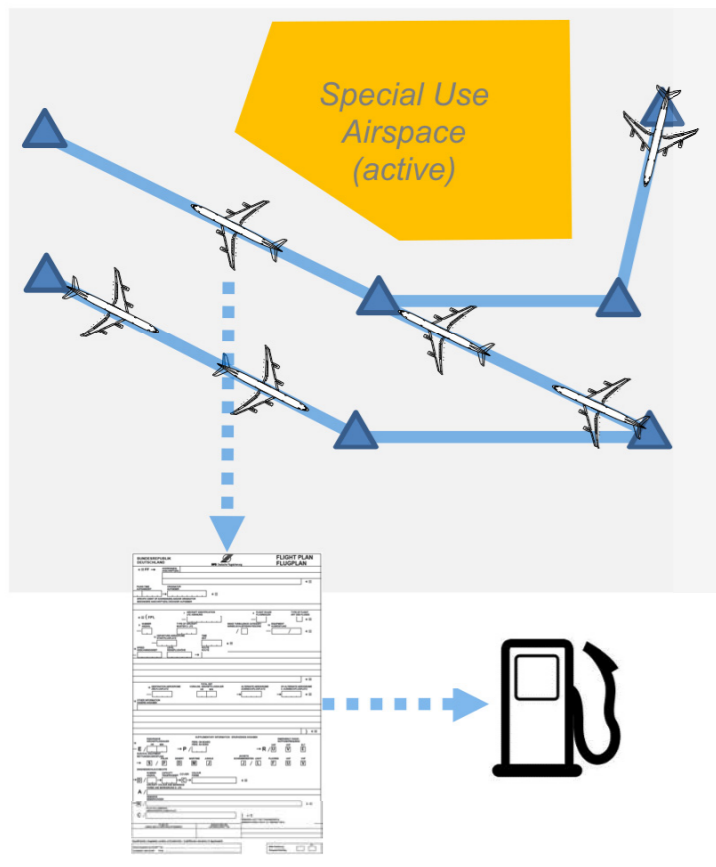
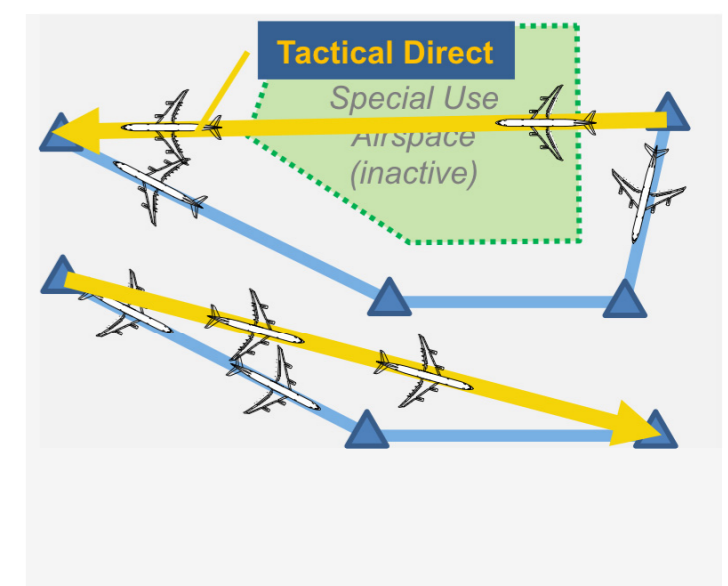


Background / objectives



- The air traffic service (ATS) route network has been designed to ensure safety and capacity.
- ATS routes help to de-conflict traffic by separating traffic flows and allowing for circumnavigation around special use airspace.
- The routing from origin to destination is part of the ICAO flight plan which is subject to ATC approval.
- Based on the flight plan route length, the airspace user calculates the amount of fuel for the flight.

- Usually, special use airspace is not used 24 hours a day and is inactive especially at weekends.
- In such cases and whenever the traffic situation permits, air traffic control tries its best to offer shortcuts, so-called tactical directs.



Approach / assumptions

Directs (DCTs) need to become **plannable routing options**, e.g. through publication in the route availability document (RAD), Appendix (App) 4.

Being part of the flight plan:

- **Route length is shortened:** Fuel burn and emissions are reduced.
- **Amount of contingency fuel is reduced:** This saves weight which in return additionally saves fuel and emissions.
- **Predictability is enhanced:** The flight follows the flight plan route and reaches the expected position at the expected time.

