AFI FRA PMT5 and UPR WS , OCTOBER 2024, NAIROBI

21 to 25 October 2024, NAIROBI, KENYA

AFI FRA PMT5 : CASE STUDY AND SIMULATION

Presented by AFI FRA PMT /BILLY DIABASENGA

With many thanks to NAMA/NIGERIA for their full support and collaboration to the preparation of this presentation.

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FRA CONCEPT DEFINITION

- A **specified airspace** within which users may freely **plan a route between a defined entry point and a define exit point**, with the possibility to route via intermediate (published or unpublished) way points, **without reference to the ATS route network**, subject to airspace availability.
- Free Route operations enable airspace users to fly as closely as possible to their preferred trajectory **without being constrained by fixed route networks or structures**. In an FRA airspace, all fixed route networks can be removed.
- Flights remain subject to **air traffic control**.
- Active airspace reservations are crossed or avoided depending on the degree of coordination (including civil/military coordination) and the status of the activity in the area.
- It is important to note the difference between "Direct Routing Operations" (DRO) and "Free Route airspace" (FRA) operations.
- Direct Route Operations will precede the implementation of Free Route Airspace.

AFI FRA Background

- The importance of implementing the FRA was keenly felt with the outbreak **of the COVID-19 pandemic in 2019**.
- These were **tough times for world aviation** and African aviation in particular.
- Ways had to be found to **reduce airlines' operating costs and ensure their survival.** **More aircraft and more flights.**
- The FRA concept, already **operational in Europe a decade** before and **supported by the global air navigation plan**, was one of the solutions to the problem.

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AFI FRA Background

- **Six volunteer FIRs/States** were tasked with implementing the FRA in their respective airspaces on an experimental basis.
- One State (**Mauritius**) had made progress by implementing FRA in Oceanic airspace.
- The experiment was extended to the continental level with **Ghana, Nigeria, Uganda and ASECNA**.
- A number of other countries (**DRC, KENYA, ZIMBABWE, …)** have opted for direct route operations (DRO) as a first step, and some are preparing to migrate progressively to the FRA.

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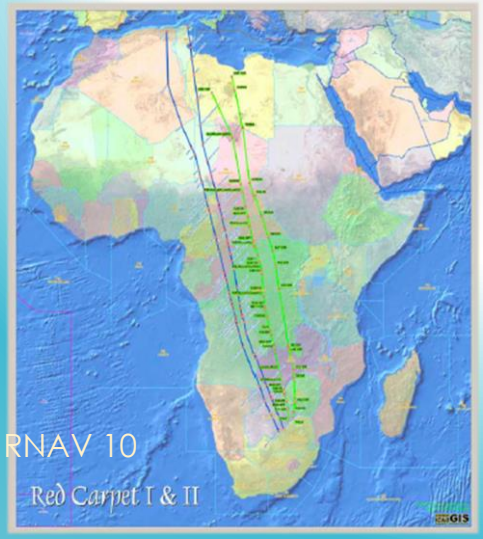
PBN ROUTES AS CROSS BORDER DCT PRECURSOR

- Large-scale operation desired
- Existing points or new points to be created
- Good example with PBN Red Carpet 1 and 2 for cross-border, but still room for improvement.
- For the rest, what to do - adapt existing trajectories or start from scratch in the city-to-city choice?



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UPR TRIALS AS CROSS BORDER DCT PRECURSOR

- Step by step methodology
- With good coordination
- Lesson learning process
- From tactical to strategic, need to carry extra fuel saved
- Increased UPR team workload to start with
- Limited to capacity/ ressources

Challenges and opportunities

Major challenges/Caution

- Preventing resistance to frequent changes, need for a broad vision, not changing too frequently.
- Right approach for buy-in (communication)

The great opportunity

- Integrating the project into the regional development communities/ organizations.
- Example : EAC Seamless sky project, etc.
- Inter FIR coordination meetings

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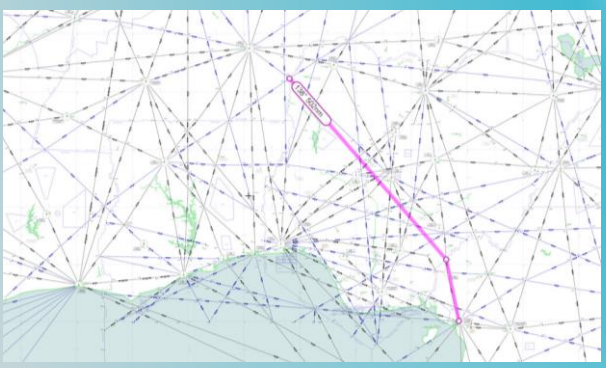
Example of local FRA Nigeria

