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ICAO APAC & EUR/NAT CMAC/FUA WORKSHOP

One-step forward



Bangkok, Thailand
19 – 23 January 2026



An Effective CMAC/FUA: from Concept to Implementation

Bin Hu (Kevin)

IATA

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01
Introduction

Introduction

International Air Transport Association (IATA)


- IATA is the trade association for the world's airlines, supporting many areas of aviation activity and helping formulate industry policy on critical aviation issues.
- From 57 founding members in 1945, IATA now represents 368 airlines in over 120 countries. Carrying 83% of the world's air traffic, IATA members include the world's leading passenger and cargo airlines.



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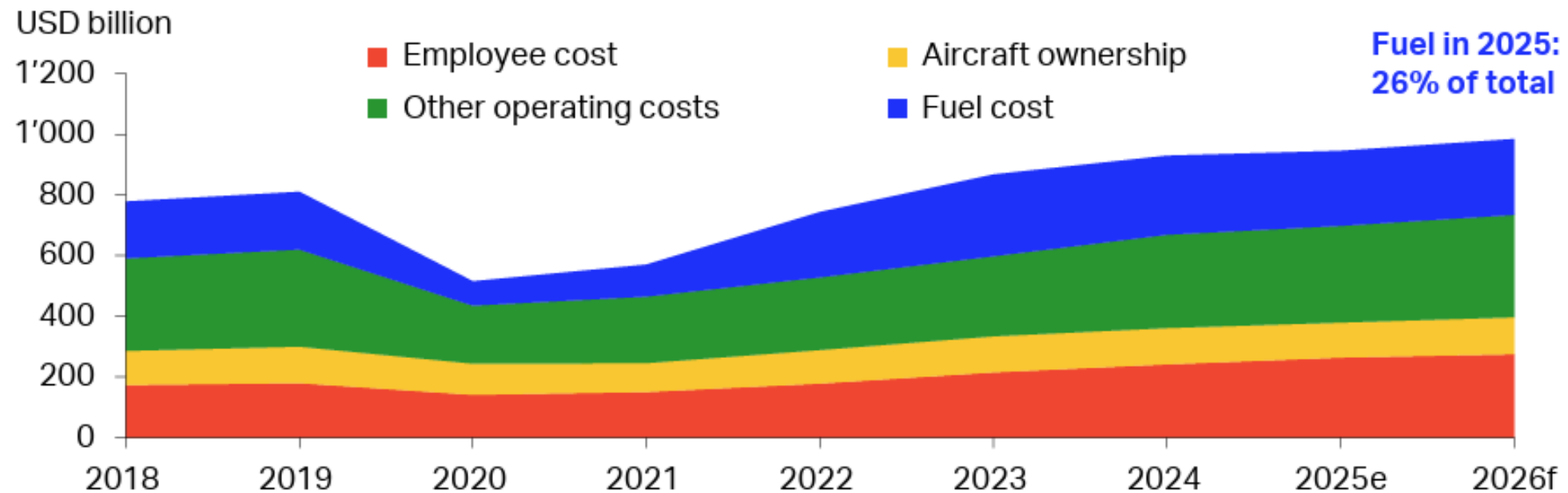
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« Our mission is to represent, lead & serve the airline industry »

Airline costs by type, pre-tax level, USD billion

Breakdown of costs, pre-tax level, USD billion



Source: IATA Sustainability and Economics using data from Airfinance Global

Net profit per passenger

Net profit per passenger in 2026: **USD 7.9**

Net profit per passenger by region, USD per passenger

USD	2025E	2026F
Middle East	28.9	28.6
Europe	10.6	10.9
North America	9.5	9.8
Latin America	7.3	5.7
Asia Pacific	3.3	3.2
Africa	1.4	1.3
Industry	7.9	7.9

Source: IATA Sustainability and Economics

02
CMAC and
FUA Concept



CMAC and FUA Concept

Expectation from airspace users and States

Airspace users' expectation:

- Safety – the highest priority
- Accessibility – effective use of the airspace and access to the optimized routings, flight levels, etc.
- Efficiency – reduced fuel costs and emissions, on-time performance, etc.
- Flexibility – availability to alternative routings in responding to the changing operational environments, e.g., wind, weather, etc.
- Predictability – more transparent and prompt information on airspace constraints during the flight and fuel planning phase, etc.

From the States' perspective:

- The obligations under Chicago Convention and its annexes
 - Improve the aviation safety (both civil and military)
 - Increase user flexibility, maximize the capacity and efficiency of the airspace system
 - Increase the attractiveness of the airspace system
-

03
Effective
Implementation





Effective Implementation

How to achieve an effective CMAC

- Establish the high-level civil-military cooperation committees and policy board to keep the strategic alignment.
 - A gradual implementation is recommended – identify and prioritize the easily achievable changes firstly, which can bring obvious and direct safety and efficiency benefits.
 - Review the existing coordination process between civil and military units (e.g., LoAs or informal arrangements) to focus more on airspace users' needs in terms of flight efficiency and further develop the coordination procedures in between.
 - Perform regular review of existing airspace structure and the usage of prohibited/restricted/danger areas, and make necessary changes (e.g., number, type or dimension of the areas).
 - A stepped approach to implement FUA (from basic concept to enhanced implementation).
 - Enable and keep the direct and promptly communications between the civil and military units to ensure effective tactical coordination and emergency response.
 - The development of any operational structure framework for civil-military cooperation and coordination should follow a project management approach.
-

Effective Implementation

How to achieve an effective FUA

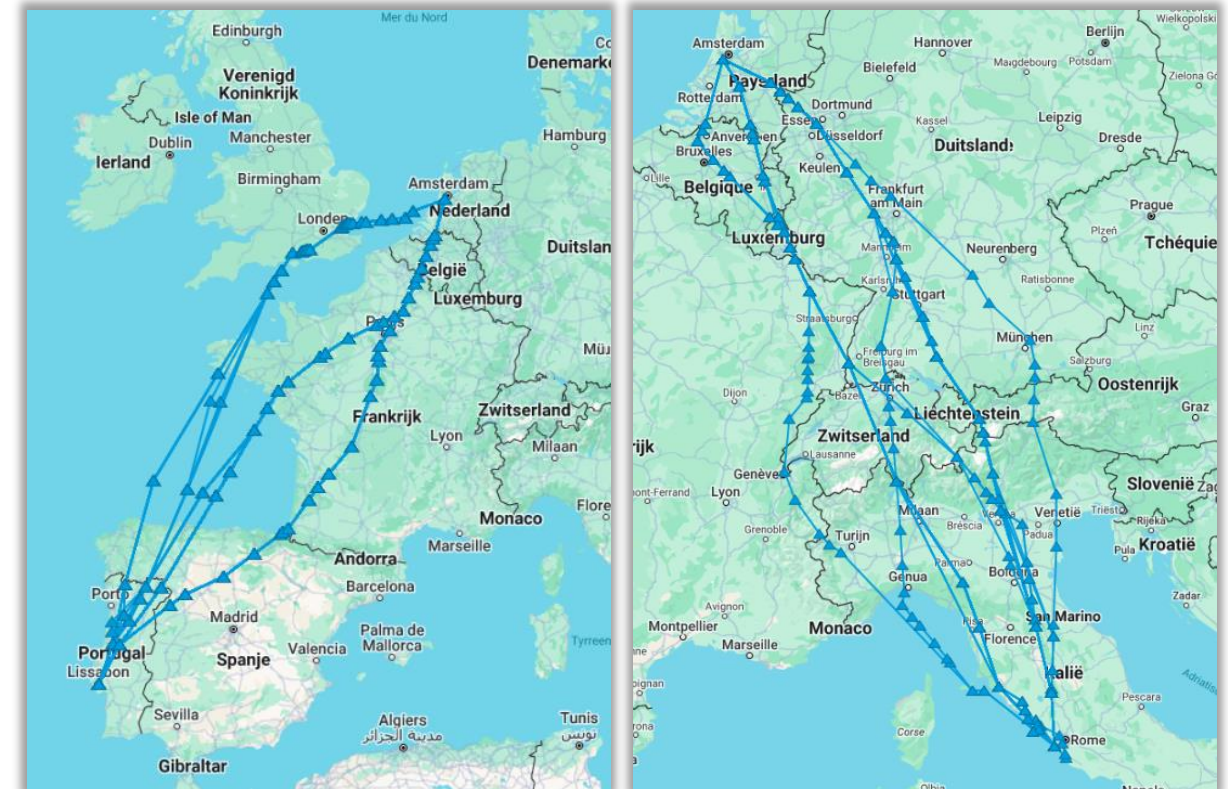
- **Cooperation between civil-military and between the States**
 - Close cooperation between civil-military and States can bring more benefits (e.g., increased entry/exit points in UPR/FRA will further allow flexible route planning to better fit operational needs).
 - Cross-border implementation enable airspace users to file trajectories in their flight plan irrespective of existing airspace boundaries.
 - The FUA should be extended at regional level (fragmented implementation does not provide operational benefits).
 - **Cooperation between ANSPs and operators**
 - ATM system logic and FPL system logic should be compatible, common understanding is required from planning phase, also the engagement of experts is essential.
 - Direct cooperation between ATM providers and airlines/CFPS providers is a key element of success, and is required at pre/tactical, operational and post operational level.
 - FUA implementation should be followed by relevant simulations (ATC, CFPS, aircraft), coordination of those activities is required.
 - Flexibility in cooperation between ATC and the airline operators during the flight can be beneficial by providing optimized and updated routings (e.g., due to weather or military activities).
-

Flight Planning

Multiple route options available for operators in consideration of various factors