Pros & cons of tactical directs

+	-
Tactical directs allow to save fuel and to reduce emissions.	Aircraft carry too much fuel.
Tactical directs reduce flight duration	Aircraft might arrive too early.
	Shortcuts lead to deviations from the flight plan route → Sector sequence is changed and the capacity of newly impacted sectors may be jeopardised.

FRAMaK demonstration project

FRAMaK demonstrated the feasibility and validated the benefits and impacts of

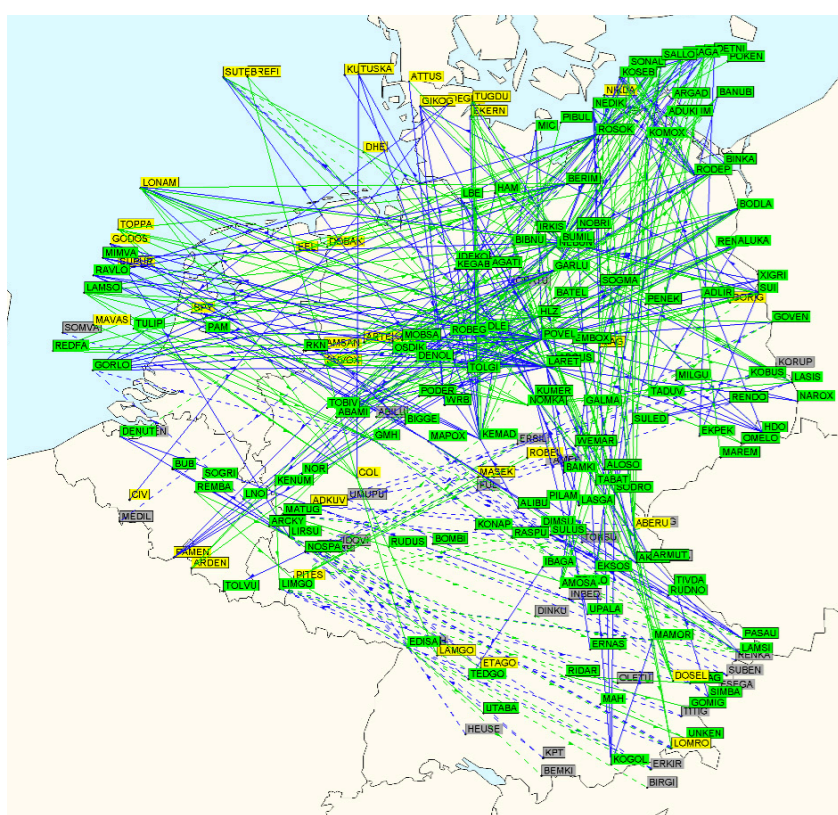
- **Cross-border directs**
- **User-preferred trajectories**

in a complex and high traffic density environment comprising MUAC and KUAC airspace

SESAR solutions

- Free route through the use of direct routing
- Free route through free routing for flights both in cruise and vertically evolving above a specified flight level
- User-preferred routing

Public cross-border directs live trials



17,295 revenue flights

Measurement periods: 4 x 1 week within 1 year
Reference period (REF): previous year

466 FRAMaK DCTs (flight plannable in RAD APP 4)

Availability:

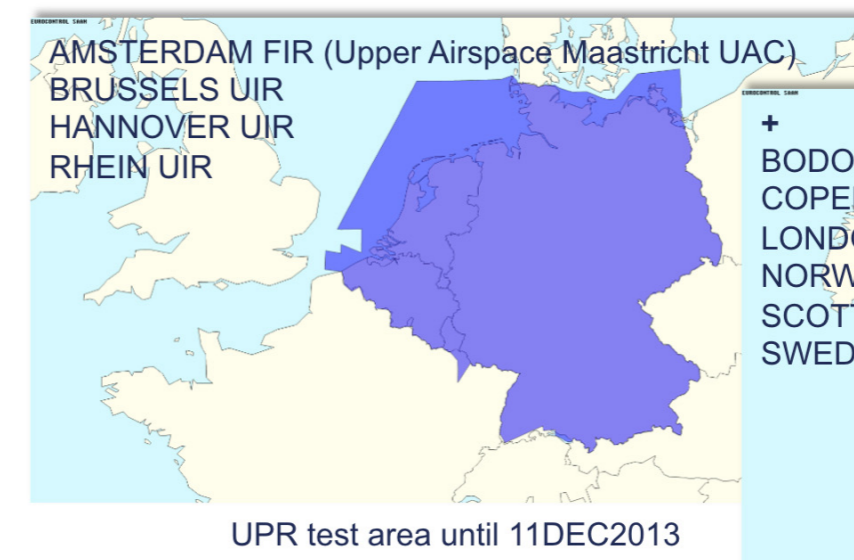
46%	H24	35%	Night + weekend
18%	Night only	1%	Weekend only

All DCTs are still operationally available!