- FRA routes don't need to go from NAVAID to NAVAID, you might need to forget about some of them for a while, as long as an aircraft can stay within the RNAV possibility.
- Remember, they are still to be maintained for back, conventional navigation and contingency

Example of local FRA Nigeria



- Local FRA entry and exit points determined on existing routes to facilitate coordination and hand overs

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Example of local FRA Nigeria

- Combination of entry, exit and intermediate points specified in AIP
- Starting with a few main routes, depending on traffic volume and flow

Example of local FRA Nigeria

- Added entry and exit points as airlines requests progressed
- Adapted gradualy as needed
- Limited intermediate points to what was strictly necessary
- Involved all key players, including the air force, in the implementation process
- Conducted CNS/ATM means evaluation and safety studies,

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Gradual implementation

- Added entry and exit points as airlines requests progressed
- Adapted gradualy as needed
- Limited intermediate points to what was strictly necessary

NIGERIAN AIRSPACE MANAGEMENT AGENCY
MALLAM AMINU KANO INTERNATIONAL AIRPORT
SEPTEMBER OVERFLIER,2024.

DATE (dd/mm/yyyy)	OPERATOR	AIRCRAFT TYPE	REGISTRATION	Call Sign	Dept. Point	Destination	Entry Point	Exit Point	Entry Time	EXIT TIME	LEVEL	FRA
01/09/2024	ROYAL AIR MAROC	B788	CNRGU	RAM 519N	GMMM	FEFF	BOVDA	GADUV	0020	0136	410	F
01/09/2024	BRUSSELS AIRLINE	A333	OOSFH	BEL 38K	FZAA	LTFM	EBIMU	ENBUT	0039	0103	360	F
01/09/2024	TURKISH AIRLINE	B38M	TCLCG	THY 672	FZAA	LTFM	EBIMU	ENBUT	0200	0226	340/360	F
01/09/2024	ETHIOPIAN AIRLINE	B788	ETAOV	ETH 508	HAAB	DXXX	GATAG	POLTO	0914		400	F
01/09/2024	ETHIOPIAN AIRLINE	A359	ETATQ	ETH 921	HAAB	DGAA	GATAG	POLTO	0937		400	F
01/09/2024	EMIRATES	B77W	A6EPH	UAE 6M	OMDB	DGAA	GATAG	POLTO	0941		340	F
01/09/2024	ETHIOPIAN AIRLINE	B788	ETAOQ	ETH 512	HAAB	DIAP	GATAG	POLTO	0955		400	F
01/09/2024	ETHIOPIAN AIRLINE	B789	ETAUR	ETH 933	HAAB	DFFD	ONSEV	GULEN	1139	1243	380	F
01/09/2024	ETHIOPIAN AIRLINE	B77L	ETARI	ETH 3921	HAAB	DGAA	GATAG	POLTO	1200		340	F
01/09/2024	BRUSSELS AIRLINE	A333	OOSFX	BEL 3UH	FKYS	EBBR	TAKUM	MIMBA	2107	2156	360	F
03/09/2024	QATAR AIRWAYS	B788	A7BCU	QTR 1424	OTHH	DIAP	GADUV	POLTO	0508		400	F
04/09/2024	ETHIOPIAN AIRLINE	A359	ETAWO	ETH 909	HAAB	GABS	ETRIS	GANDA	1503		400	F
05/09/2024	ROYAL AIR MAROC	B738	CNROP	RAM 509	GMMN	FKYS	BOVDA	OBUDU	0113	0220	350/370	F
05/09/2024	ROYAL AIR MAROC	B738	CNRNZ	RAM 265	GMMN	FZAA	BOVDA	OBUDU	0053	0203	370	F
05/09/2024	LUFTHANSA	B748	DABYQ	DLH 572	EDDF	FAOR	ENBUT	EBIMU	0116	0140	350	F
05/09/2024	ETHIOPIAN AIRLINE	B38M	ETAWI	ETH 927	HAAB	DGAA	GATAG	POLTO	0206		380	F
05/09/2024	TURKISH AIRLINE	B38M	TCLCL	THY 672	FZAA	LTFM	EBIMU	ENBUT	0231	0258	360	F
05/09/2024	KLM	B77W	PHBVK	KLM 104	FACT	EHAM	EBIMU	ENBUT	0419	0442	320	F