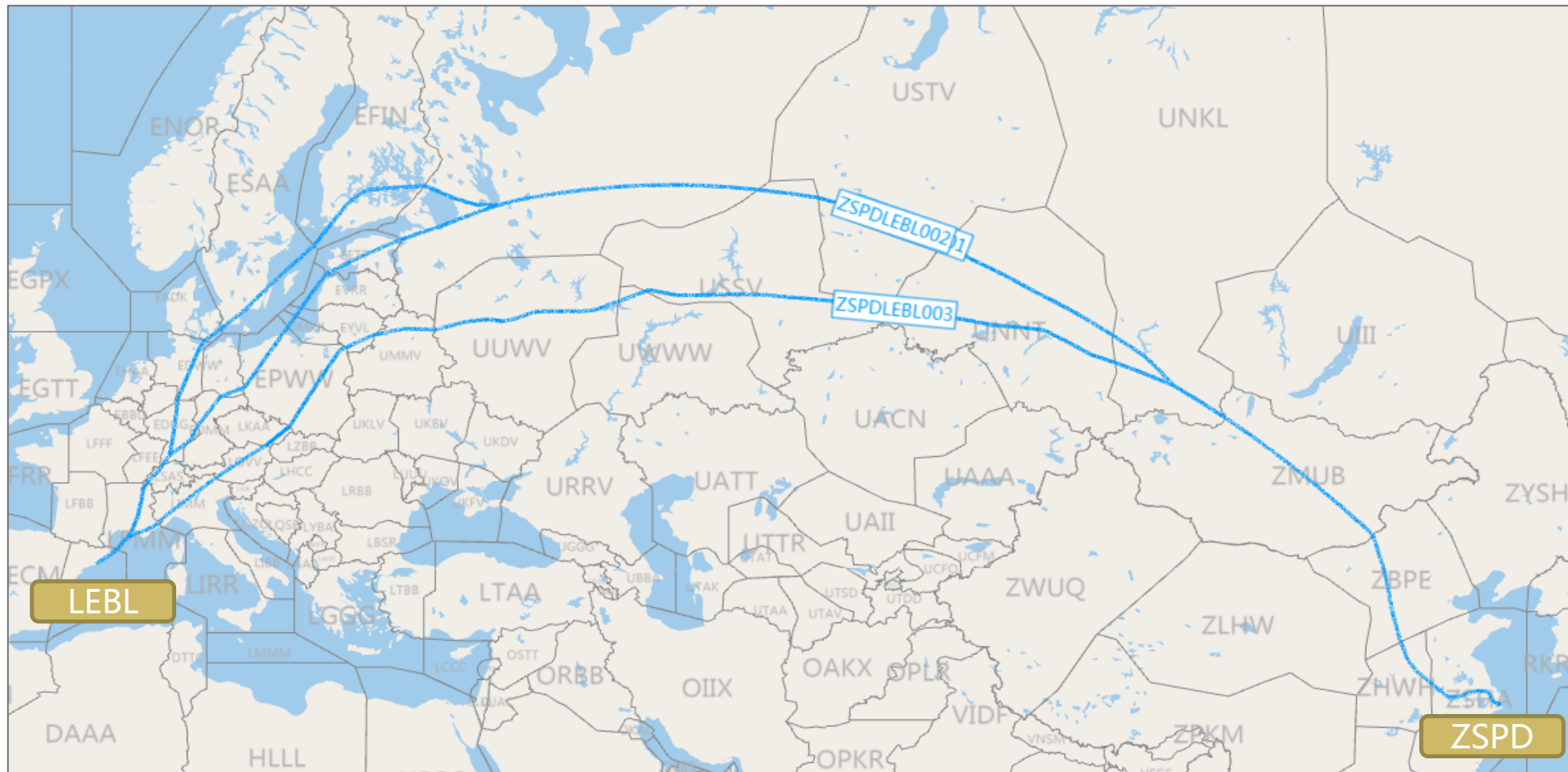
- Day of operation route choices will be made by Dispatchers based on:
 - Flight time and distance
 - Costs (fuel and ANS charges)
 - Weather (wind/temperature, typhoon, volcano, etc.) and payload
 - Airspace closures by NOTAMs
 - Available routes and flight levels, enroute airports, other operational requirements and rules, etc.

- More available routes enable the choice for the optimal route.



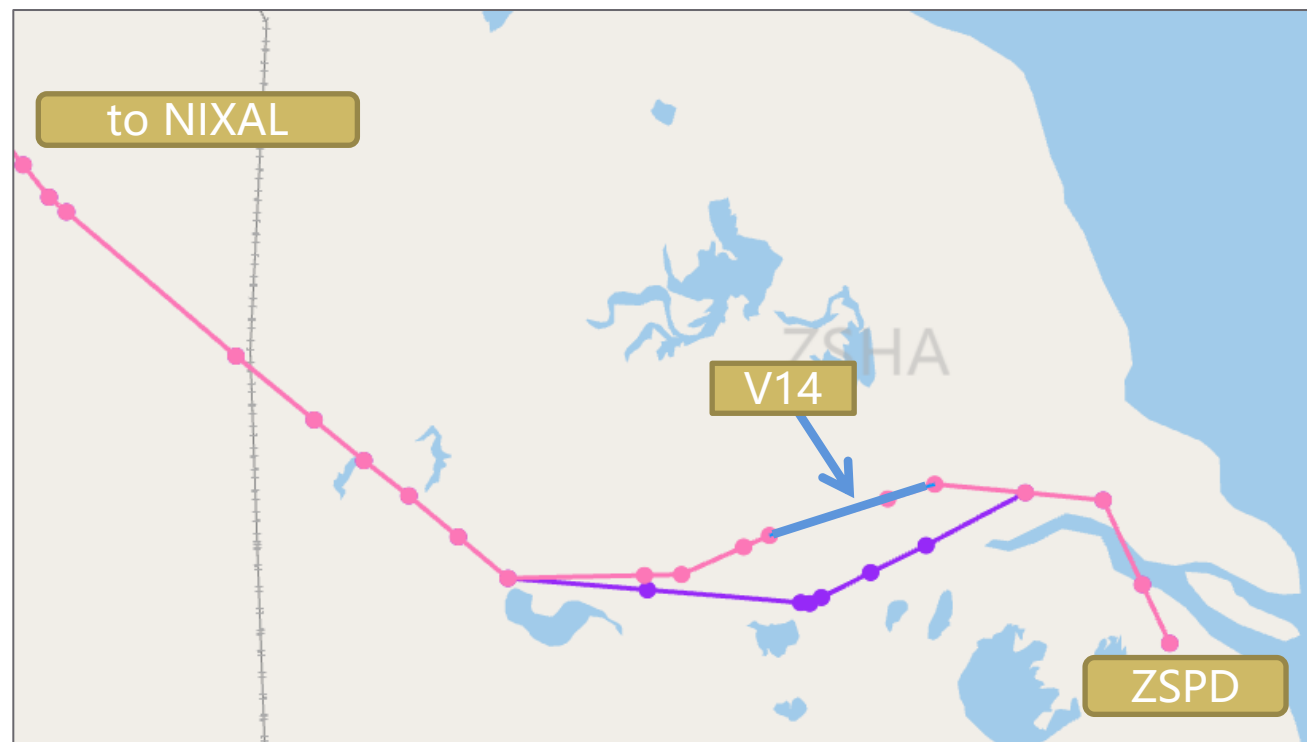
Example of flexibility in route choice AMS-LIS & AMS-FCO

Example of ZSPD – LEBL



Example of ZSPD – LEBL

Selection of domestic routes



Choose an advantageous scheduled flight route:

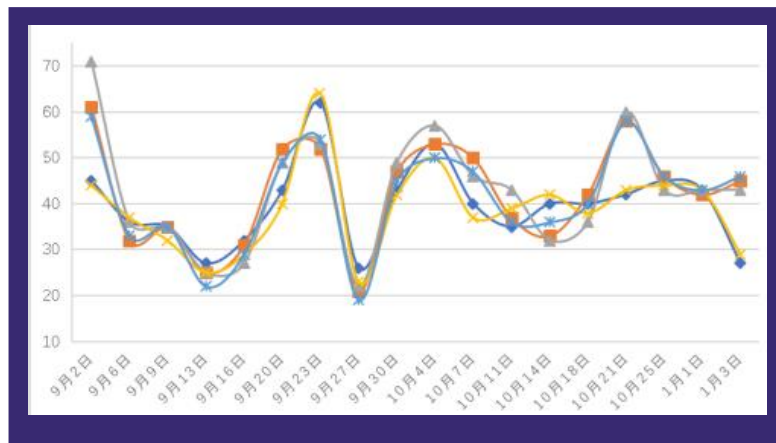
- Shorter distance
- Less traffic flow

Example of Route Optimization

Operation analysis



Maximum available payload



Average wind variation trend



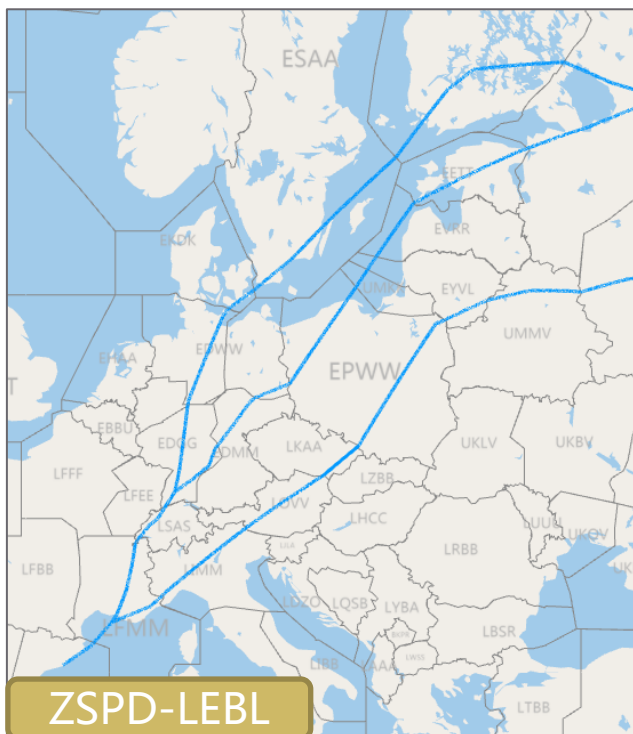
Flight time variation

KJFK-ZBAA:

- Use CDR (L512 in Japan) and monitor the NOTAMs
- Create the optimal route based on the wind/temperature and aircraft performance of the day

REF AIP ENR3.3			
CDR ARE ESTABLISHED AS FLW,			
	RTE	PERIOD	MNM APPLICABLE ALT
1)	L512	2411051200/2411052200	MEA
2)	Z13	2411051200/2411052200	MEA
3)	Z14	2411051200/2411052200	MEA
4)	Z25	2411051330/2411052200	MEA
5)	Z26	2411051330/2411052200	MEA
6)	Z27	2411051330/2411052200	MEA
7)	Z40	2411051400/2411052200	MEA
8)	Z41	2411051400/2411052200	MEA
9)	Z262	2411051330/2411052200	MEA

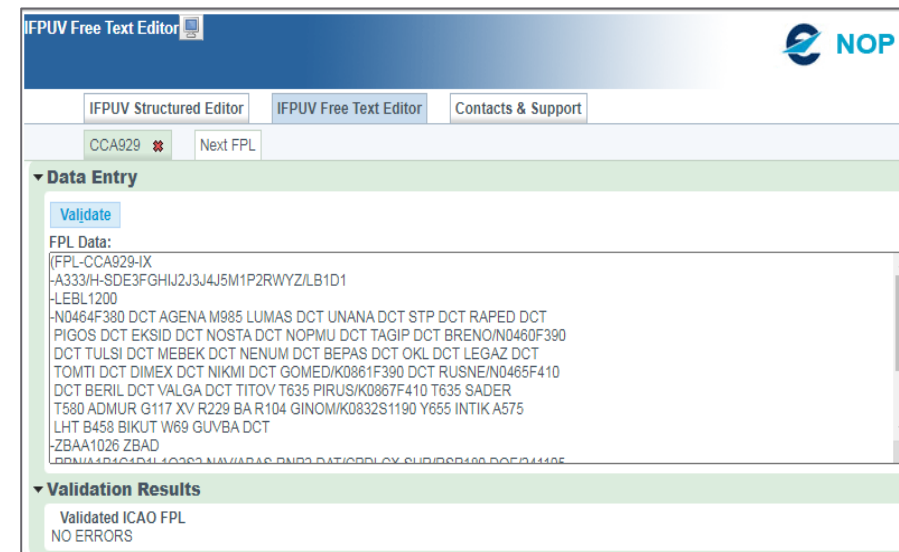
Example of Route Optimization



Use free route airspace and offer more selection

LEBL-ZBAA:

- Use FRA and verify the FPL in advance
- If encountering restrictions, promptly change routes
- Periodically prepare and adjust the routes (ARINC)



