

NATIONAL PBN IMPLEMENTATION PLAN

2012 - 2016

Republic of Armenia

Content

1. General provisions

page
3

1.1	Compliance and requirements	3
1.2	Advantages and possibilities	3
2.	The description of air traffic in the airspace of the Republic of Armenia	3
2.1	Air traffic intensity specifications within 2008-2011	3
2.2	Analysis of the number of flights	4
3.	Brief description of the navigation field of the Republic of Armenia	4
3.1	Navigation field in the upper airspace	4
3.2	Aerodrome navigation field	4
4.	The use of navigation systems for the PBN implementation	4
4.1	VOR/DME use	4
4.2	DME/DME use	5
4.3	GNSS use	5
5.	Selection of PBN specifications in Armenia	5
5.1	Principles of PBN specifications selection	5
5.2	Implemented PBN specifications in the airspace of the Republic of Armenia	5
6.	Main events/activities of PBN implementation	5
6.1	PBN implementation strategy	5
6.2	Main activity of PBN implementation	6
7.	The current situation and introduction plan of PBN	6
7.1	The current PBN situation in the Republic of Armenia	6
7.2	RNAV5 modernization demand in the airspace of the Republic of Armenia	6
7.3	The modernization of RNAV1 STAR and SID routes in "Yerevan" TMA	6
7.4	The implementation of RNAV1 arrival and departure routes in "Gyumri" TMA	7
7.5	Implementation of RNP APCH in "Shirak" airport	7
7.6	PBN in "Erebuni" airport	7
7.7	PBN introduction plan in the Republic of Armenia till the year of 2016	7

1. General provisions

- 1.1 PBN implementation plan, based on the specifications of the airspace of the Republic of Armenia, has been developed in accordance with Resolution A36-23,

approved by the 36th ICAO Assembly Session in September of 2007. The plan has been developed based on the PBN Manual specifications (Doc. 9613 ICAO), so that the PBN benefits could be applied by aircraft operators and air navigation service providers with minimum costs, as well as the integration of the navigation system of the Republic of Armenia into the European regional and world air navigation systems could be implemented.

- 1.2 The advantages of the civil aviation flights, carried out on the basis of PBN specifications of the airspace of the Republic of Armenia, are numerous and allow to:
- increase the effectiveness by reducing the flight route and approach path length;
 - increase productivity by reducing the spatial separation tracks;
 - increase the level of safety by increasing the accuracy of navigation;
 - improve the arrival charts at the airports in all weather conditions and meet the obstacle clearance safe height requirements through aircraft flight optimized routes;
 - reduce delays in the airspace and airports by introducing additional parallel routes in key areas and additional points of departure and arrival;
 - reduce workload of ATC and flight personnel as during the regional navigation the aircraft operates the flight according to the planned track without the controller's intervention;
 - eliminate the need for developing a new arrival, departure, approach procedures when new navigation systems are installed, which is associated with substantial costs;
 - reduce noise in the populated areas.

The plan also focuses on the navigation method, which includes air traffic forecasts, aircraft saturation with equipment/performance, respective ground infrastructure, communication, navigation, surveillance, and other issues.

2. The description of air traffic in the airspace of the Republic of Armenia

2.1 Air traffic intensity specifications of the airspace of the Republic of Armenia within 2008-2011 period are presented in the table below.

Year	Departure/landing	Over flights	Total
2008	8791	32282	41073
2009	8885	29622	38507
2010	10056	32504	42560
2011	10164	36264	46428

2.2 The table shows that the intensity of air traffic in the airspace of the Republic of Armenia significantly increased in 2010 and 2011. It should be noted that in 2012 the number of flights decreased, which was caused by the global economic crisis. However, it is expected that in the 2013-2016 period, the annual increase will be

about 4-4.5%. That growth will require infrastructure modernization in the air traffic management system (ATM system), ATM procedures improvements based on the PBN.