- **Involved all key players, including the air force, in the implementation process**
- **Conducted CNS/ATM means evaluation and safety studies,**

Gradual implementation

Defined FRA significant points combination as per the AIP SUP template

- AFRAA - Konate - Director Technical and Operations
- AIRAC AIP SUP 10 of 2022 (1)
- Current - POST FRA IMPLEMENTATION - REQUEST FOR ADDITIONAL FRA DIRECT ROUTES - Second phase FRA increment
- CURRENT UPDATED - STANDARD OPERATING PROCEDURE - FREE ROUTE AIRSPACE - SOP - FRA - APPROVED
- FRA Check List of Implementation Actions
- POST FRA IMPLEMENTATION - REQUEST FOR ADDITIONAL FLIGHT PLANNABLE DIRECT ROUTES
- POST FRA IMPLEMENTATION 2 - REQUEST FOR ADDITIONAL FRA DIRECT ROUTES
- QUALITY ASSURANCE and SAFETY REPORT - 2022 - FREE ROUTE AIRSPACE - LOCAL - NCAA

From	To	Remark
FRA Horizontal Entry Point (E)	FRA Horizontal Exit Point (X)	
	FRA Intermediate Point (I)	
	FRA Arrival Connecting Point (A)	
FRA Intermediate Point (I)	FRA Horizontal Exit Point (X)	Flight plan direct or via one or several intermediate points.
	FRA Intermediate Point (I)	
	FRA Arrival Connecting Point (A)	
FRA Departure Connecting Point (D)	FRA Horizontal Exit Point (X)	
	FRA Intermediate Point (I)	

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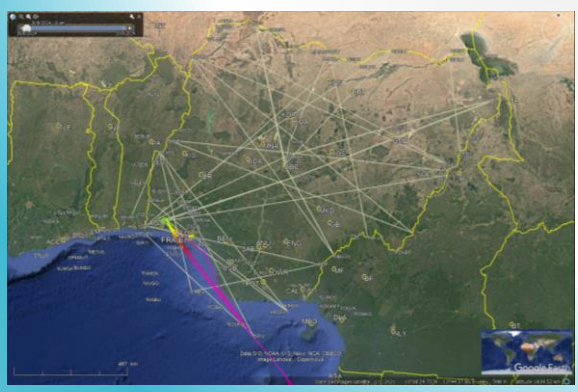
Example of local FRA Nigeria

- Granting tactical Direct for aircraft requesting Direct on the radio.
- These requests can be the subject of a study to transform them into plannable DCT or FRA route segments.



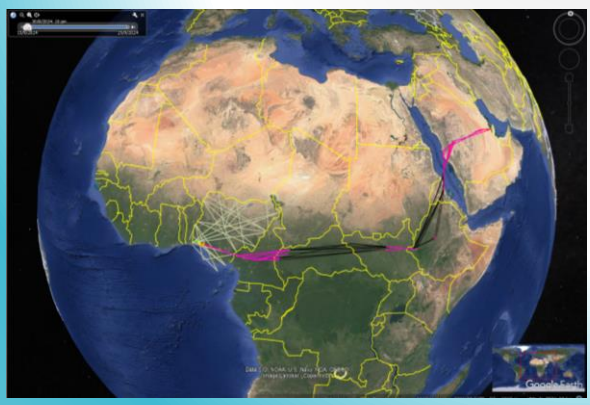
Example of local FRA Nigeria

Impact of South Sudan Contingency

Over SOUDAN AIRSPACE, The ongoing conflict with :

- ✓ airport closures,
- ✓ Route restrictions;
- ✓ altitude restrictions,
- ✓ flight prohibition,
- ✓ communication issues, withdrawing of navigation aids,

has affected the FRA in Nigerian airspace as noticed, some FRA routes recorded NIL flight operations.



