



FROM INNOVATION TO SOLUTION

FREE ROUTE AIRSPACE MAASTRICHT AND KARLSRUHE (FRAMaK)

Dr. Morten Grandt, DFS



#SESAR
@SESAR_JU

founding members



EUROPEAN UNION



EUROCONTROL

Project Overview

- Free Route Airspace Maastricht and Karlsruhe (FRAMaK) is a joint initiative of
 - DFS Deutsche Flugsicherung GmbH
 - Deutsche Lufthansa AG
 - Eurocontrol Maastricht UAC
- Funded by SESAR Joint Undertaking in the framework of „SESAR Integrated Flight Trials and Demonstration Activities“, Lot 2
- Consortium Lead: DFS
- Start: 01 June 2012
- Duration: 24 months

FRAMaK | Free Route Airspace
Maastricht and Karlsruhe



Lufthansa



Objectives

- FRAMaK demonstrates the feasibility and validates the benefits and impacts of
 - **Cross-Border Directs**
 - **User Preferred trajectories****in a complex and high traffic density environment** comprising MUAC and KUAC airspace
- The project addresses gains in the **Key Performance Areas**
 - Efficiency
 - Environmental Sustainabilitywhile the effects on Capacity are carefully evaluated.



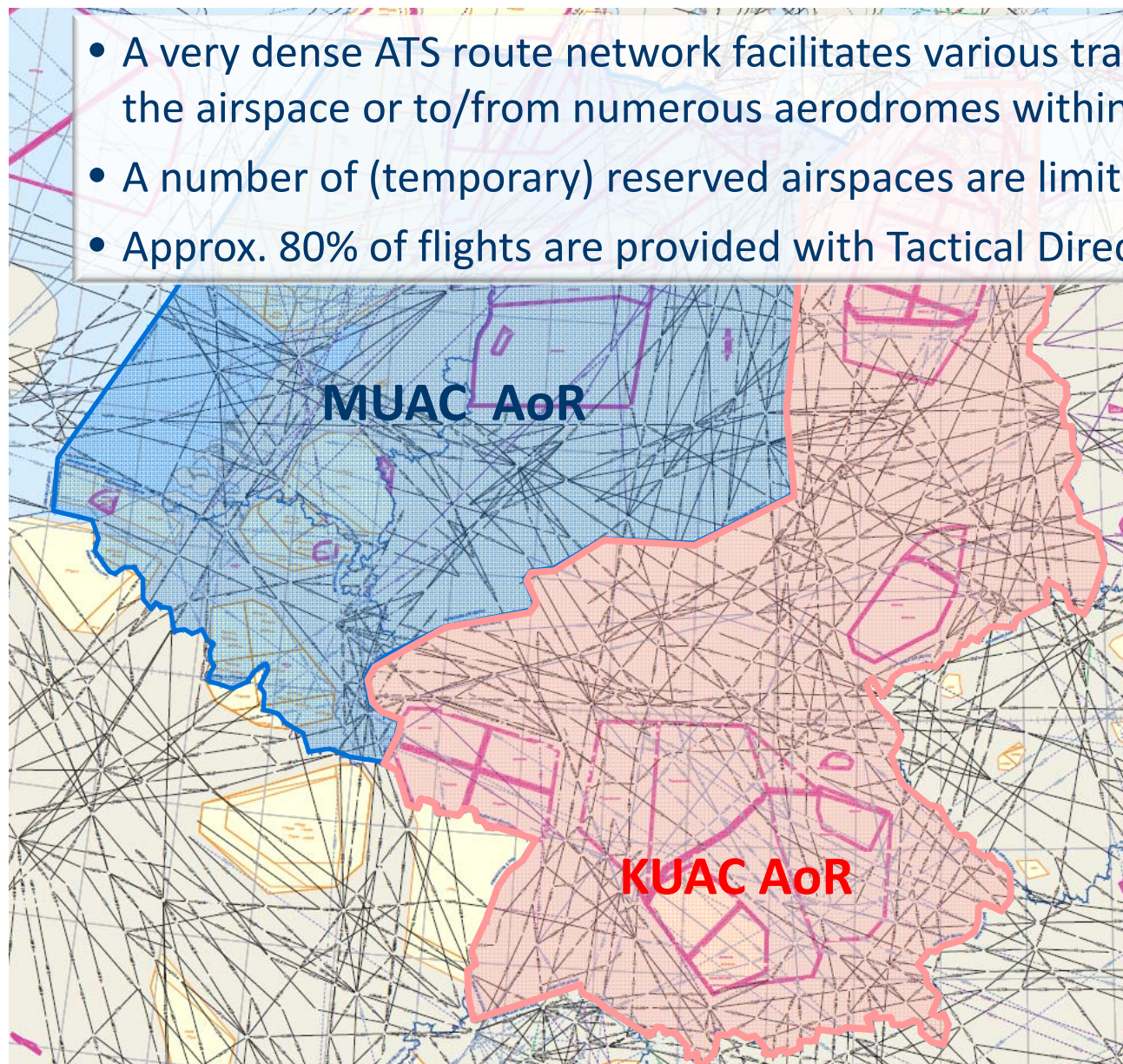
Relationships & Coherency

- FRAMaK determines conditions for a **realistic and stepwise transition** towards a Cross-Border Free Route Airspace.