3. Brief description of the navigation field of the Republic of Armenia

3.1 Navigation field in the upper airspace of the Republic of Armenia for the en-route flights consists of VOR/DME-s, which are located in Yerevan "Zvartnots" and Gyumri "Shirak" airport areas. But the field does not completely cover the entire airspace of the Republic of Armenia, especially east and south-east regions. In this respect in the frame of the "South Gate" project with the help of "Swedavia" company in the spring of 2007, in 3 South Caucasus countries: Armenia, Georgia and Azerbaijan, B-RNAV regional navigation based on VOR/DME-s was introduced in the upper airspace, which allowed all 3 countries to cover the navigation field throughout the region avoiding all unnecessary expenses. At present for the en-route flights in the airspace of the Republic of Armenia DME/DME and global navigation satellite systems (GNSS) are also used to provide RNAV5 (B-RNAV) navigation.

3.2 Aerodrome navigation field is characterized by the availability of GNSS, VOR/DME-s and NDB-s, which gives the aircraft possibility to carry out non-precision approach procedures. For the implementation of precision approach procedures the airports are equipped with ILS systems.

4. The use of navigation systems for the PBN implementation

4.1 VOR/DME use

Aircraft flight management system (FMS), finding out the location of VOR/DME and their exact coordinates, calculates the plane coordinates in WGS-84 coordinate system, and then calculates the deviation from the intended flight track. The limitation of VOR/DME usage infrastructure is the low accuracy of radial angle measurement, not less than $\pm 3^\circ$, the average operational accuracy of VOR/DME-s is $\pm 5^\circ$. Taking into consideration the navigation system errors (NSE) and the flight technical errors (FTE), VOR/DME-s can meet only RNAV5 navigation specification requirements not further than 110-120 km from their location place.

4.2 DME/DME use

Using two DME-s, navigation accuracy is about 1 km, which allows using the navigation infrastructure to meet RNAV1 navigation specification requirements. However, taking into account the significant complications connected with the

DME-s right installation, which will not be able to provide the necessary accuracy in all directions and the purchase of additional DME equipment will be required. At present DME/DME infrastructure is not applied in the RNAV1 procedures in the aerodrome zone.

4.3 GNSS use

GNSS covers the current satellite GPS and GLONASS system groups and is added to the systems. In the RA airspace GPS and GLONASS are used jointly in the domain of civil aviation. When they are used jointly, alongside the high accuracy of the position, increase of integrity, availability and continuity services is acquired.

5. Selection of PBN specifications in Armenia

5.1 The selection of PBN specifications is a key element, which is typical for the requirements of the airspace and ATM technical means. The main selection sources of PBN specifications are the aircraft saturation with equipment/performance and their development forecasts, navigational infrastructure and the regulatory framework.

5.2 Subject to the conditions specified in paragraph 5.1 in the airspace of the Republic of Armenia as the first stage the following PBN specifications have been used.

- RNAV5 - introduced in "Yerevan" FIR for all en-route flights based on GNSS, VOR/DME, DME/DME, IRS sensors. All the routes of "Yerevan" FIR have RNAV names according to ICAO Annex 11.
- RNAV1 - introduced in "Yerevan" TMA for all departure and arrival routes based on GNSS sensors. All the departure and arrival routes have SID-s and STAR-s names according to ICAO Annex 11.
- RNP APCH – introduced in the TMA over RWY 09 and 27 in "Zvartnots" airport for all aircraft equipped with GNSS sensors. According to ICAO PANS-OPS Document 8168 these landing procedures have RNAV (GNSS) names.
- APV BaroVNAV – introduced in the TMA over RWY 09 in "Zvartnots" airport for all the aircraft equipped with VNAV equipment.

6. Main events/activities of PBN implementation

6.1 PBN-implementation strategy for the Republic of Armenia foresees:

- Safety evaluation during PBN introduction and safety monitoring after introduction,
- Transitional period during which the service is provided to RNAV/RNP-equipped and non-equipped aircraft.

6.2 Main activity of PBN implementation includes:

- Analysis of aircraft saturation with RNAV/RNP equipment,

- Establishment of requirements for the aircraft saturation with RNAV/RNP equipment in accordance with EASA AMC requirements and development of permission granting order for the aircraft,
- Training of flight personnel,
- Training of controlling personnel,
- Analysis of communication, navigation, and surveillance means and their updating if necessary,
- If necessary development of working technologies, procedures and phraseology amendments and supplements.