ARRIVALS QTR 77X IMPACTED BY CONTINGENGY IN SUDAN AIRSPACE

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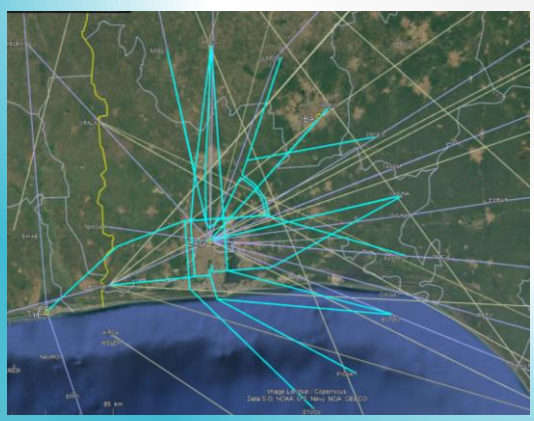
Example of local FRA Nigeria

Challenges between overflights and arrivals

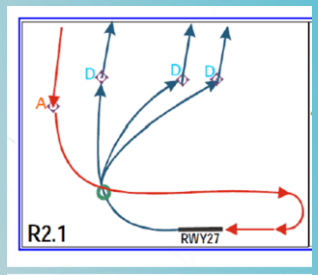
- ❑ Overflight routes generally converge on NAVAIDs, with the exception of a few PBN routes.
- ❑ Arrival FRA routes converge on SIDs, STARs, IAFs, TMAs, CTRs
- ❑ FRA Overflights not to be constrained by NAVAIDS locations.
- ❑ CCO/CDO implementation encouraged to reduce controller workload.

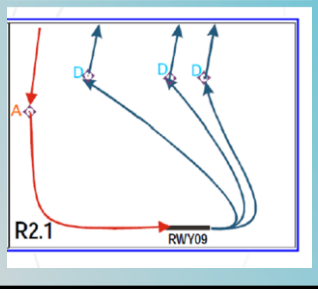


STARs commence at TMA, SIDs Terminate at TMA, THUS FACILITATING FRA VERTICAL CONNECTIVITY

Example of local FRA Nigeria

EXAMPLE ONLY





DATA FROM NAMA

NAMA

FREE ROUTE AIRSPACE IN NIGERIA

SIDS & STARS LAGOS

1. FRA: NANOS DCT BUDSI DCT LAG: UNI –DIRECTIONAL

S/N	OPERATOR	CALLSIGN	DEPT	DEST	EXIT
1.	EUROPEAN AIR TRANSPORT	BCS 081	EBBR	DNMM	NANOS
2.	LUFTHANSA	DLH 568	EDDF	DNMM	NANOS
3.	AIR ATLANTA ICELANDIC	ABD 2610	EBLG	DNMM	NANOS
4.	BURAQ AIR	BRQ 189	HLLM	DNMM	NANOS
5.	QAK NIG	MOEPL	EGLF	DNMM	NANOS

2. FRA: LAG DCT NANOS:UNI –DIRECTIONAL

S/N	OPERATOR	CALLSIGN	DEPT	DEST	EXIT
1.	EUROPEN AIR TRANSPORT	BCS 081	DNMM	EBBR	NANOS
2.	BURAQ AIR	BRQ 190	DNMM	HLLT	NANOS
3.	EZNIS AIRWAY	EZA 901	DNMM	LTAI	NANOS

3. FRA: LAG DCT GATAG: BI –DIRECTIONAL

S/N	OPERATOR	CALLSIGN	DEPT	DEST	EXIT
1.	ETHIOPIAN AIRLINE	ETH 901	HAAB	DNMM	GATAG

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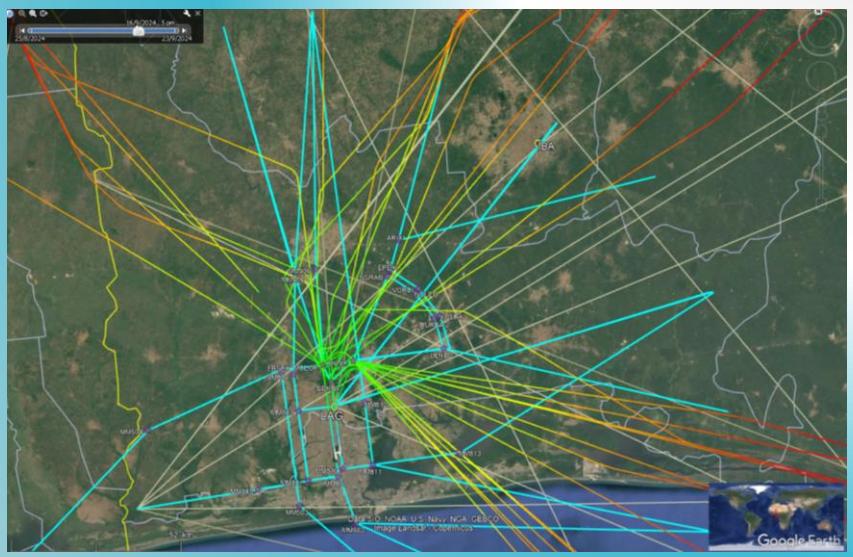
Example of local FRA Nigeria