- Complementing the strong emphasis on operational aspects and potentials for short-term implementations, in view of the mid- and long-term perspective FRAMaK is coordinated with
 - FRA evolutions of the **SESAR Working Programme** related to SESAR PAC 03 “Moving from Airspace to Trajectory Management”/ Free Routing / AOM 501 and 502, currently under consolidation in OFA 03.01.03;
 - the **FABEC FRA programme**.
- Seamlessly related to preceding FRA activities of KUAC and MUAC FRAMaK forms **a major step towards the implementation of Primary Common Projects, in particular ATM Function #3** (Flexible Airspace Management and Free Route).

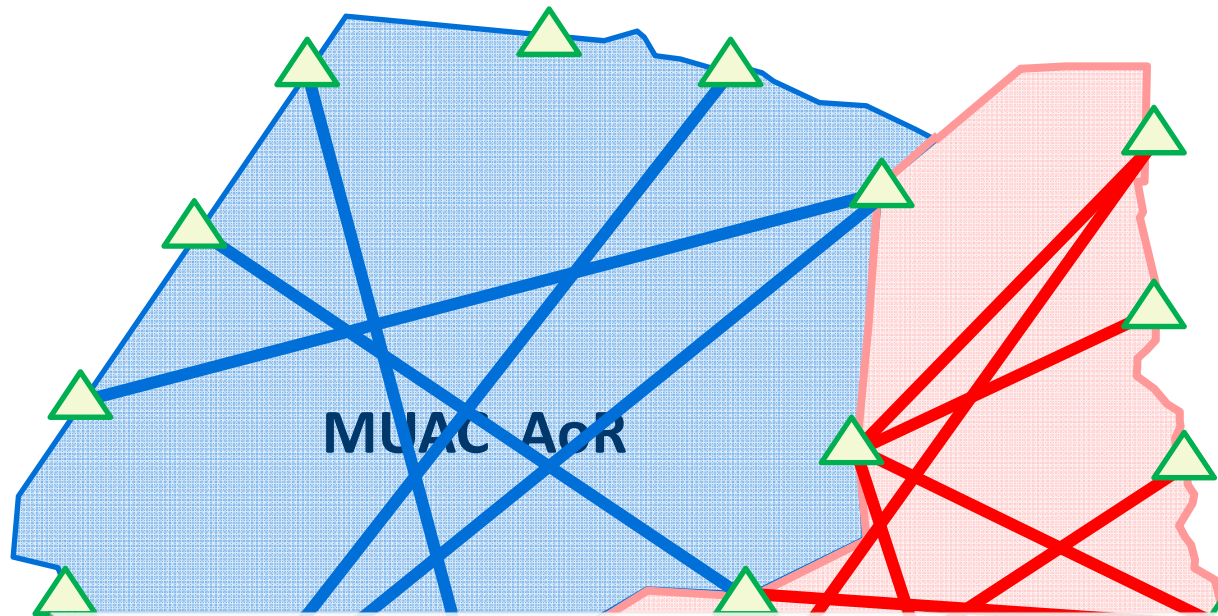


Basis: ATS Routes in KUAC and MUAC AoR

- A very dense ATS route network facilitates various traffic flows crossing the airspace or to/from numerous aerodromes within the area.
- A number of (temporary) reserved airspaces are limiting routing options.
- Approx. 80% of flights are provided with Tactical Directs.



Step 1: Local DCTs by FRAK and FRAM



- Numerous DCTs have been implemented on a “local” basis by Free Route Airspace Karlsruhe (FRAK) and Free Route Airspace Maastricht (FRAM), or even across the boundary by FABEC Night Network.