Special attention will be paid to the work in a mixed navigation environment. The work in the mixed navigation environment may affect the controller’s workload, especially in high-density traffic conditions. The work in the mixed navigation environment also depends on the complexity of ATS route network, separation of SID-s and STAR-s and, of course, ATC automated system features.

7. The current situation and introduction plan of PBN

7.1 The current situation in the Republic of Armenia connected with the PBN is shown in the table below.

13 December 2012	“Yerevan” FIR	ATS routes	RNAV5 on all sensors
13 December 2012	“Yerevan” TMA	SIDs, STARs	RNAV1 on GNSS
13 December 2012	“Zvartnots” a/p	RWY09, RWY27	RNPAPCH(RNAV(GNSS))
13 December 2012	“Zvartnots” a/p	RWY09	BaroVNAV

7.2 As far as all ATS routes of "Yerevan" FIR are RNAV5 routes, there is no need for their modernization within the coming 5 years. At present almost in all ECAC countries RNAV5 navigation specifications are applied for the en-route flights. Some Western European countries are exceptions, where due to the high intensity of traffic in certain parts of the airspace, RNAV1 or RNAV2 navigation specifications are used. In the RA airspace a need for modernization of RNAV5 navigation specifications will arise if similar need will be created in the airspace of our neighboring countries. At that time agreeing with the neighboring countries and acting together, RNAV5 navigation specifications will be updated in all the region.

7.3 As far as all STAR and SID routes of "Yerevan" TMA are RNAV1 routes, there is no need for their modernization within the coming 5 years as well. It should be noted that because of the difficult terrain, RWY 27 RNP APCH (RNAV (GNSS)) procedure is with a bit longer track and there is a strong need to study the introduction of RNP AR APCH procedure, which will significantly reduce the flight track. But it all depends on the aircraft equipment.

7.4 The implementation of RNAV1 arrival or departure routes in "Gyumri" TMA isn't needed for the time being, as at present in "Gyumri" airport only airplanes of Russian Federation, which are not yet using RNAV procedures, carry out flights.

7.5 In "Shirak" airport RNP APCH procedures within the next 2-3 years are not needed to be implemented due to the above-mentioned reasons. However, it is planned to conduct studies on the application opportunities of such and/or RNP AR APCH procedures.

7.6 In "Erebuni" airport aircraft equipment will also be studied and, if necessary, there may arise a need for the introduction of PBN procedures. But as a military airport of common use and basing, "Erebuni" airport is not included in the plan of the civil aviation.

7.7 In the domain of civil aviation of the Republic of Armenia PBN introduction plan till the year of 2016 is presented in the table below.

Year	“Yerevan” FIR, ATS routes	“Yerevan” TMA, SIDs/STARs	“Gyumri” TMA, SIDs/STARs	“Zvartnots” a/p	“Shirak” a/p
2012	RNAV5 Is introduced	RNAV1 Is introduced		RNP APCH 09/27 Is introduced BaroVNAV 09 Is introduced	
2013	-	RNAV1 monitoring	RNAV1 Introduction study	RNP APCH 09/27 BaroVNAV 09 monitoring BaroVNAV 27 Introduction study	RNP APCH 02/20 and BaroVNAV 02/20 Introduction study
2014	-	RNAV1 Monitoring and modernization study	RNAV1 Introduction study	RNP AR APCH 27 Introduction study	RNP APCH 02/20, BaroVNAV 02/20 or RNP AR APCH 02/20 Introduction study
2015	-	Modernization study	RNAV1 or RNP1 Introduction planning	Modernisation planning	Modernisation planning
2016	-	If necessary RNP1 SIDs/STARs introduction	If necessary RNAV1 or RNP1 SIDs/STARs introduction	If necessary RNP AR APCH 27 and BaroVNAV 27 introduction	If necessary RNP APCH 02/20, BaroVNAV 02/20 and/ or RNP AR APCH 02/20 introduction