Acting now — The Implementation of Performance Based Navigation (PBN) in Nigeria

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Introduction

The Government of Nigeria has implemented various measures for the mitigation of CO_2 emissions in its efforts to contribute to the global targets set by ICAO. These measures and initiatives, which include improvement of airport operations and infrastructure, air navigation facilities and air traffic management system, and the acquisition of more fuel-efficient aircraft by Nigerian operators, etc. are all detailed in the State Action Plan.

One of the significant projects embarked upon to improve the air navigation facilities and air traffic management systems aimed at reducing flight times, terminal delays, fuel consumption, and distance flown within the Nigerian airspace, is the implementation of the Performance Based Navigation (PBN) by the Nigerian Airspace Management Agency (NAMA).

The PBN Project

In accordance with the AFI PBN Roadmap, the implementation of the PBN Project started with the conduct of World Geodetic System (WGS) 84 surveys of 24 airports in Nigeria. This included PBN approaches with Lateral Guidance (LNAV), as well as approaches with Vertical Guidance (BARO VNAV) for some specific airports. These were in addition to the Standard Instrument Departure Routes (SIDs) and the Standard Terminal Arrival Routes (STARSs) for five (5) airports. The primary purpose of the project is to provide the required capacity for the global migration from ground-based system of navigation, to satellite-based navigation as contained in the National Performance Based Navigation Implementation Plan.

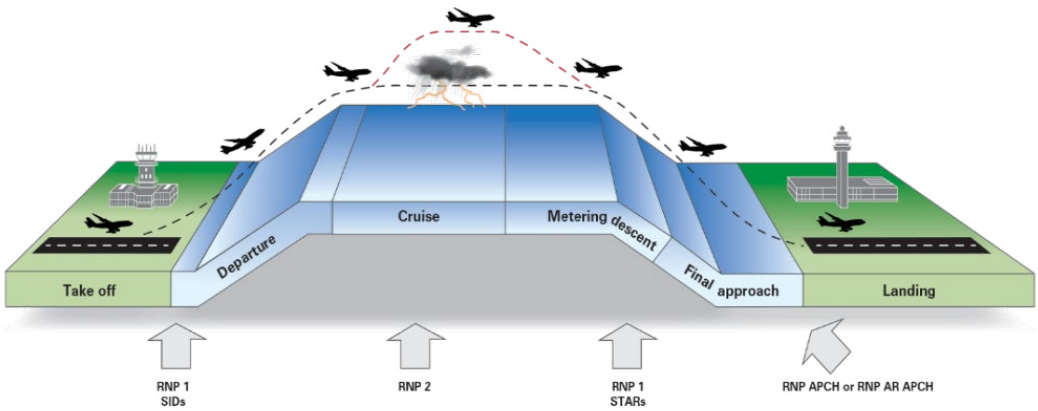

FIGURE 1: Application of PBN in the Nigerian Airspace

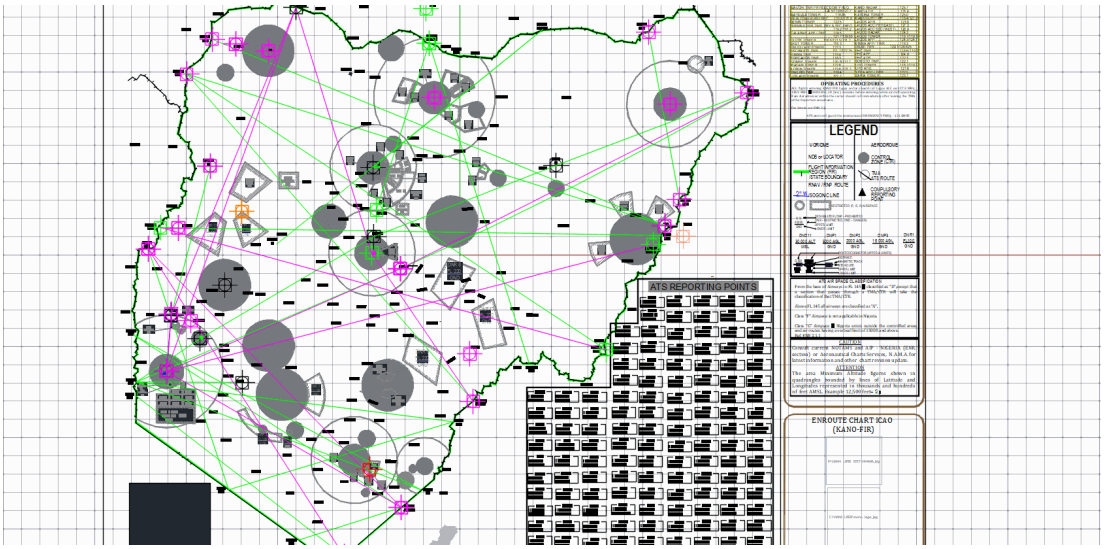

FIGURE 2: FRA implementation in Kano FIR – (Published and yet-to-be published direct route segments)