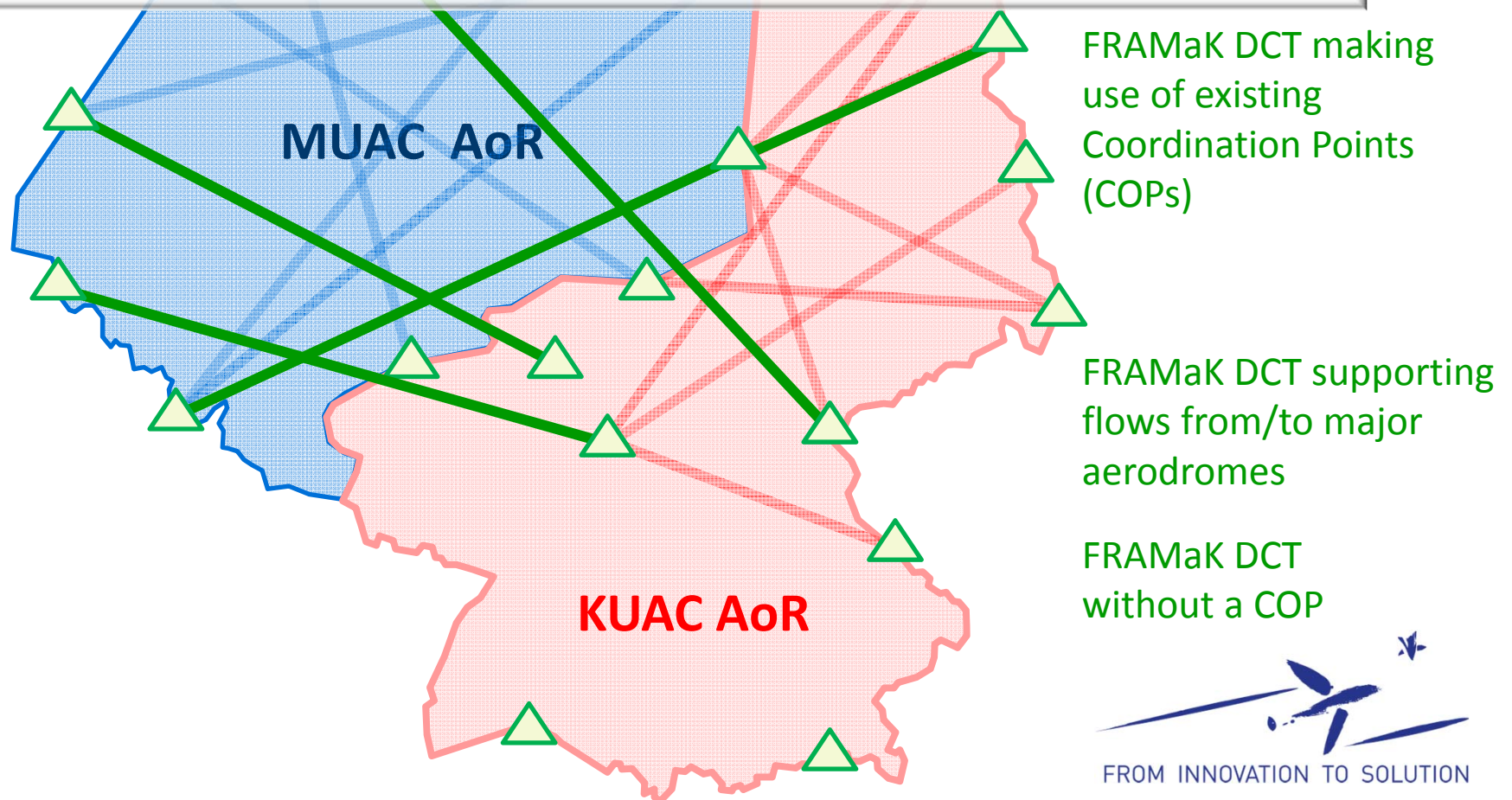
- Day-by-day many flights are provided with Tactical DCTs even beyond the AoR boundary, e.g. from a position within KUAC airspace towards a far-reaching waypoint within MUAC airspace and vice versa.