Dynamic or static restrictions

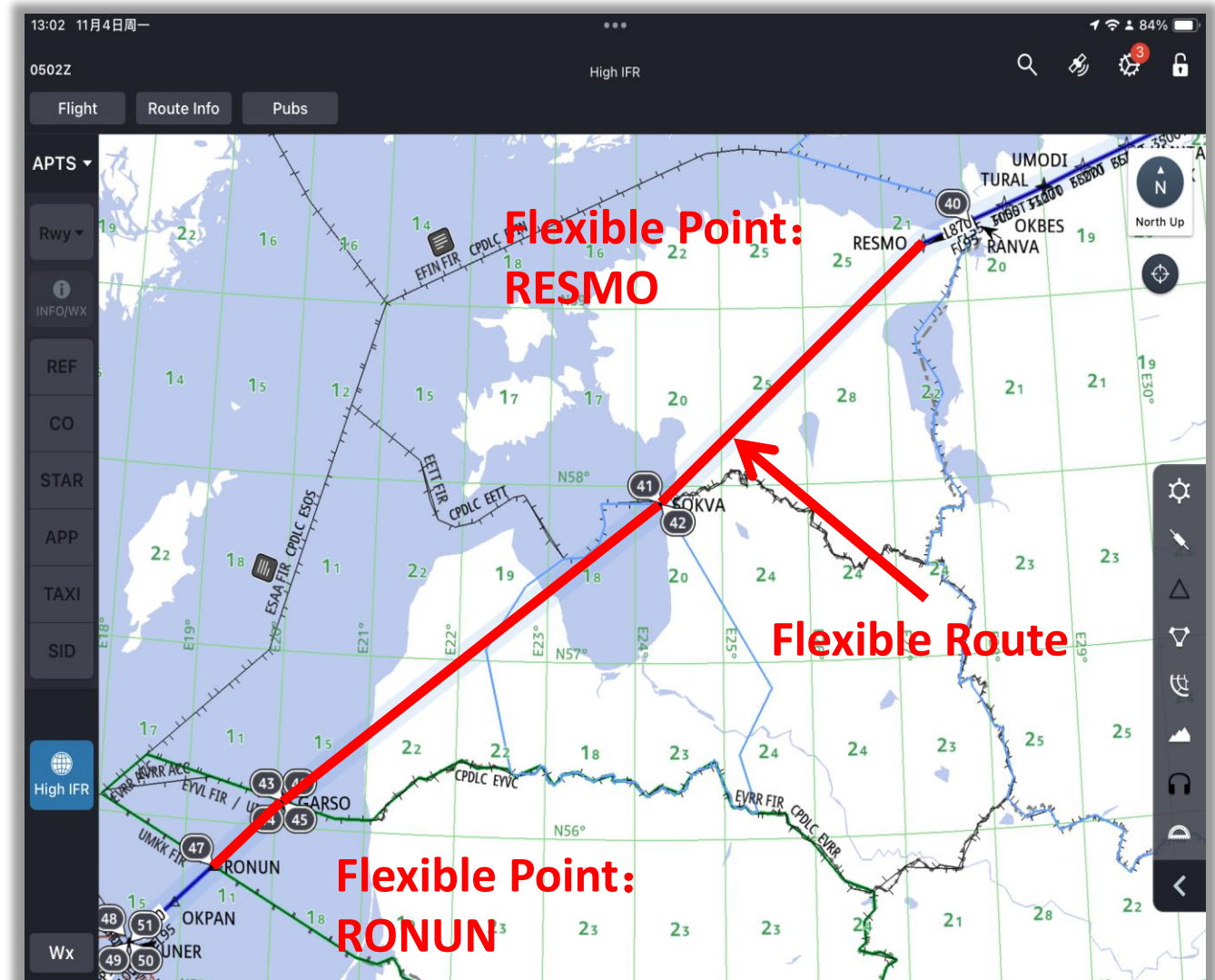
Example of ZGGG – EDDF

Company Route No. 03NF (active)

RESMO to RONUN TALLINN FIR

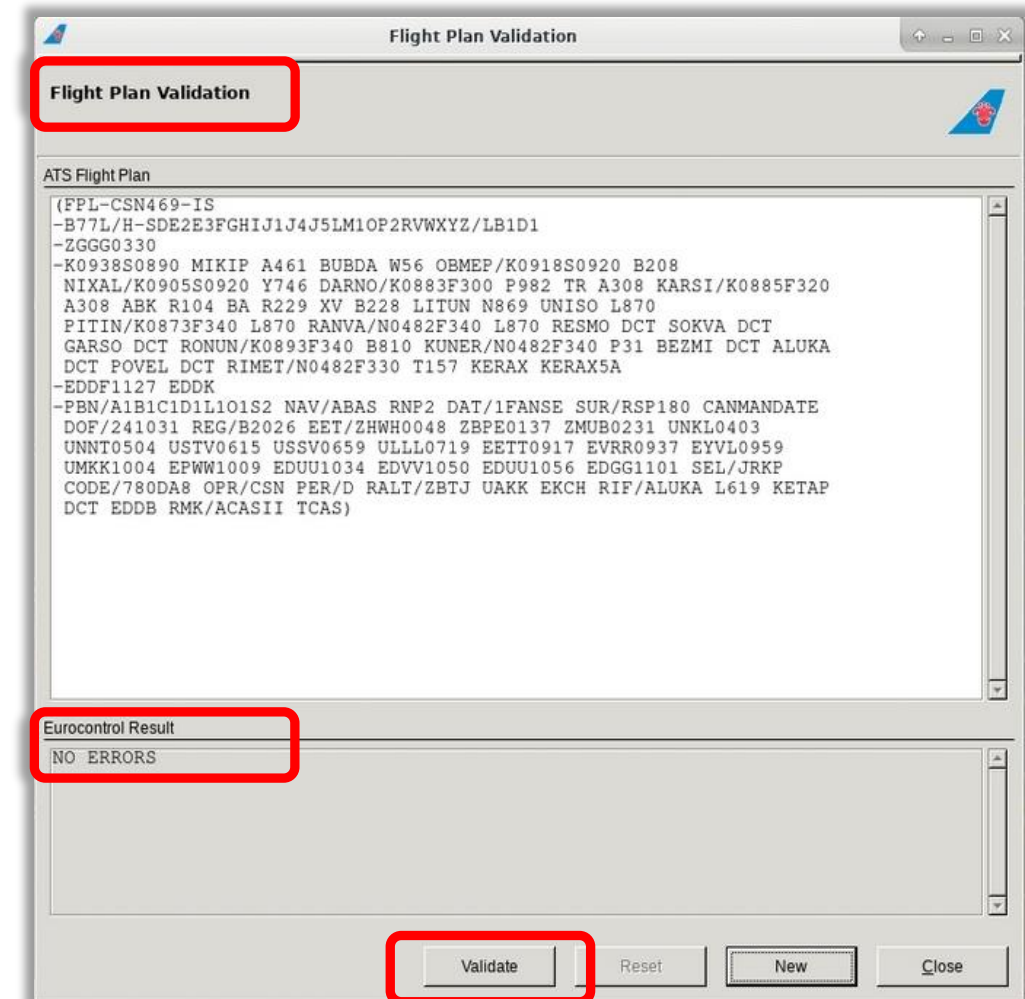
Company Flight Plan Rules:

- MFT (Minimum Fuel Track)
- Preserved DCT route sector



Example of ZGGG – EDDF

- Verify the company routes against RAD (5 days prior to an AIRAC cycle)
- Comply with restrictions (AUP/UUP)
- FPL Validation
 - Use the flight planning system to test the FPL
 - Use the web to test the FPL



Flight Plan Validation

Flight Plan Validation

ATS Flight Plan

```
(FPL-CSN469-IS  
-B77L/H-SDE2E3FGHIJ1J4J5LM1OP2RVWXYZ/LB1D1  
-ZGGG0330  
-K0938S0890 MIKIP A461 BUBDA W56 OBMEP/K0918S0920 B208  
NIXAL/K0905S0920 Y746 DARNO/K0883F300 P982 TR A308 KARSI/K0885F320  
A308 ABK R104 BA R229 XV B228 LITUN N869 UNISO L870  
PITIN/K0873F340 L870 RANVA/N0482F340 L870 RESMO DCT SOKVA DCT  
GARSO DCT RONUN/K0893F340 B810 KUNER/N0482F340 P31 BEZMI DCT ALUKA  
DCT POVEL DCT RIMET/N0482F330 T157 KERAX KERAX5A  
-EDDF1127 EDDK  
-PBN/A1B1C1D1L1O1S2 NAV/ABAS RNP2 DAT/1FANSE SUR/RSP180 CANMANDATE  
DOF/241031 REG/B2026 EET/ZHWH0048 ZBPE0137 ZMUB0231 UNKL0403  
UNNT0504 USTV0615 USSV0659 ULLL0719 EETT0917 EVRR0937 EYVL0959  
UMKK1004 EPWW1009 EDUU1034 EDVV1050 EDUU1056 EDGG1101 SEL/JRKP  
CODE/780DA8 OPR/CSN PER/D RALT/ZBTJ UAKK EKCH RIF/ALUKA L619 KETAP  
DCT EDDB RMK/ACASII TCAS)
```

Eurocontrol Result

NO ERRORS

Validate Reset New Close

Example of FPL Validation

- CZ403, FPL was sent normally and passed through the Eurocontrol web test early at previous night.
- Hours later, a rejection report was received from EUCHZMFP due to revalidation, and suggested alternative route was included at the same time.
- After redispach and FPL refiling, take-off punctuality was not affected eventually.

ZCZC SOE1319 141601

QU CANUDCZ

.SHAFP8X 141601

141555 EUCHZMFP

**YOUR FPL CSN403 2155 231114 ZUCK EDDF HAS FAILED IFPS
REVALIDATION, IF NO REROUTE IS FILED EXPECT A SIGNIFICANT OPERATIONAL PENALTY**

(FPL-CSN403-IS

-B77L/H-SDE2E3FGHIJ1J4J5LM1OP2RVWY/LB1D1

-ZUCK2155

-K0885S0720 PINAB W80 BEVNU/K0918S0780 W80 WFX/K0933S0840 W179

OMBON B330 SUNUV W197 ANDIM B215 NIXUK/K0898S0920 B215 IBANO G470

AKLAS W192 FKG A368 SARIN/K0895F300 M166 KRG T523 ATBAN/K0892F320

L994 TITUR N985 NOGBA N984 UDREM L93 SONAT M60 ANDAT/K0880F340

P157 OKDON N87 ROGID/N0470F340 M854 KETOL/N0470F340 DCT ALAMI DCT SALLO

DCT POVEL DCT RIMET/N0473F330 T157 KOKEB/N0421F230 T157 KERAX

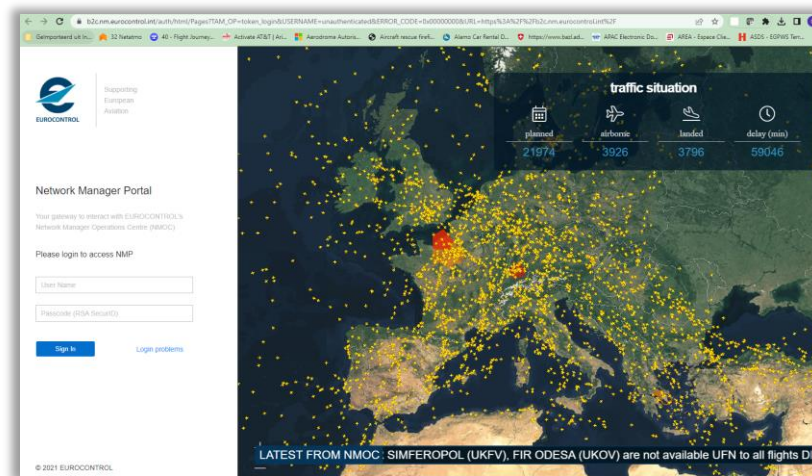
KERAX4A

-EDDF1047 EDDK

Interaction with ANSPs is the Key

How to improve the system on regular basis

- Have regular meetings with ANSPs to discuss route proposals
- Analyzing actual routes to discover possible route efficiency improvements
- Requesting new route options for existing city pairs, or authorizing routes for new city pairs
- Opportunities may come after fleet changes or new technical developments on the ground, e.g., when there is a flight level requirement to use a CDR and a new aircraft is introduced, this route could be used



In EU, the Network Manager Portal developed by Eurocontrol enables airlines to optimize flight plans after filing.