By April 2020, in collaboration with the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA), nine (9) PBN Area Navigation Regional Routes (RNAV10 Routes) have been implemented to enhance regional connectivity, reduce flight distance, flight time, fuel consumption, CO_2 emissions, cost of operations, pilot workload, and an increase the capacity of the airspace. These new routes, which connect cities in Nigeria to regional destinations, were in addition to other PBN Routes earlier established. The new routes include UQ300 connecting Lagos to the Central African Republic; UY604 linking Abuja and Port Harcourt to Southern Africa; UQ181 connecting East and Central Africa to Europe through Nigerian airspace; and UQ400 connecting Southern Africa to North Africa through Nigeria to Europe.

In addition to the new routes, the Free Route Airspace (FRA) concept was implemented in 2021 in the Kano Flight Information Region. The FRA concept is associated with the ICAO Aviation System Block Upgrade (ASBU) modules B1-FRTO on free routing in defined airspace, where the flight plan is not defined as segments of a published route network or a track system to facilitate adherence to the user preferred profile. The benefits of the FRA concepts include fuel savings per route leg as much as 289.21kg per user, multiplied by the number of users per day. This could translate to estimated CO_2 savings per route leg of 942.35kg per user, multiplied by number of users per day.

Impact of the PBN Project

The implementation of PBN has:

- led to the reduction of flight delays and diversions attributable to holding for weather improvements and outright air returns. The PBN implementation has complemented the Total Radar Coverage of the Nigerian Airspace and has resulted in the review of the mandatory Minimum State Weather Conditions;
- brought about further reduction of flight delays attributable to use of conventional navigational facilities, which has inherent limitations of accuracy, reliability, integrity and availability. This has led to increase in flight efficiency and reduction in fuel burn and CO_2 emissions as stated in Table 1;
- enhanced flight safety through continuous decent procedures that reduce the risk of controlled flight into terrain and loss of control;
- allowed for more efficient use of the airspace and reduced the need to maintain senor-specific routes and procedures, with their associated cost; and
- resulted in the need to avoid the development of senor-specific operations with each new evolution of navigation systems, which could be cost-prohibitive.

TABLE 1: New PBN RNARV10 Routes with Savings in Distance, Fuel and Emissions

S/No	Route Designator	Type of Route	Routing	FIRs Involved	Distance Savings (nm)	Fuel Savings (kgs)	CO_2 Savings (kgs)
1	UQ300	New Route RNAV10 IATA Request	KOKAM – NLY – ILBAS – EDGOT	Brazzaville, Kano	29	179	566
2	UY604	RNAV10 New, Nigerian Request	POT-BIPIV	Kano, Brazzaville	30	193	610
3	UQ181	New Route RNAV10 IATA Request	BIPIV - TENTU	Brazzaville, Kano, Accra	44	550	1750
4	UQ400	New Route RNAV10 IATA	BIPIV – NANOS	Brazzaville, Kano, Niamey	30	179	566
5	UQ324	New Route RNAV10 IATA Request	NY-GULEN-KELAK	Niamey, Kano, Ndjamena, Khartoum	50	618	1953
6	UY333	RNAV10 New, Nigerian request	KIGRA-OPDOL-UBEVA	Kano, Niamey, Algiers Tunis	44	550	1730
7	UY87	New Route RNAV10	TYE-KIDKI	Kano, Accra, Abidjan	15	91	287
8	UY57	New Route RNAV10 ACCRA Request	LIREX-SESIG	Kano, Accra, Abidjan	7	39	123
9	UQ200	New Route RNAV10 IATA Request	ADDIS – LAGOS (GWZ - GADUV	Addis, Khartoum, Ndjamena, Brazzaville, Kano	95	950	3002
10	UY87	New Route RNAV10	TYE-KIDKI	Kano, Accra, Abidjan	15	91	287

The Future Work on the PBN Project

With the resultant effects of implementing the PBN project, NAMA intends to consolidate the positive gains by taking more pragmatic actions on the project in the next three years including:

- reviewing the PBN roadmap and the WGS 84 survey of all airports;
- developing a national Satellite Based Augmentation System (SBAS) and Ground Based Augmentation System (GBAS) plan, and conduct a cost benefit analysis for their implementation, amongst others; and
- intensifying the training and retraining of all relevant personnel on the project.