AF132
KQ534
DT566
AT555
DL54

DCT TO IAF vs STARs

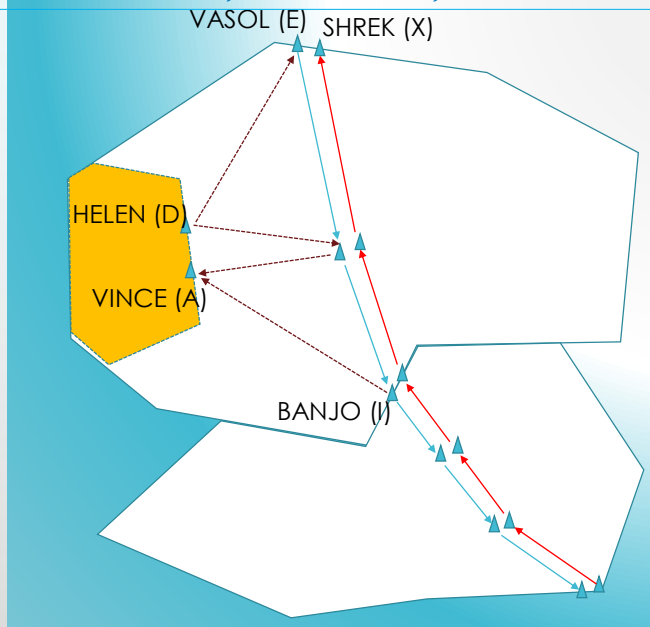


FRA CONNECTING ROUTES

General Issues

Proper access to/from terminal airspace rea may need to be considered.

This may require a definition of FRA Connecting Routes to facilitate flight planning and traffic distribution, providing the route from a specific FRA (A), FRA (D), FRA (AD) or FRA (I) points to a FRA (X), FRA (E) or FRA (EX) point or vice-versa.



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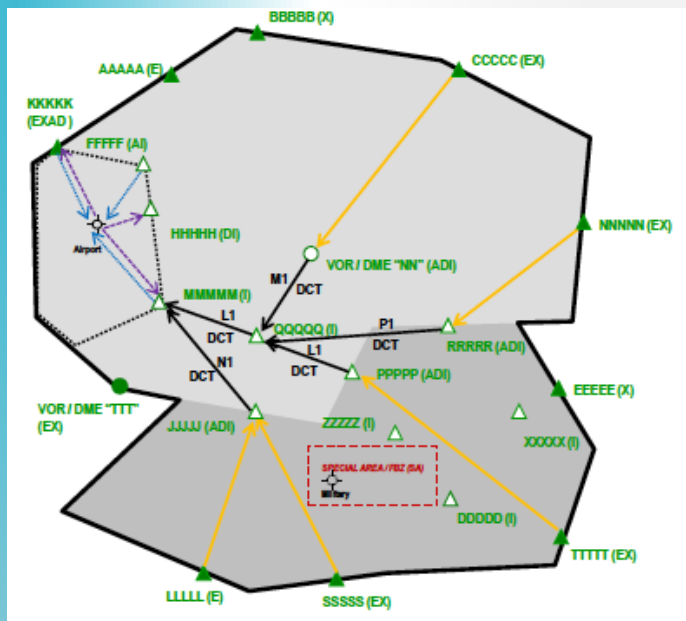
FRA CONNECTING ROUTES

- Routes leading to / from the TMA
- May resolve current problem of aircraft flying off published ATS routes from Top-of-Descent to TMA Entry Points!
- In some States, random area navigation operations are not permitted
  - For example: Present position direct