Project	Number of DCTs	Availability	Fuel savings (million kg)	Fuel savings (tonnes)	Reduction of emissions
FABEC Night Network	142	at night, at weekends	1.2	3,700	CO ₂ : 12,000 NO _x : 37
FRAK (Phases 1&2)	144	usually 24 hrs	1.4	7,700	CO ₂ : 24,000

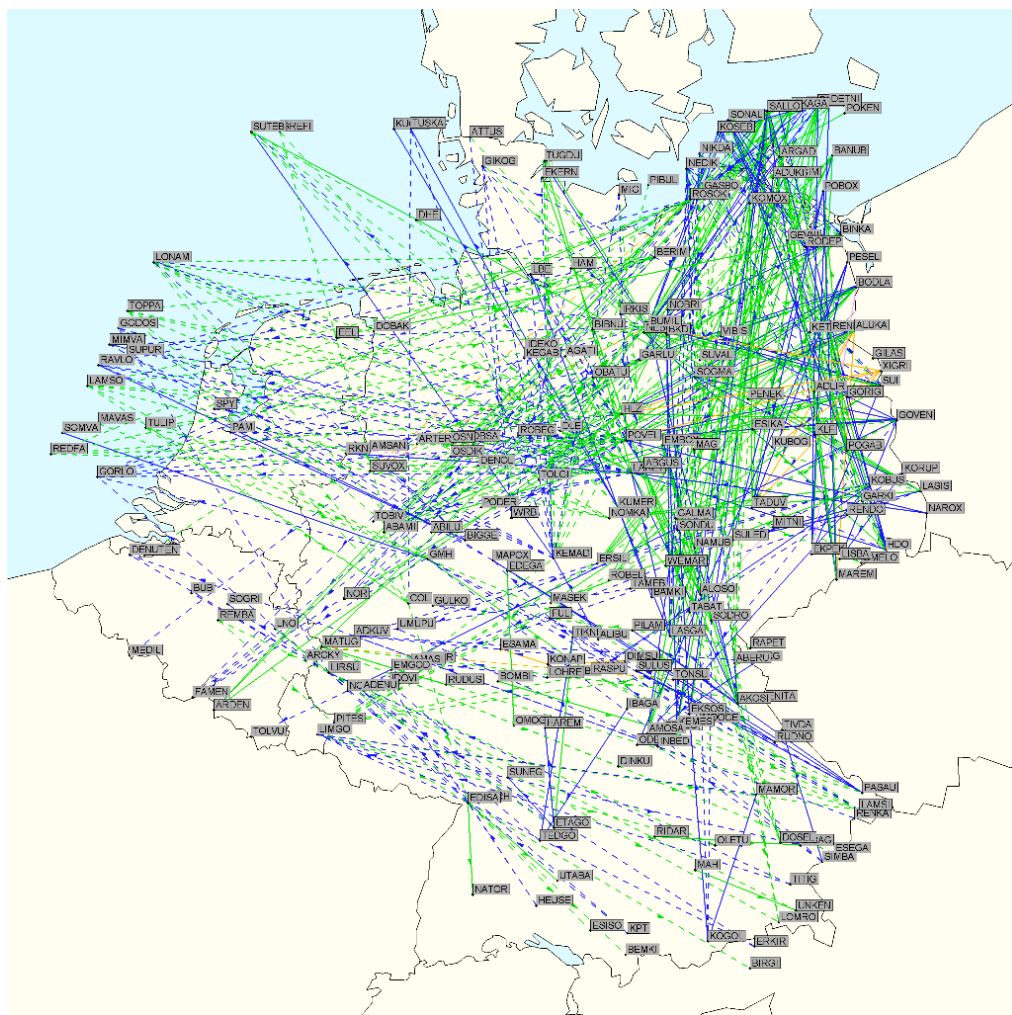


Step 2: FRAMaK DCTs in support of cross-border traffic

- The basic idea behind the elaboration of FRAMaK Cross-Border DCTs was to “formalise day-by-day ATCO behaviour and make DCTs plannable”
- In several workshops operational experts identified new DCT routing options for both, overflights and flights to/from major aerodromes



FRAMaK Cross-Border DCTs publicly available in RAD App 4



FRAMaK DCTs as of AIRAC 1401

Public Cross-Border DCT Live Trials comprise:

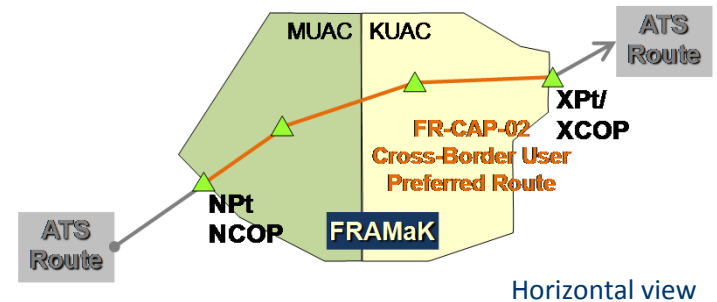
- 56 former FRAM or FRAK DCTs re-labelled as now supporting cross-border flows
- 296 new FRAMaK DCTs
- 87 DCTs developed in the framework of FRAMaK but not cross-border, therefore not labelled.
- Availability:
 - 41% H24
 - 40% Night + Weekend
 - 18% Night only
 - 1% Weekend only
- All DCTs will persist after the FRAMaK project.