Network Manager Portal Flight

>	☆	ARCID	REG	OPR	ADEP	ADES	EOBT	EOBT Validity	TOBT	TSAT	TT	E/CTOT	DELAY ↓₂	REGUL+ AVG DL	REGUL+
>	☆	KLM1586	PHEXG	KLC	LIPE S	EHAM	04-07:15				15	07:41C	11 ⓘ	9	KLK3C04M
>	☆	KLM1651	PHHSD	KLM	EHAM C	LIPZ	04-07:10				14	07:33C	9 ⓘ	8	KLK3C04M
>	☆	KLM83J	PHEZY	KLC	EHAM C	LIRQ	04-07:35				13	07:56C	8 ⓘ	9	KLK3C04M
>	☆	KLM81K	PHBXE	KLM	EHAM C	LIRF	04-07:35				13	07:55C	7 ⓘ	9	KLK3C04M
>	☆	KLM69F	PHBCD	KLM	EHAM C	LGAV	04-06:25		06:25	06:56	16	07:12C	31 ⓘ	45	LGAVA04+
>	☆	KLM23F	PHEXC	KLC	EHAM C	LDSP	04-08:20				13	08:33E	*28* ⓘ	23	KLK3C04M
>	☆	KLM58X	PHBXS	KLM	LIRF C	EHAM	04-08:20	185			25	08:45E	*27* ⓘ	10	EHAMA04M+
>	☆	KLM68V	PHEXA	KLC	EDDN S	EHAM	04-12:30				10	12:40E	*24* ⓘ	62	EDMFR04M
>	☆	KI M54R	PHRXW	KI M	I HRP S	FHAM	04-09:35				10	09:45F	*22* ⓘ	15	KD3C04M+

Network Manager Portal Flight

Flight Details Airspace Profile Point Profile **Flight Management** e-Helpdesk Slot Swap Ops Log History IFPS History

Flight plan Extra addressing - Enter up to 100 AFTN addresses

```
(FPL-KLM23F-IS
-E190/M-SDE2E3FGIJ1RWY/HB1
-EHAM0820
-N0442F390 EDUP0 Z739 MISGO DCT TIVUN DCT NEGIX DCT DINKU M867 XERUM DCT BAVAX DCT RADIZ/N0417F370
DCT ALIVO DCT NUPSO
-LDSP0147 LDZD
-PBN/A1B1D101S2 DOF/230504 REG/PHEXC EET/EDVV0012 EDUU0024 LOVV0057 LJLA0109 LDZ00119 CODE/485085
RVR/175 IFP/MODESASP OPR/KLC ORGN/EHAMKLMF PER/C RMK/TCAS)
```

STATUS: Filed - Targeted

Result

EOBT VALIDITY **+ 12:20** CTOT **08:58** DELAY **26**

[RAD Homepage](#)

MESSAGE

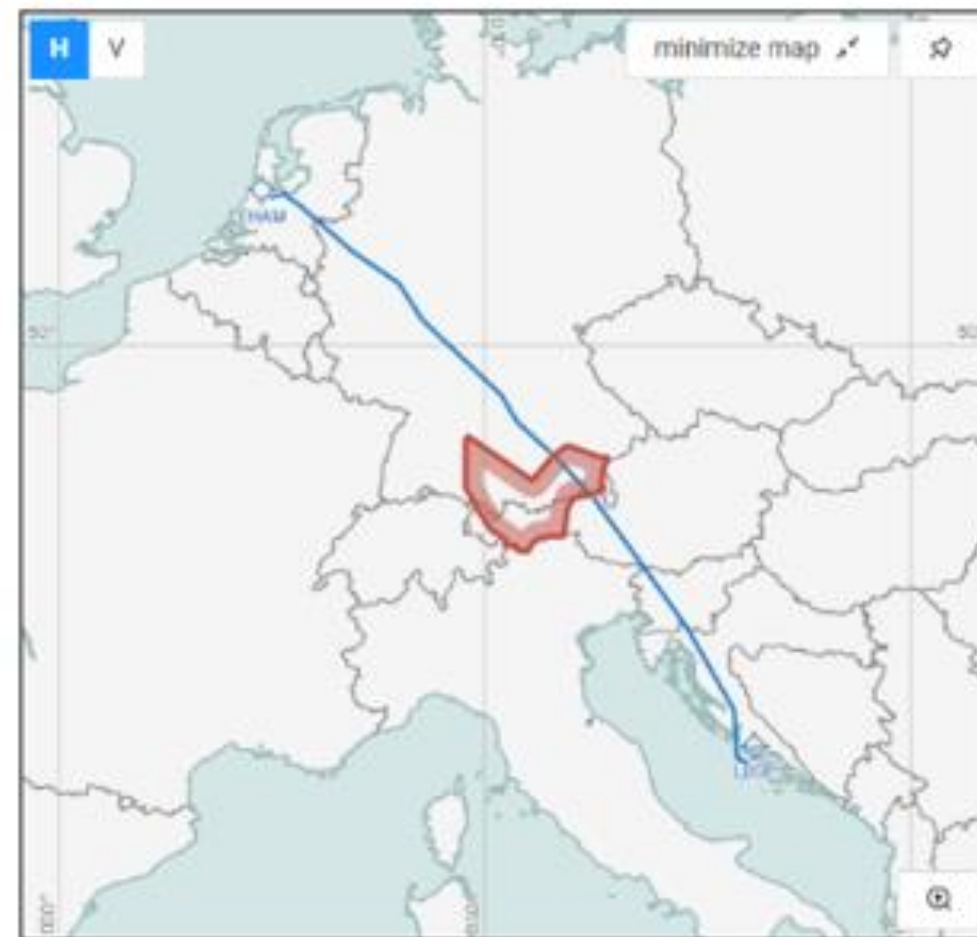
Caught in measure

DETAIL

[KLK3C04M](#)

ACTION

Avoid



Network Manager Portal Flight

Flight Details Airspace Profile Point Profile **Flight Management** e-Helpdesk Slot Swap Ops Log History IFPS History

Flight plan Extra addressing - Enter up to 100 AFTN addresses

```
(FPL-KLM23F-IS
-E190/M-SDE2E3FGIJ1RWY/HB1
-EHAM0820
-N0442F390 EDUPO Z739 MISGO DCT TIVUN DCT NEGIX DCT DINKU M867 XERUM DCT BAVAX DCT RADIZ/N0417F370
DCT ALIVO DCT NUPSO
-LDSP0147 LDZD
-PBN/A1B1D101S2 D0F/230504 REG/PHEXC EET/EDVV0012 EDUU0024 LOVV0057 LJLA0109 LDZ00119 CODE/485085
RVR/175 IFP/MODESASP OPR/KLC ORGN/EHAMKLMF PER/C RMK/TCAS)
```

STATUS: **Filed - Targeted**

Result

EOBT VALIDITY **+ 12:20** CTOT **08:58** DELAY **25** [RAD Homepage](#)

MESSAGE	DETAIL	ACTION
Caught in measure	KLK3C04M	Avoid <input checked="" type="checkbox"/>

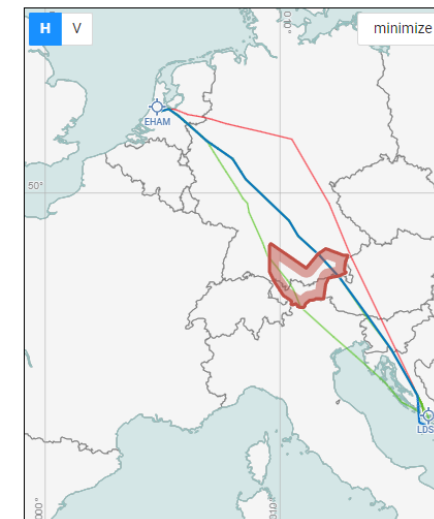
Show the full route catalogue

Route proposal criteria

Route proposal results

ORIGINAL ROUTE	CDR	ERROR	TOT	DELAY	EET	NM	FCI	RCI	EV	REGUL+
▶ EHAM LDSP 1		OK	08:58	25	110	762	3361	843	+ 12:20	KLK3C04M

PROPOSED ROUTE ID	CDR	ERROR	TOT	DELAY	EET	NM	FCI	RCI	EV	REGUL+	TYPE	ROUTE ACTIONS
▶ EHAM LDSP 5004		Overload			103	727	3244	843	+ 12:20		STANDARD	Copy FPL Copy F15 Validate
▶ EHAM LDSP 5024		Overload			104	727	3244	843	+ 12:20		STANDARD	Copy FPL Copy F15 Validate
▶ EHAM LDSP 5003		Overload			108	736	3322	851	+ 12:20		STANDARD	Copy FPL Copy F15 Validate
▶ EHAM LDSP 5021	CDR1	Overload	08:34	0	104	768	3321	871	+ 12:20	KD3C04M	STANDARD	Copy FPL Copy F15 Validate
▶ EHAM LDSP 5005		Overload			108	748	3326	843	+ 12:20		STANDARD	Copy FPL Copy F15 Validate

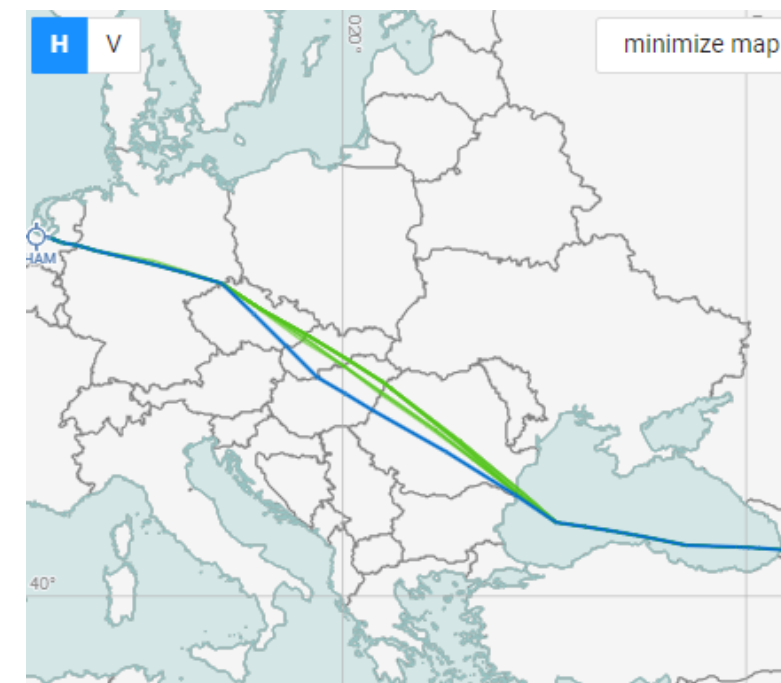


Network Manager Portal Flight

→ ORIGINAL ROUTE	TOT	DELAY	EET	NM	FCI	RCI	EV	REGUL+
EHAM VIDP 1			446	3810	60195	5324	+ 15:20	
N0477F330 ARNEM L620 HMM DCT NOMKA DCT OMELO DCT ODNEM DCT ERGOM DCT BUDOP DCT UDROS/N0471F350 UM859 KARDE UN644 ROLIN/N0472F350 N644 C USETU G500 BUTRA L181 DAROW Z767 VAJEN G500 FIRUZ/N0480F350 P500 PS T400 NONIB L509 SULOM/M083F350 A466 ELKUX ELKUX6C								

