKO *A	109
UNOKO	UNOKO *B	113
UNOKO	UNOKO *C	88
UNOKO	UNOKO *D	74

Example flight planning RNAV1 STARs EDDF

Questions & discussions