FRAMaK UPR Flight Trials: Concept Elements / Capabilities

User Preferred Route

The ability of the Airspace User to plan and file FPLs comprising DCT segments from lateral/vertical entry to exit points of the FRAMaK airspace, allowing (published) intermediate navigation points by Airspace User's free choice.



Design and Demonstration:

- Determination of the UPR Test Area
- ≥50 UPR Flights of DLH (SEP 2013 – MAR 2014) on 6 citypairs and additional dry-runs with DLH flight planning system (LIDO flight)
- Data collection and analysis
- Filing non-published DCT segments is not according to IFPS rules
→ FRAMaK Operational Procedure and Test Plan clarify the procedures for planning, FPL filing and execution of UPR Test Flights



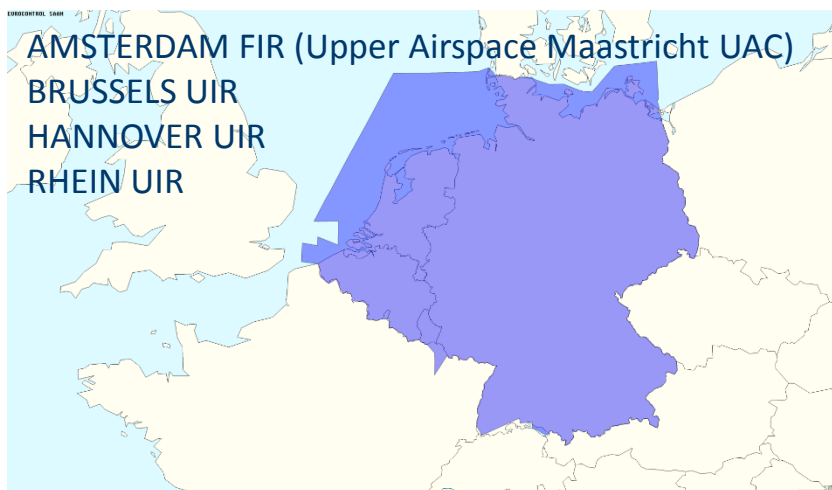
FRAMaK UPR Flight Trials: UPR Test Flights

- SEP 14, 2013, Lufthansa started UPR Test Flights initially serving Inner-European citypairs at weekends.
- The first long-range flight EDDM-KSFO took place NOV 21.
- Since DEC 12 an extended UPR Test Area is effective.
- Until now 53 flights have been executed, 45 additional flights are planned due end of MAR.

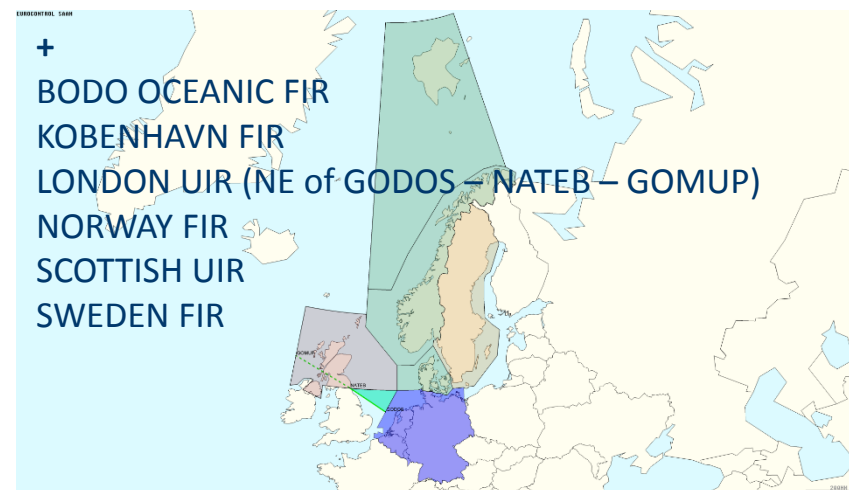
UPR Test Flights' Citypairs
ICAO (IATA)