PROPOSED ROUTES

EXEC TIME	REROUTING NOTE	DELAY	EET	NM	FCI	RCI	EV	OPP ACTIONS	ROUTE ACTIONS
▶ 20-07:57	KLM 3 WIDE		445	3801	60093	5356	15:20	👍 👎	Copy FPL Copy F15 Validate
▶ 20-07:57	KLM 3 WIDE		445	3801	60110	5356	15:20	👍 👎	Copy FPL Copy F15 Validate
▶ 20-07:57	KLM 3 WIDE		445	3802	60123	5357	15:20	👍 👎	Copy FPL Copy F15 Validate
▶ 20-07:57	KLM 3 WIDE		445	3801	60125	5368	15:20	👍 👎	Copy FPL Copy F15 Validate
▶ 20-07:57	KLM 3 WIDE		445	3801	60125	5368	15:20	👍 👎	Copy FPL Copy F15 Validate



Recommendations

- Airlines need as much flexibility as possible to deal with wind variation. Impact on:
 - Passenger connections
 - Fleet connections
 - Crew working hours
- Necessity of having FUA is essential for choosing the most optimal flight path
- FUA can help bypass congested airspace sectors
- FUA/FRA/UPR development is supported by airlines and can assist during development

All these points will lead to reduction of emissions for airlines which helps the industry reach global aviation commitment to achieve net zero carbon in 2050.

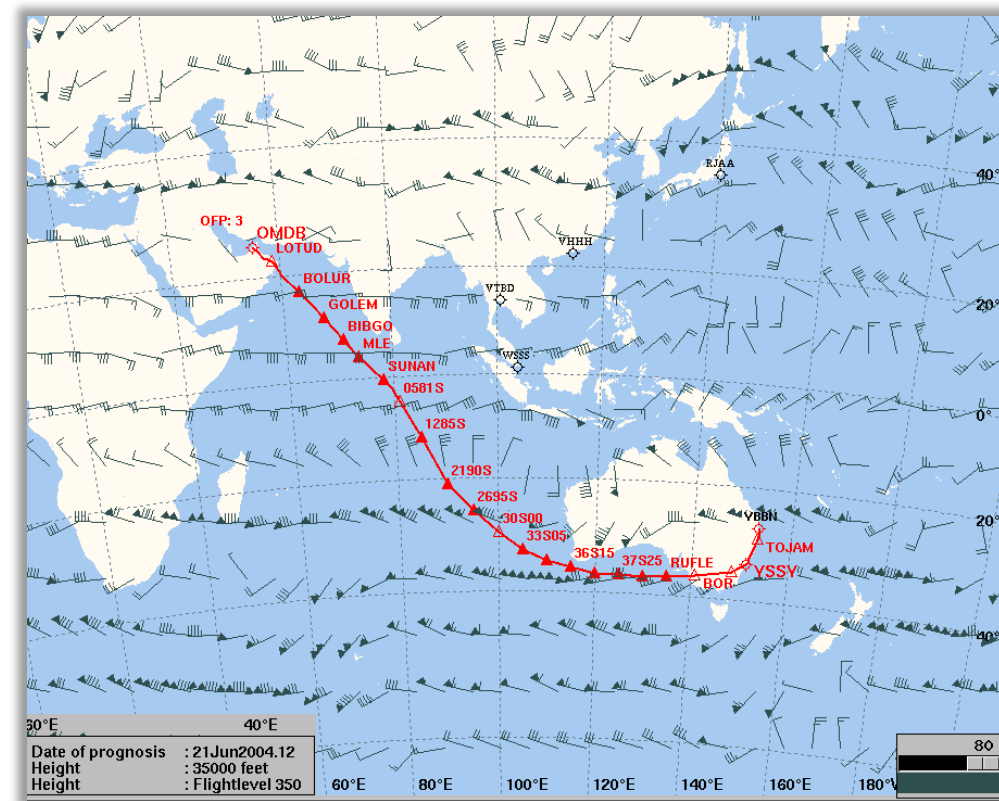
04
Free Route
Airspace
(FRA)



Free Route Airspace (FRA)

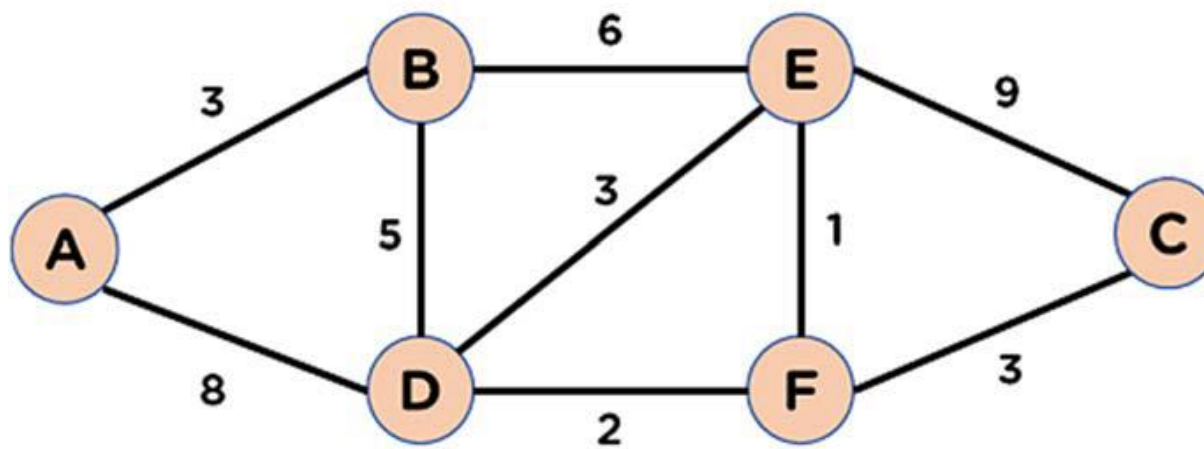
FRA and Flight Planning Systems in Action

- FRA is not DCT: Free Route Airspace is not direct (sometimes this is common understanding from Pilot and Controller perspective).
- The modern flight planning tools are proposing optimum routings for Dispatchers, considering numerous factors.
- Example of OMDB – YSSY
 - Distance increase – 1200 NM
 - Time saving – 43 mins
 - Fuel saving – 8400 kg



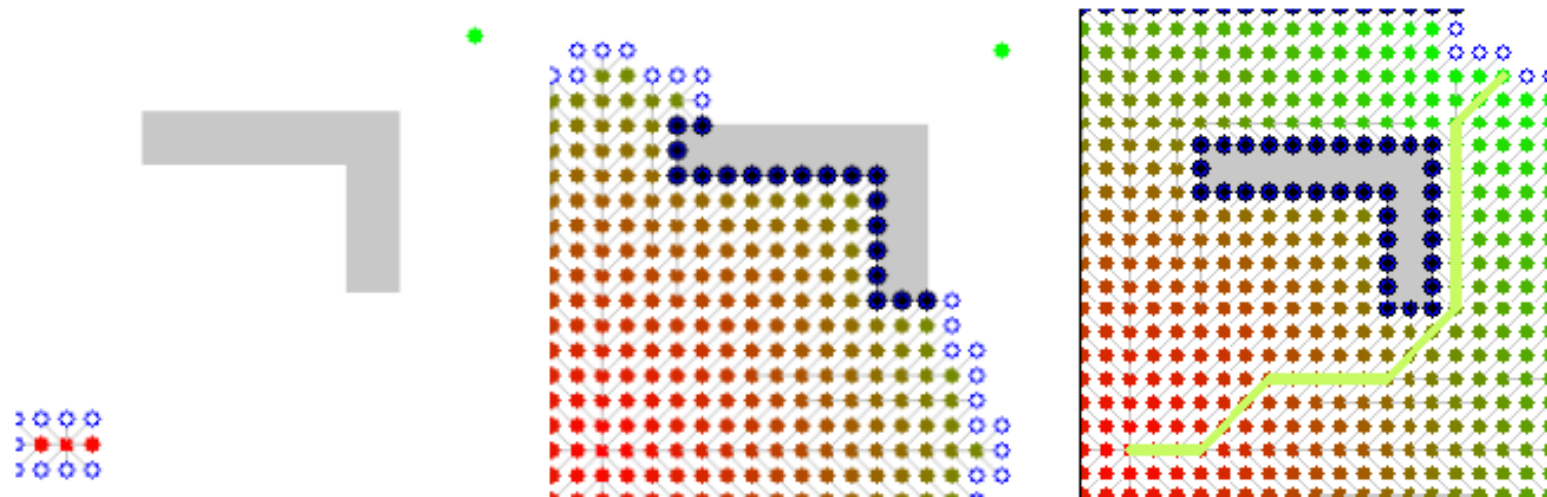
Why FRA?

- Route generation by modern flight planning systems – find the most optimal trajectory with advanced flight planning programs
- Dijkstra's Algorithm – select the leg with the shortest route
- For example, from point A to point C: A – B – D – F – C



Dijkstra's Algorithm in Action

- The algorithm is attempting to find the shortest distance between the Red and Green dots, and against a restriction (gray bar).
- Flight planning systems can take rules created by ANSPs and put them into action.





Modern Flight Planning Systems

- The modern flight planning systems make the calculation under their algorithms and generate route options based on the ANSPs rules (e.g., the restrictions in place).
- Flight planning systems also take optimization methods (fuel burns, emissions, cost or time), weather, winds, and operator preferred rules into account while performing the route generation process.
- Future use idea: utilizing the SWIM network, flight planning systems could import ATC airspace/flow control restrictions in real time and take them immediately into account during flight planning, this would allow ANSPs greater levels of collaboration between all stakeholders.

Using Rules to Find the Route

- One of the best examples on how to present flight planning rules is the Route Availability Document (RAD) in Eurocontrol airspace:
 - Reduce rule complexity
 - Present in a machine-readable format
 - Remove the need to publish permanent NOTAMs

Airway	From	To	Point or Airspace	Utilization	Time Applicability	Categorisation	Operational Goal
P55	SONEB	GOTIG		ONLY AVBL FOR TFC ARR (EHAM, EHG, EHLE)	H24	S	To force traffic onto arrival transitions
P62	TEBRO	PISAP		ONLY AVBL FOR TFC ARR (EDDL, EDLN, EDLV, ETAD, ETNG, ETNN, ETOU)	H24	S	To force traffic onto arrival transitions
Z729	BADLI	ZWN		NOT AVBL FOR TFC ARR (EDDR, EDRZ, ELLX, ETAR) THIS TRAFFIC SHALL FILE LBU Z11 TAGIK Z818 RINEX MANEM	H24	S	to force traffic to inbound routes
Z12	UMDAS	KETEG		NOT AVBL FOR TFC 1. WITH RFL ABV FL245 EXC DEP ETAR 2. DEP EDDS	H24	S	1. To integrate departures from ETAR into upper airspace routings 2. To force departing traffic onto correct routing
L608	KPT	TEDGO		NOT AVBL FOR TFC 1. DEP (EDMMFIR, LSZR) 2. VIA N851 LBU 3. DEP LI** WITH ARR BASEL_GROUP 4. ARR EDGGFIR EXC ARR (EDDG, EDDK, EDDL, EDDR, EDFH, EDKZ, EDLA, EDLD, EDLE, EDLI, EDLM, EDLN, EDLP, EDLS, EDLV, EDLW, EDRZ, EDVK, EDWO)	H24	C	1.,2.: No direct connection from lower airspace. To force traffic to another transition route 3. to reduce complexity avoiding creative FPLs 4. to force not listed ARR via other routes.