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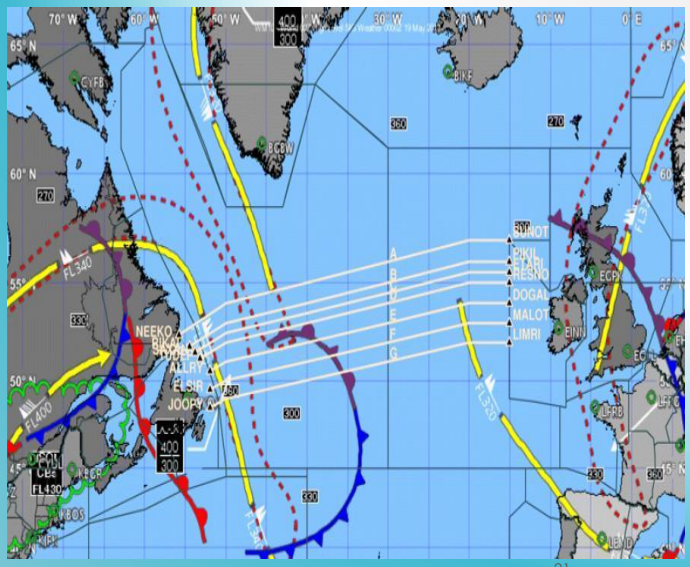
RANDOM ROUTES

Aircraft must conform with correct entry and exit points, on both sides of the Atlantic, to avoid operational delays and in order to uplink oceanic clearances

Between these entry points are a series of other intermediate points, plotted at every 10 degrees of longitude to form different random routes, every 12 hours.

Eastbound random routes take advantage of the Jetstream, westbound routes avoid the Jetstream



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Working tools : (Free or Paid)

- **ICAO GIS,** to identify city pairs and statistics
- **Jeppview,** integrator and distributor of AIS data
- **GoogleEarth Pro**, for studies
- **ArcMap:** for cartography
- **Flight radar 24 Gold:** for flight statistics and metadata
- **Skyvector,** for flight planning
- **Autocard,** for drawing
- And **many others.**

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Statistics and traffic flow 2010 -2030

Figure 1. Évolution des flux de trafic aérien de 2010 à 2030 (prévisions fondées sur l'OAG)

Source : ICAO

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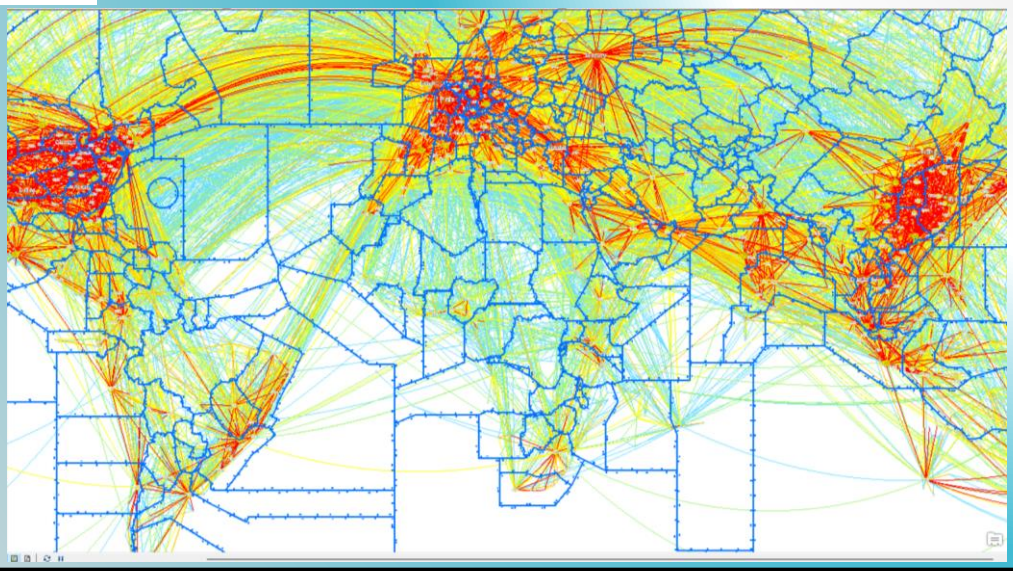
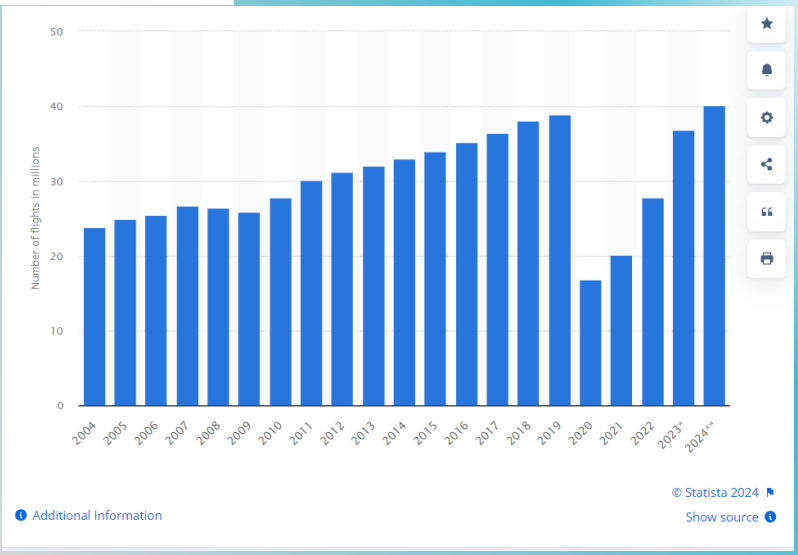
ICAO Statistics and traffic flow 2018