EDDM-ENGW	(MUC-OSL)
EDDM-EGCC	(MUC-MAN)
EDDM-KSFO	(MUC-SFO)
EDDF-ESSA	(FRA-ARN)
EDDF-KLAX	(FRA-LAX)
EDDF-CYVR	(FRA-YVR)

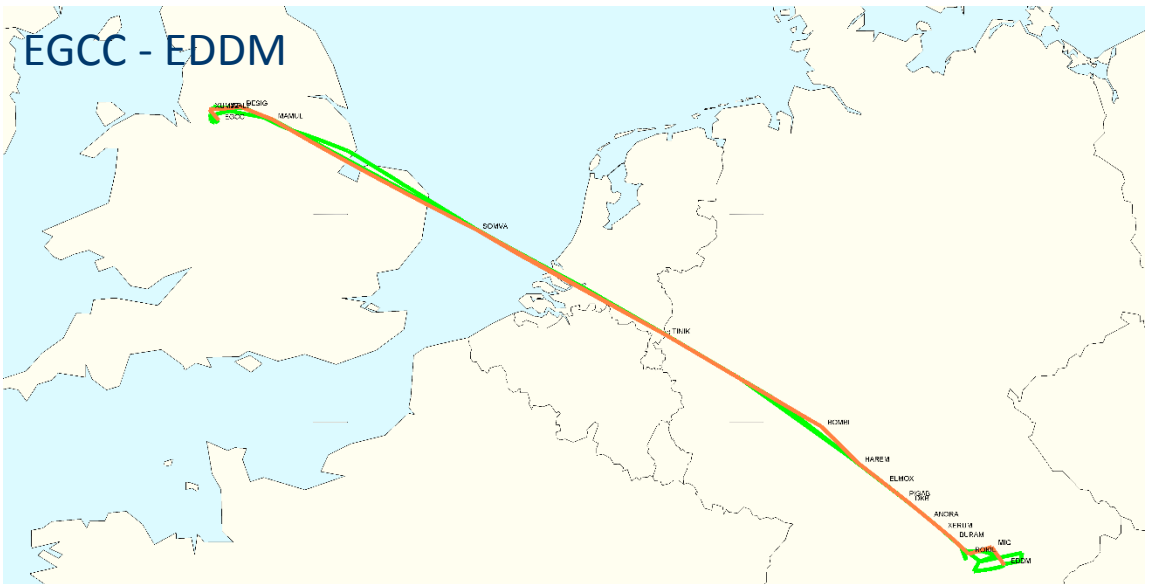
UPR Test Area till 11DEC2013



UPR Test Area from 12DEC2013



FRAMaK UPR Flight Trials: UPR Flight Routings



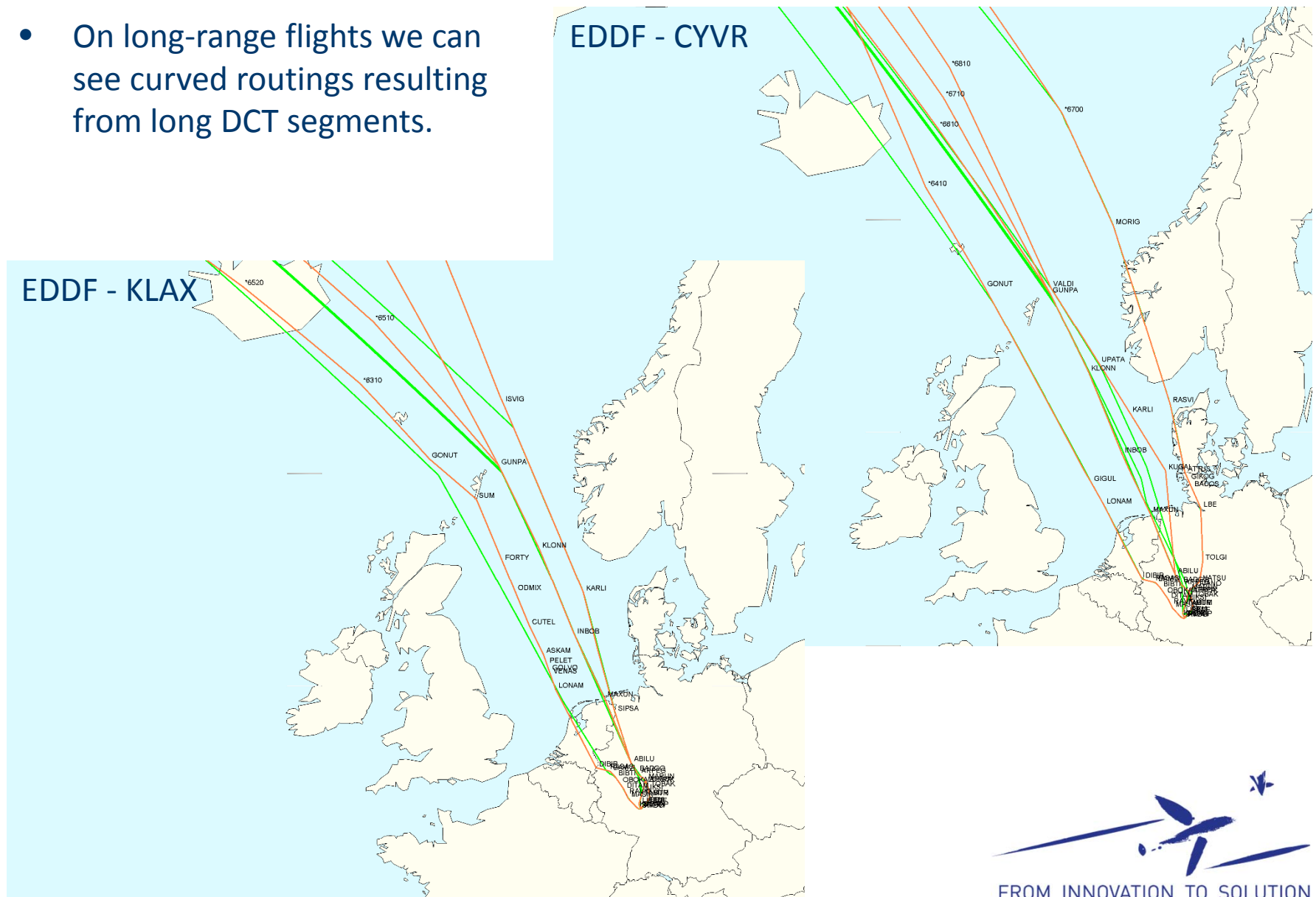
- Citypair EDDM – EGCC has been operated based on UPRs on weekends due to MIL areas.