Authorized Direct Routes

- Eurocontrol also publishes authorized direct routes, which allow flight planning systems to take advantage of numerous options from a single waypoint, instead of fixed airways.
- The direct route may not be the most efficient; however, with the options provided by ANSPs, the most efficient direct can be found by the flight planning systems prior to departure with weather forecast, etc.

ID	From	To	Lower Vert. Limit (FL)	Upper Vert. Limit (FL)	Available or Not (Y/N)	Utilization	DCT Time Availability	Operational Goal
LTS026	YAPZU	ADKAR	275	660	Yes	TBD - General conditions apply	H24	To avoid Air Defence Zone
LF5491	GONEK	TABOV	305	500	Yes	ONLY AVBL FOR TFC VIA LFRGGA	H24	Fuel saving Direct trajectories

Recommendations

- Simplify the rules as much as possible (e.g., clearly state which airway or points affected and what the operators can/can't do within the airspace, and the applicable time, etc.) and enable the operators storing them in the system to allow for route generation.
- Add a process to modify the rules mid-cycle as needed or create a “dynamic” rule system that would allow ATC to make changes to flows as required.
- Include flight planning system providers in discussions to find the best way to present the information (machine-readable).
- Phased approach and multi-tier roll out to the system, e.g., trial and transitions to new preferred trajectory system, expansion to domestic/cross-border airspace, expansion to FRA concept system.

EUROCONTROL

Network Management Directorate

6 FRA in the RAD

6.1 General Provisions

- (1) The provisions in this Section are also supplementary to the provisions of ERNIP Part 1, Chapter 8 and presents the specificities of FRA design description in the RAD. If not explicitly stated, these provisions are applicable in either non-cross-border FRA area or cross-border FRA area.
- (2) The RAD for FRA includes traffic flow rules and/or flight planning facilitation options valid on specific:
 - a) Significant point(s).
 - b) Airspace Volume(s) (FIR/UIR, AoR of relevant ATC Unit - CTA/UTA, TMA, CTR or individual/collapsed control sector(s) within an ATC unit, Free Route Airspace, area or zone (FBZ, NPZ, etc.), etc.).
 - c) Aerodromes.
- (3) When, for FRA purposes, describing the en-route DCT (Direct) flight plan filing options in accordance with ICAO Doc 4444 PANS-ATM, the following terms are used differentiated by their meaning:
 - a) “FRA DCT” - En-route DCT (Direct) in FRA area based on FRA Concept.
 - b) “RAD DCT” - Fixed en-route DCT (Direct) defined in RAD. This is a non-cross-border or cross-border RAD DCT, which facilitates FRA concept implementation but is not part of the FRA design.
- (4) The above terms can also be used:
 - a) In relation to cross-border FRA operations - cross-border “FRA DCT”.
 - b) In relation to cross-border non-FRA operations - cross-border “RAD DCT”.
 - c) When defining a limit - “FRA DCT” limit or “RAD DCT” limit; or
 - d) In combination of all above - cross-border “FRA DCT” limit or cross-border “RAD DCT” limit.

```

23149 : [EG50275]
23150 : ANYDEF DCT FL195 TO FL245 DIGSU+EG+E UMBAG+EG+E
23151 : NOT AVAILABLE FOR
23152 : ( ANDNOT((ORIGIN EGLL VIA GOTGO+EG+E)));.;
23153 : [EG50275]
23154 : ANYDEF DCT FL195 TO FL245 DIGSU+EG+E UMBAG+EG+E
23155 : NOT AVAILABLE FOR
23156 : (ISACTIVE(RESREG "EGHTAEAL"));.;
23157 :
23158 : [EG5028]
23159 : ANYDEF DCT FL165 AND BELOW HON+EG+V MOSUN+EG+E
23160 : NOT AVAILABLE FOR
23161 : ( ANDNOT(ORIGIN EGBB));.;
23162 : [EG5028]
23163 : DURING EG5028A VIA FL165 AND BELOW HON+EG+V DCT MOSUN+EG+E
23164 : MUST USE
23165 : ALWAYS FL165 AND BELOW MOSUN+EG+E DCT ANY LEVEL BCN+EG+V DCT EXMOR+EG+E ABBEW+EG+E.
23166 : ALWAYS FL165 AND BELOW MOSUN+EG+E DCT BCN+EG+V ANY LEVEL FELCA+EG+E NICXI+EG+E.
23167 : ALWAYS FL165 AND BELOW MOSUN+EG+E DCT BCN+EG+V ANY LEVEL FIFAH+EG+E NICXI+EG+E.
23168 : ;
23169 : [EG5028]
23170 : ANYDEF DCT FL165 AND BELOW HON+EG+V MOSUN+EG+E
23171 : NOT AVAILABLE FOR
23172 : ((ARRIVAL AG LE OR
23173 : ARRIVAL AG LI OR
23174 : ARRIVAL AG LFALL) ANDNOT((ARRIVAL LEMG OR
23175 : ARRIVAL LFBZ)));.;
  
```

Operational Trial of South-East Asia-Oceanic Implementation of Free Route Operations (SEA-O FRTO)

A case study for expanding access to airspace volumes

- In August 2024, the South-East Asia-Oceanic Implementation of Free Route Operations (SEA-O FRTO) project team commenced a trial involving four ANSPs (CAAS, AirNav Indonesia, Airservices Australia, and Airways NZ) and four airlines (SIA, GIA, QFA and ANZ). The trial combined several existing and emerging UPR programs and enhanced their potential efficiencies primarily through cooperation of neighboring ANSPs to create a larger volume of access and remove constraints of tracking points at FIR boundaries.
 - Effectively ‘connecting’ the FIRs of the ANSPs provided opportunity for UPR flights to be planned for maximum distance with minimal restriction between thirty-seven (37) agreed city-pairs.
 - A review of the trial and identification of benefits and expansion opportunities took place in Q1/2025. Data collated represented total savings achieved for UPR vs fixed routes for the restricted set of city-pairs used in the trial.
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Operational Trial of South-East Asia-Oceanic Implementation of Free Route Operations (SEA-O FRTO)

A case study for expanding access to airspace volumes

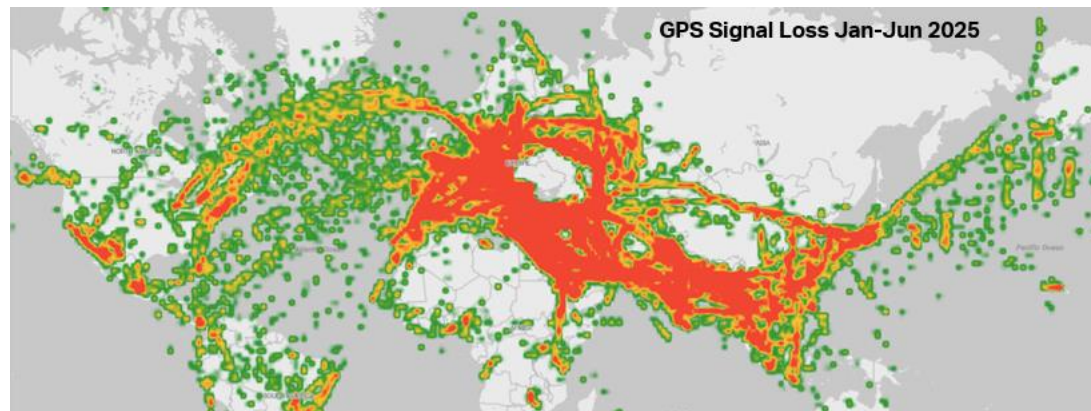
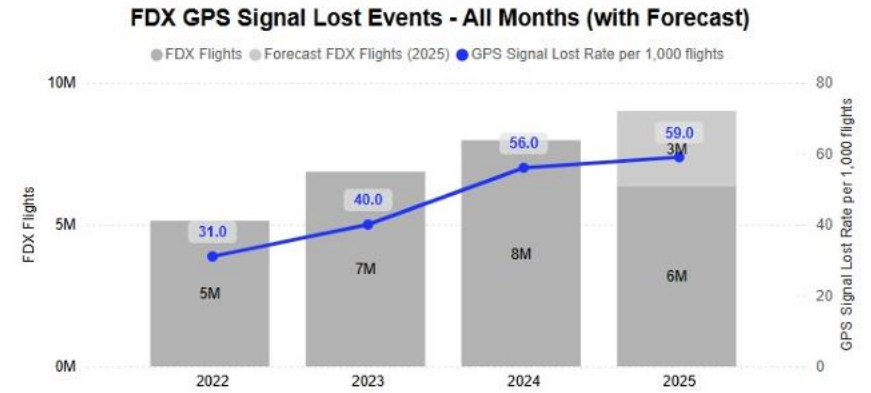
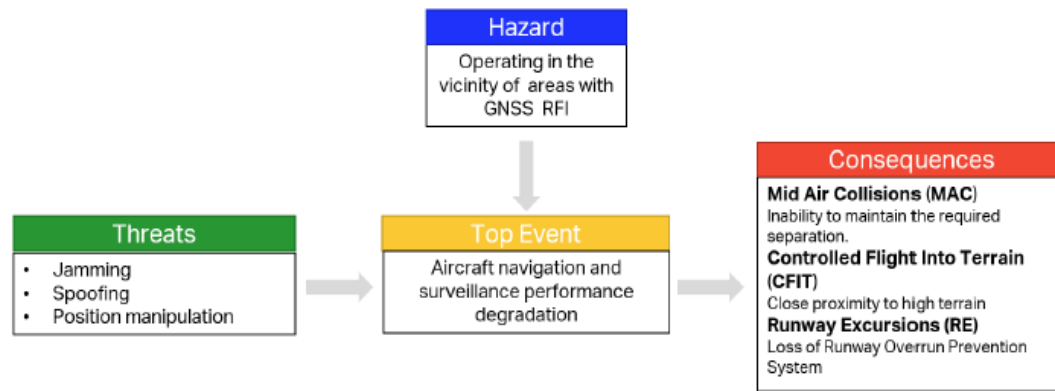
- After considering the airline data on fuel and CO2 efficiencies, it was agreed to extend the trial until 31 October 2025 and expand it by adding two ANSPs (NiuSky Pacific and Fiji Airports), as well as four additional airlines (Cathay Pacific (CPA), Eva Air (EVA), Fiji Airways (FJA), and JetStar Airways - Australia (JST)) operating in an expanded suite of city-pairs.
 - Post-completion of the trial on 31 October 2025, data was further collated and analyzed with results showing significant savings and efficiencies in fuel burn and CO2 emissions. The data represented what can be achieved in total when multiple States work in cooperation by effectively joining their FIRs to create a large seamless airspace volume.
 - Similar outcomes could be achieved by enabling greater access to Military Restricted Areas when military activities permit, so that access is granted to greater seamless volumes of airspace. The longer distance a UPR can be planned and flown without restriction, the greater the benefits that can be realized.
-

05
CMAC for
Global
Challenges



CMAC for Global Challenges

GNSS Interference – reported GPS signal loss events evolution



Impacts on Aircraft Systems and Operations

- GNSS interference, whether jamming or spoofing, can lead to a temporary or non-recoverable failure or degradation of PNT (Position, Navigation & Timing) information provided by GNSS. This can result in a wide range of issues during various phases of flight:
 - Navigation Issues
 - Surveillance Issues
 - Alerting System Issues
 - Timing and Data Link Issues
 - Other System Impacts
 - Repeated or widespread disruptions of GNSS signals can lead to increased workload for both flight crews and air traffic controllers, potentially causing cognitive overload or confusion and increasing the risk of errors. The combination of multiple issues can have cumulative adverse effects on flight safety.
 - GNSS jamming and spoofing can also affect ground-based systems, especially those using GNSS for timing.
-

What happens when there is GNSS signal interference?