www.statista.com



Global airline flights saw consistent growth from the early 2000s, peaking at 38.9 million in 2019. However, the COVID-19 pandemic led to a dramatic decline, with flights dropping to 16.9 million in 2020. Since then, the numbers have rebounded, and it is projected that flights will reach 40.1 million by 2024.

https://www.statista.com/statistics/564769/airline-industry-number-of-flights/

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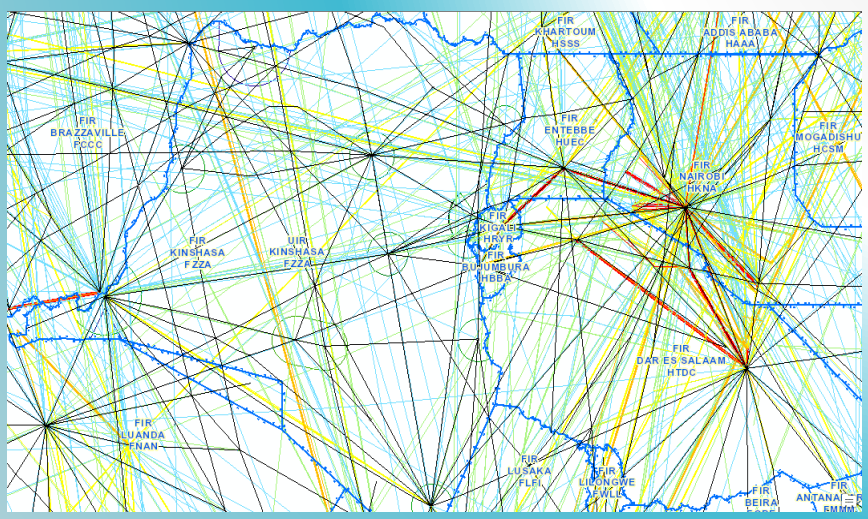
ICAO GIS city pairs data base



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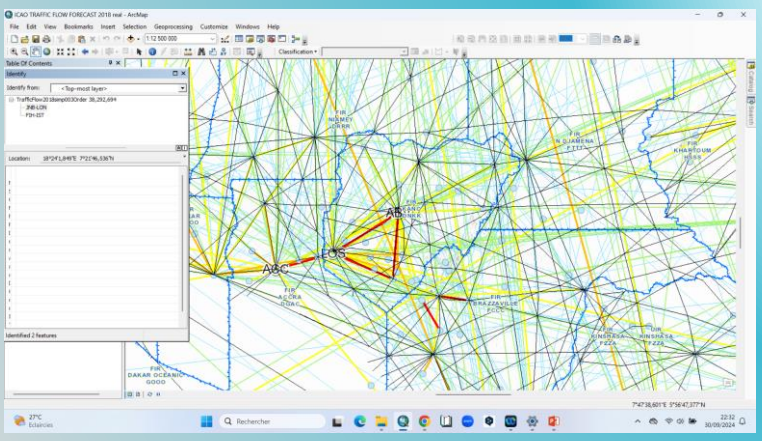
Global city pairs data base