- Some modifications were necessary at the MUAC LON boundary due to crossing flows.
- On short-range flights we usually do not see curved routings but long DCT segments.



FROM INNOVATION TO SOLUTION

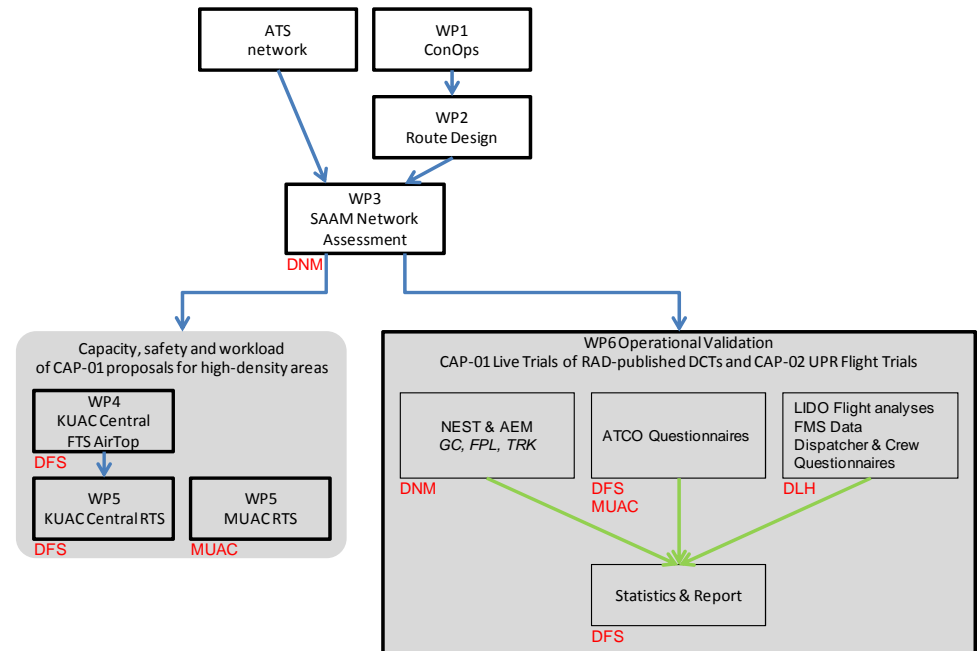
FRAMaK UPR Flight Trials: UPR Flight Routings

- On long-range flights we can see curved routings resulting from long DCT segments.