- Inability to use GNSS for navigation
- Loss of RNAV approach capability
- Inability to conduct/maintain RNP and RNP AR operations
- Triggering of ground proximity warning system's terrain warnings
- Inconsistent aircraft position
- Loss of ADS-B, wind shear, terrain and surface functionalities
- Failure/degradation of ATM/ANS/CNS and other systems using GNSS as a time reference
- Potential airspace infringements and/or route deviations



What happens when there is weather?

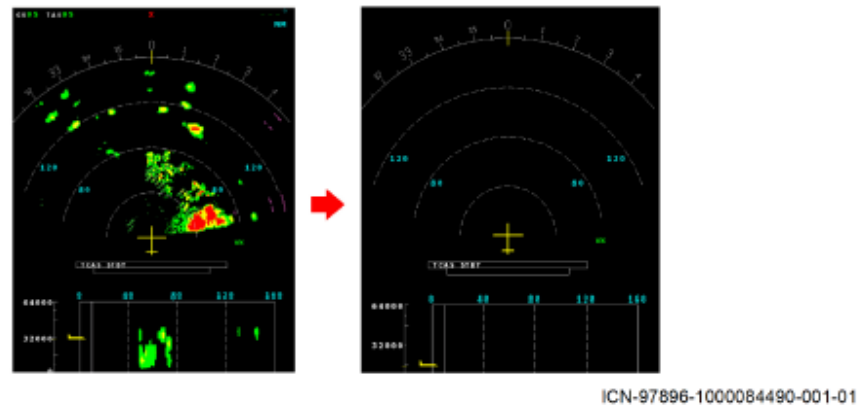


Figure 1. Normal Weather Display gets Cleared when Position Jump is Detected

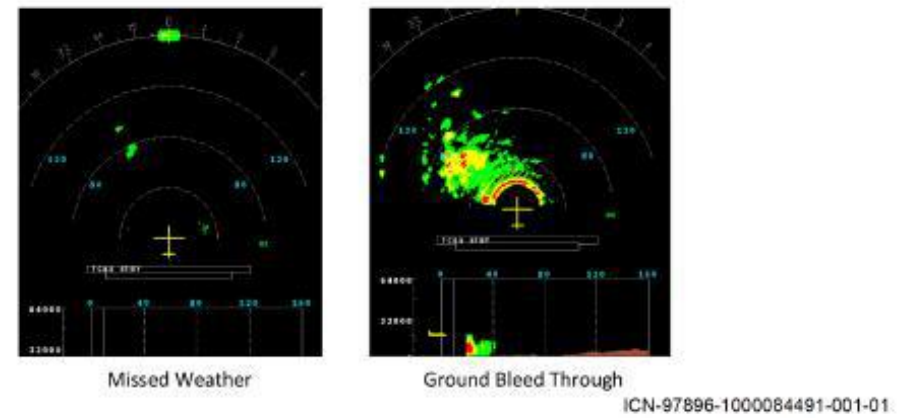


Figure 2. Mis-Represented Weather Resulting from Incorrect Position

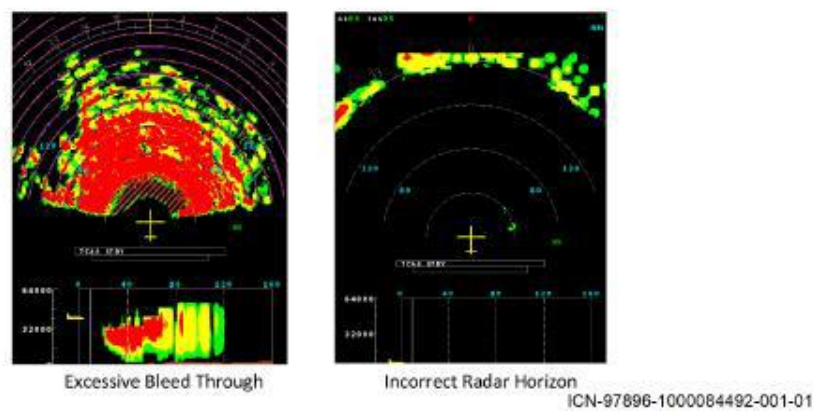


Figure 3. Mis-Represented Weather Resulting from Incorrect Altitude

Recommendations

Multi-faceted approach to address GNSS RFI effectively

- Effective ICAO/State coordination for military RFI
 - Enhanced monitoring and reporting for non-military RFI
 - Source identification and mitigation
 - Aircraft and avionic resilience
 - Operational procedures and training (contingency planning, pilot and ATC trainings)
 - Research and development (alternative/complementary PNT technologies, cybersecurity, etc.)
 - ...
-

CMAC for Global Challenges

Airspace users' expectation: safety, accessibility, efficiency, flexibility, predictability

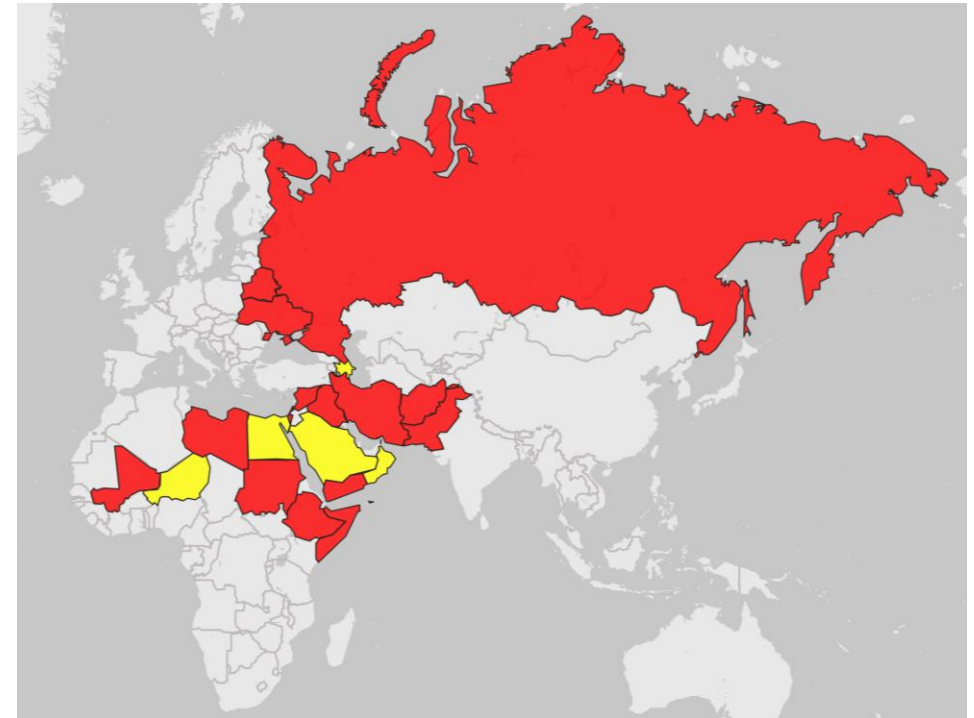
- GNSS RFI (safety)
 - Severe weather – avoid the typhoon, volcano, etc. (safety, flexibility)
 - Airspace closures – earlier communication by NOTAMs (predictability) with alternate route options (efficiency, flexibility), etc.
 - ATM/airspace contingency – providing contingency plans and routes (safety, accessibility)
 - Enroute alternate airports – more options for special/remote airspaces, e.g., high terrain, ocean areas (safety, efficiency, flexibility)
 - Airspace availability – access to the airspaces effectively and increase the connectivity during the geopolitical tension and disruptions (accessibility, efficiency, flexibility)
 - ...
-

06
Airspace
Availability



Airspace Availability

- Airspace disruption, specifically due to political unrest, continues to impact airline operation. In cases where there is a long-term airspace disruption, airlines continue to face challenges impacting efficient operations around airspace no longer available for civil aviation.
- Primarily due to inefficiencies in the airspace that existed prior to the airspace disruption but were amplified with the re-directed traffic. The most recent airspace disruption in the Middle East compounded the problem for airline operators, given the limited airspace that is available for cross regional traffic, specifically from/to Europe.
 - Ensure resilience of air navigation system and operational efficiency during and after an airspace disruption.
 - Airspace contingencies and cross-regional framework for development and implementation of airspace optimization initiatives.