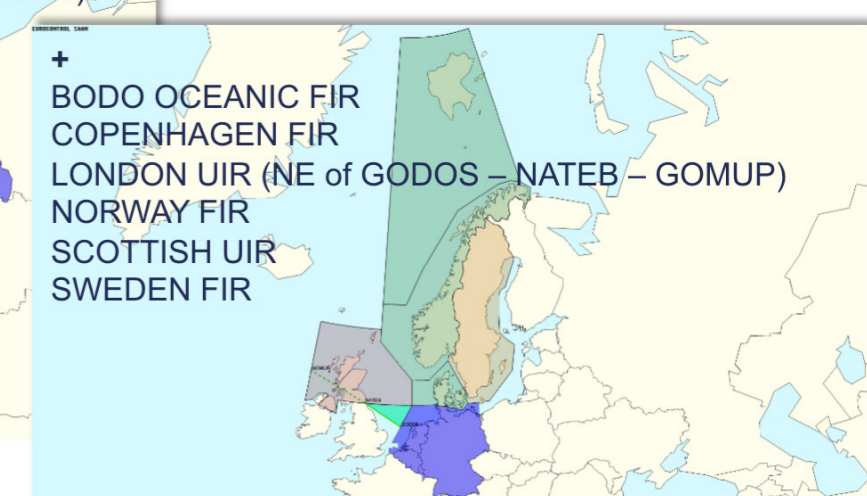
User-preferred route (UPR) test flights

Between SEP 2013 and MAR 2014 Lufthansa conducted **62 UPR test flights**.
6 city pairs were served, 3 of them intra-European, 3 transatlantic.
Since DEC 2013, an extended UPR test area has been effective.

UPR Test Flights' Citypairs (ICAO (IATA))	
EDDM-ENGM	(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 until 11DEC2013



UPR test area from 12DEC2013

Results

Route length	Potential benefit compared to REF	-6.8 NM	(-0.6%)
	Actual benefit compared to REF	-3.7 NM	(-0.3%)
Fuel burn	Actual fuel savings	-56.4 kg	(-0,4%)
	Actual savings	-178.1 kg	(-0.5%)
CO ₂	Deviation of track from FPL route	-13.8 NM	(-1.3%)
	REF:	-16.4 NM	
FPL coherence	→ 15% better prediction		

Total potential savings were estimated > 1.5m NM per year (9m kg fuel / 30m kg CO₂ emissions).

Average route extension was reduced from 2% to 1.7%. The SES RP I target was 4.65 % deviation from the great circle. It has thus been more than fulfilled.

- For most flights additional tailwind components between 1 and 3 knots were utilised with the UPR routing.
- In some cases even additional headwind on the UPR routing was accepted since the route length reduction was the predominant factor in view of an overall benefit.
- **Savings**
 - Short-haul flights: 6...87 kg take-off fuel
 - Long-haul flights: 280...618 kg take-off fuel
- Questionnaires of ATCOs, dispatchers and cockpit crews provided valuable feedback on opportunities and risks.



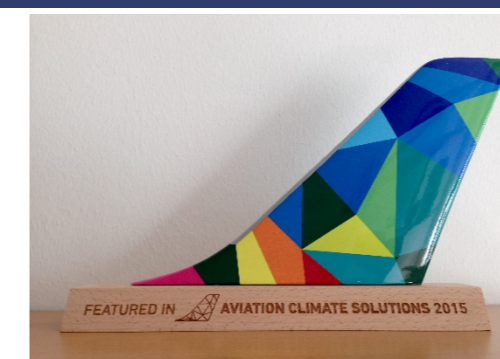
Benefits

Awards

Project partners



IHS Jane's
ATC Award 2015



Selected for the 100 Aviation
Climate Solutions 2015



Lufthansa

DFS Deutsche Flugsicherung