FRAMaK Performance Assessment

- FRAMaK Performance Assessment comprises all types of validations (**FTS, RTS, Live Trials, Flight Trials**).
- All flights relevant for FRAMaK Cross-Border DCTs within 4 measurement periods (1 week each) will be analysed with regard to **Great Circle, FPL, and actual track** referring to the respective period in the reference period (previous year).
- UPR Flight Trials will be analysed on a case-by-case basis.
- Focus of the assessment is on Flight Efficiency and Environmental Sustainability.
Possible side effects (→ Capacity) and especially operator workload are considered as well.



FRAMaK Cross-Border DCTs: Potential Benefits

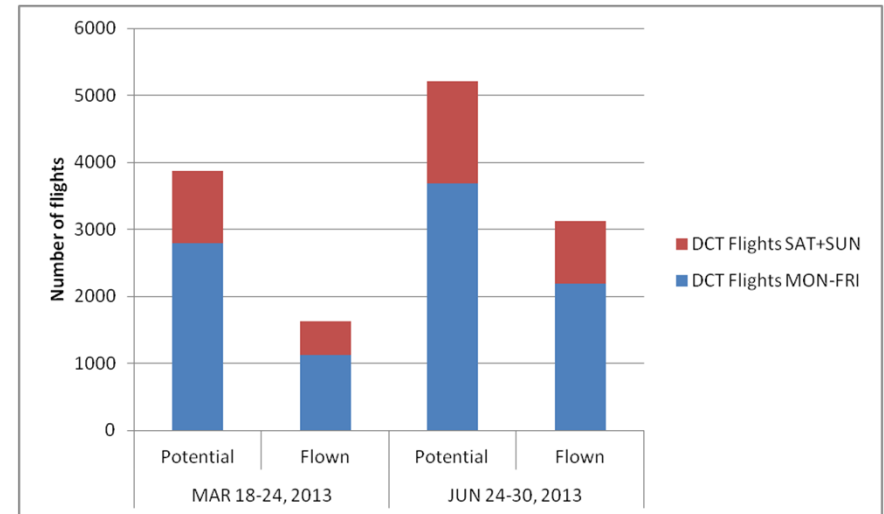
- SAAM analysis of one summer week (end of JUN) and one winter week (end of OCT) extrapolated to the full year. Additional analysis was made for weekends.
- Based on shortest route option FRAMaK DCTs (up to AIRAC 1401) are **available for 10.479 flights per summer week and 8.693 flights per winter week. 33% of potential flights are on weekends.**
- In total, **potential savings are > 1.3 Mio NM p.a. (45% of savings are achievable by only WE flights).** Average saving is 2.7 NM per flight.

	Summer Complete Week	Winter Complete Week	Summer Weekend	Winter Weekend
Number of flights	10.479	8.693	3.527	2.833
Route length Savings [NM]	28.527	23.035	12.858	10.328
Route length savings in two periods [NM]	51.562		23.186	
Route length savings per year [NM]	1.340.612		602.836	
Fuel savings [kg] (1 NM \triangleq 6 kg fuel)	8.043.672		3.617.016	
CO ₂ savings [kg] (1 NM \triangleq 20 kg CO ₂)	26.812.240		12.056.720	
Direct Cost savings [EUR] (1 NM \triangleq EUR 5)	6.703.060		3.014.180	



FRAMaK Cross-Border DCTs : Measurement Periods MAR & JUN '13

- Based on actual flights:
Out of all flights in the FRAMaK airspace which were eligible to DCT usage, **up to 62% (JUN2013, weekend)** filed at least one FRAMaK DCT.



Potential and actual benefits

- **Why not more?** – The FPL route is not only a matter of route length but of:
 - **Weather** (AOs aiming for tailwind effects, avoiding bad weather conditions)
 - **Capacity** (AOs avoiding delay in congested airspace)
 - **Route charges** (using FRAMaK DCTs may cause longer route portions in „expensive“ airspace)
 - **Delay regarding adaptation** of DCT routeing options from RAD into AOs' company routes





Thanks for your attention



#SESAR
@WorldATM_Now