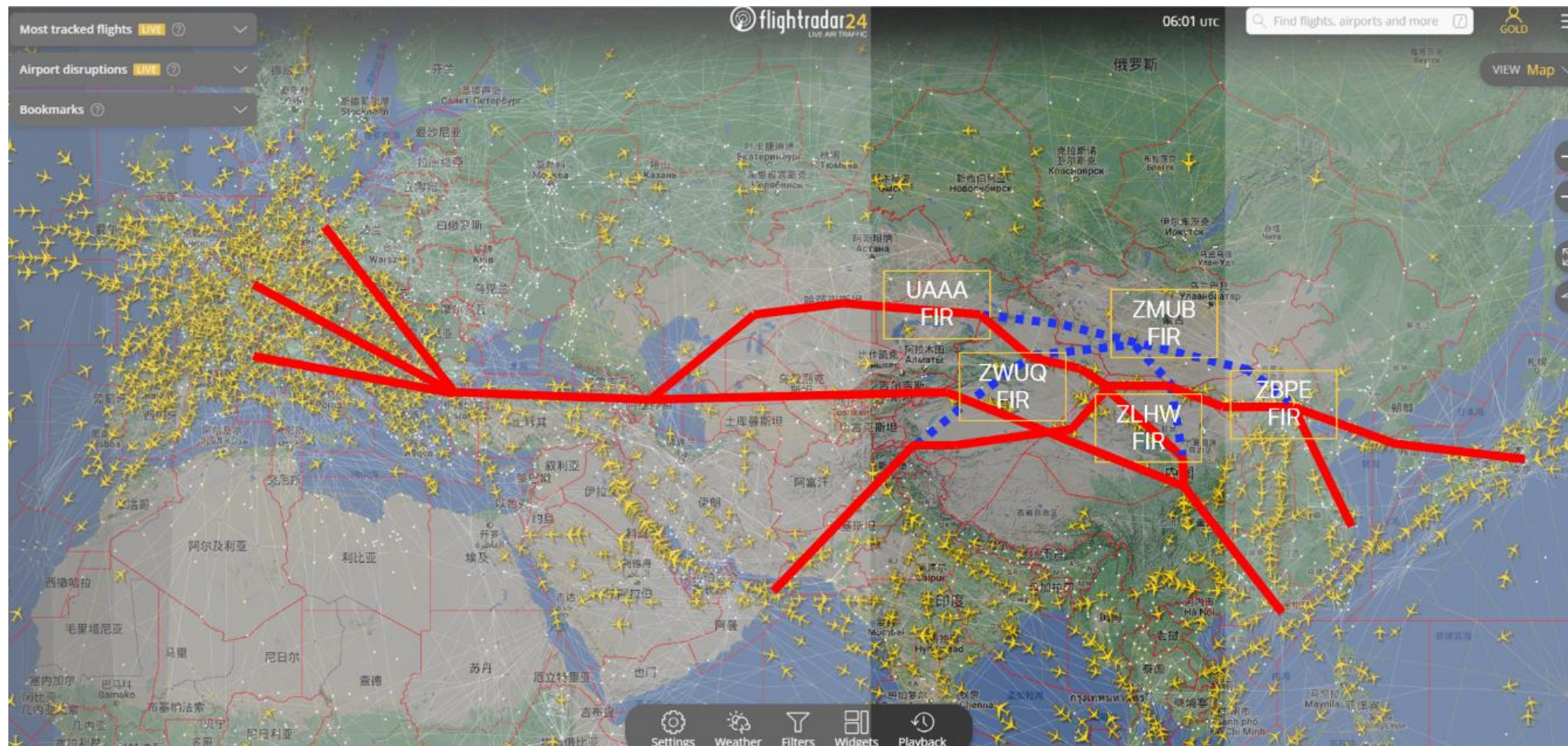


Example of the FIRs at EU – Asia Interface

Annual flights by FIRs

FIR	2022	2023 (YoY)	2024 (YoY)
ZWUQ	26,008	157,178 (+504.34%)	429,905 (+173.51%)
ZLHW	431,380	912,827 (+111.61%)	1,313,810 (+43.93)
ZMUB	35,339	48,554 (+37.39%)	73,755 (+51.90%)
UAAA	112,721	160,231 (+42.15%)	191,599 (+19.58%)
UACN	104,802	139,104 (+32.73%)	152,113 (9.35%)
UAII	141,243	188,397 (+33.39%)	223,576 (+18.67)

The EU – Asia Interface



Challenges in Airspace Efficiency and Optimization

Where are we for today

Challenges for operators

- Airspace structure and capacity issues – ATFM delay, vertical/lateral efficiency...
- Geopolitical and operational disruptions (e.g., airspace and route closure with short notice by NOTAMs) – ATFM delay, increased flight time and distance, additional fuel burn and emissions...
- Inflexible routes and limited alternatives – operational flexibility, efficiency and costs...
- Limited and inflexible entry/exit points – operational flexibility and efficiency...
- Limited options for diversion or emergency forced landing – operational costs and flight safety...
- Operational limitations (e.g., crew duty time for long-haul flights) – ATFM delay, operational costs...
- ANS charges – operational costs and sustainability...

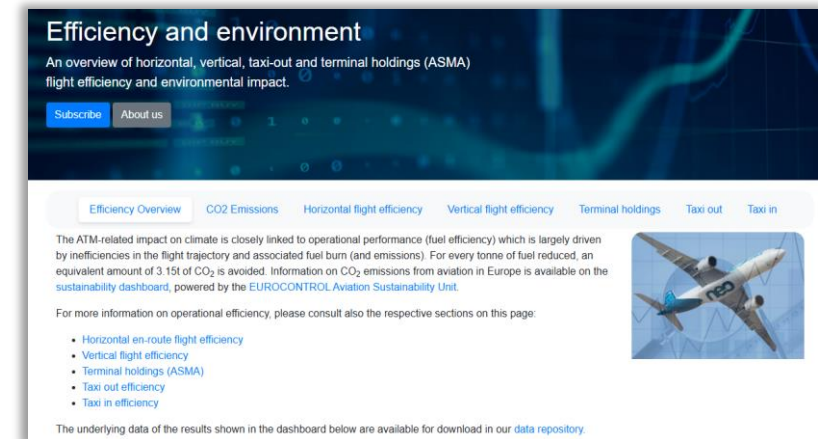
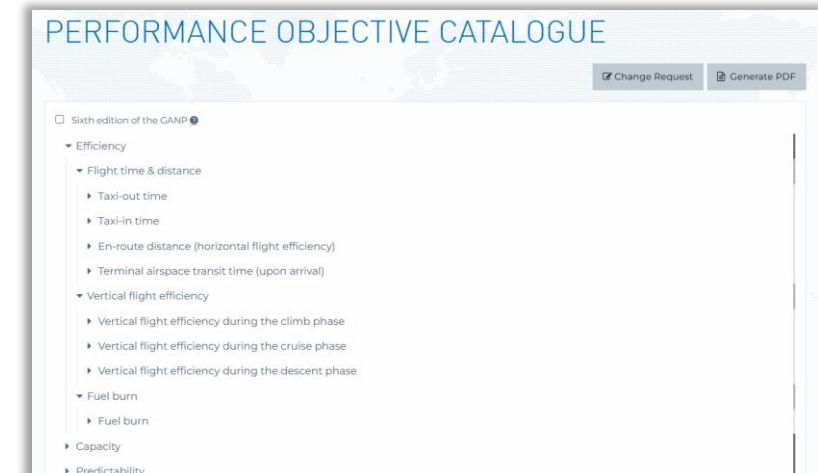
Challenges for the industry

- Multi-party coordination among the stakeholders in complex airspace – cross-region/State/FIR and civil-military coordination, consultation with airspace users
- Fragmented airspace plannings – uncoordinated airspace/route design and development
- Collection of real data – airspace simulation/evaluation, data-driven decision making
- Performance-based approach – KPI monitoring to identify and proactively address the airspace issues (safety, capacity, efficiency and environmental impact, etc.)
- Slow adoption of the new technologies/concepts – e.g., models and tools to support the evaluation of the “What-if” scenarios, FRA planning and implementation
- Environmental protection – industry targets to minimize the environment impact

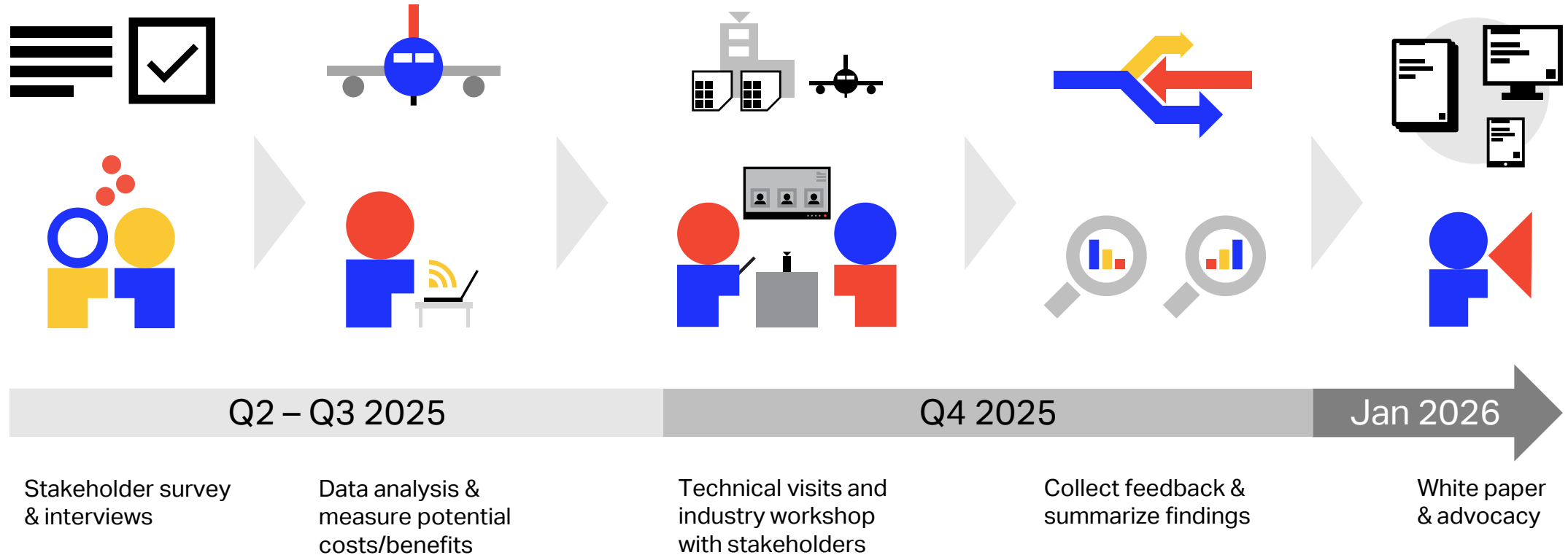
IATA's Response: Data-driven Airspace Efficiency Study Project

A data-driven solution to support the airspace evaluation and optimization initiatives

- Real data collection and analysis
- Statistical modelling and flight simulation using industry recommended KPIs on efficiency and environment
- Interviews with key stakeholders
- Technical visit to key facilities and technical meetings
- Desk research to identify and summarize the findings
- Industry review of the draft conclusions and validation with all stakeholders
- ...



Project Timeline



The 2025 ATMB & IATA Workshop

A regional initiative led by ATMB and IATA for greater level of air/ground collaboration and harmonization



- 25-27 Nov 2025 in Xi'an, China
 - 103 participants from 9 States, 20 operators and 7 international organizations/institutes
-

Next Steps

- Draft White Paper: the project team is currently developing a white paper with 5 major parts, including the urgent challenges in the airspace, collective call from the airlines and ANSPs, viable solution and feasibility assessment, data-driven validation of the benefit and impacts, conclusions and strategic roadmap. The white paper is to provide a comprehensive report of the study and share the relevant information and practices with the industry.
 - Cross-border Coordination: for large airspace optimization projects in complex airspace, analyzing overall/individual benefits and cost/impact for different stakeholders and multi-party coordination are crucial. The project team is continuing to facilitate the implementation of the proposals and provide strategic recommendations to the industry.
 - Improvement of Prototype: the project team is also planning to work with suppliers and improve data collection, aiming to develop a more mature data integration tool with multiple sources of industry databases, and achieve more advanced functionalities, e.g., real-time or post-event analysis of the operational performance data.
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Key Takeaways



Key Takeaways

An Effective CMAC/FUA: from Concept to Implementation

1. **Effective implementation of CMAC/FUA**: robustly building the trust and strategic alignment, simplifying and strengthening the existing coordination process/procedures, innovating in airspace management with modernized supporting tools, and unlocking enormous potentials
 2. **Data-driven and performance-based approach**: actively leveraging the industry database and tools to support the decision making in airspace optimization, timely monitoring the KPIs on efficiency and environment of airspace operations (e.g., effectiveness in using the reserved airspace, actual using rate of available airspaces, etc.)
 3. **Regularly review and post-ops analysis**: continuously improving the usage of airspace to maximize the overall benefits by analyzing the operational data and identifying the gaps between the supply and demand sides of airspace resources (e.g., regular post-ops review meetings to discuss the numbers and operational areas to be enhanced, maturity of the whole processes, etc.)
-

Thank You