Right clic, identify
Right clic on city pair, copy record

FID	2814
Shape	Polyline
City_pair	JNB-LON
FREQ2017	3591
FREQ2018	3291
FREQdiv2	1646
DepCity	JNB
dep_lat	-26.1392
dep_long	28.246
ArrCity	LON
arr_lat	51.505299
arr_long	0.055278
DistKMrout	9032.952658
City_name	Johannesburg
departures	107094
departur_1	106808
ISO3_CODE	ZAF
Terr_Name	South Africa

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FRA SIGNIFICANT POINTS

Final goal with UPR trials : to have EXIAD defined/published points

Code	Meaning	Utilization
"E"	**Entry point**	For entering the free route airspace
"X"	**Exit point**	For exiting the free route airspace
"I"	**Intermediate point**	For flight level/direction changes
"D"	**Aerodrome Departure Point**	at the end of SID or at departure aerodrome
"A"	**Aerodrome Arrival Point**	at the start of STAR or at arrival aerodrome

In a given FRA space, the flight path will be :

Flight	Path
Overflight:	**E => I*=> X**
From external FRA to a an aerodrome under FRA:	**E => I* => A**
From an aerodrome under FRA to the outside:	**D => I* =>X**
Flight linking two aerodromes under FRA :	**D => I* => A**

*as needed, one or more Ex FRA point : OPERO(EX), PISPA(I)

Possible Role combination
EX, AD, (EXAD to be discussed) ,…

FRA points founded on 5LNC and NAVAIDs coding

FRA is based on very simple procedures derived from the use of DCT

EXERCISE LOCAL/CROSS BORDER

- identify **routes or city pairs** by priority
- determine **FIR entry and exit points**
- **Examine constraints** (restricted/ prohibited/ dangerous areas, CNS/ATM equipments and resources, contingency, fixed ATS routes, hotspots) and propose mitigations (such as Intermediate points,…)
- **For new points**, use lat/long if necessary for trials if allowed, or other coding and create 5LNC once conclusive or necessary

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EXERCISE Local/Cross-Border

Cross-Border case study

- Coordinate with stakeholders and neighboring FIRs
- Prepare LOA/LOP
- Coordination meetings could solve the problem at one time or seperately.
- Set implementation date with neighbours
- Train users (ATCO, Flight Planners, Pilots).
- Monitor after implementation

EXERCISE : Planned efficiency

Calculating benefits in planning

- ❑ Calculating the distance of the fixed or basic route
- ❑ Calculating the distance to the FRA or UPR route
- ❑ Calculate the difference between the two routes (fixed and FRA/UPR)
- ❑ Convert the distance found into flight time
- ❑ Multiply by the average number of flights per year on each route considered.

Nigerian Airspace Management Agency
Corporate Headquarters

Internal Memo

Date:	**7th September, 2021**
To:	
From	
Subject:	**REQUEST FOR ADDITIONAL FLIGHT PLANNABLE DIRECT ROUTES**
Ref:	
No. of Pages:	**13**

The subject matter above refers.

Consequent upon an earlier request by IATA for Flight Plannable Direct Routes within the Kano FIR, and the subsequent approval and publication of the Flight Plannable Direct Routes, it has become imperative to develop additional Flight Plannable Direct Routes due to the benefits as follows;

a. Reduction in flight time

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EXERCISE : Planned efficiency

Calculation of Actual gain :

- ❑ Deduct total time saved, total fuel, carbon, etc. for FIR
- ❑ Compare the planned gains and the gain actually achieved in the UPRs, and make annual projections if necessary.

Examples

FROM LOCAL TO CROSS BORDER DRO/FRA

	ENTRY	EXIT	ROUTE	FIXED	DCT	SAVING	FLIGHTS	TOTAL DIST	Temps min	Fuel kg	CO2 kg
Local	OPERO	PIPLO	UA610	721,5	718,8	2,7	1098	2964,6	370,575	19835,0269	62678,6849
Cross border	GV	LAG	UA610	2067,2	2031	36,3	1098	39857,4	4982,175	266670,917	842680,097

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Questions?

Comments?

Thank you.