Approved by the Performance Based Navigation (PBN) Task Force of the Russian Federation established by the Order of the RF Ministry of Transport No. VO-44-r (BO-44-p) dated 06/06/2013 (Minutes No. 3-62-pr (3-62-пр) dated 15/11/2013)

Performance Based Navigation (PBN) Implementation Plan for the Airspace of the Russian Federation (version 2.0)

Moscow, 2014

General

The Performance Based Navigation (PBN) Implementation Plan for the airspace of the Russian Federation (hereinafter referred to as "Plan") has been developed in accordance with the A36-23 Resolution approved by the 36th Session of ICAO Assembly in September 2007 and the A37-11 Resolution approved by the 37th Session if ICAO Assembly in October 2010.

This Plan has been developed based on the PBN Manual (ICAO Doc 9613) to provide PBN benefits at minimum costs for the aircraft (hereinafter referred to as "A/C") operators and air navigation service providers, as well as to integrate the Air Navigation System of Russia into the regional European and global air navigation systems.

During the development of the Plan the results of the analysis of annual growth in air traffic, infrastructure of the navigation aids, communication and surveillance means, operational capabilities of the aircraft fleet, as well as other issues recommended by ICAO for consideration within the framework of the PBN implementation process have been considered. Implementation of PBN in the airspace of the Russian Federation provides the following:

- Increase of flight operations efficiency due to reduction of route and approach path length.
- Increase of capacity due to the reduction of flight paths spatial spacing.
- Flight safety level enhancement due to the improved air navigation accuracy.
- Improvement of arrival paths at airports under all meteorological conditions, as well as the capability to meet and maintain the requirements for the obstacle clearance limit through using the optimized A/C flight paths.
- Reduction of delays in the airspace and at the airports with high-density air traffic through the introduction of additional parallel routes and additional arrival and departure fixes in the terminal areas.
- Decrease of controller and flight crew workload.
- Elimination of the necessity to develop flight procedures and maneuvering procedures due to the introduction of new navigation systems.
- Simplification of the operational approval process for users through providing a limited set of navigation specifications intended for global use.
- Reduction of noise level over the populated areas.

The Plan includes the following Appendices:

Appendix No.1. List of activities on PBN implementation in the airspace of the Russian Federation.

Appendix No.2. Implementation stages of the routes based on navigation specifications, in the airspace of the Russian Federation.

Appendix No.3. Implementation plan for RNP APCH (LNAV, LNAV/VNAV, LPV), RNP AR APCH at the airdromes of the Russian Federation.

1. Air Traffic Density Analysis of the Russian Federation airspace

Air Traffic Density Analysis of the Russian Federation airspace for 2008-2013 is given in Table 1 below.

In 2009, the air traffic load in Russian airspace was reduced due to the effects of the global economic crisis. In 2010-2011, the air traffic load exceeded the 2008 level and by some estimates will grow by about 6% per year over the next 5-7 years. This growth will require the Air Traffic Management (ATM) infrastructure modernization and ATM procedures improvement including those based on PBN.

Table 1.

Year	Flights, Total	International	Domestic
2008	1094754	655398	439356
2009	987969	605387	382582
2010	1109663	676879	432784
2011	1248106	767971	480135
2012	1318475	822134	496341
2013	1418749	871662	547087

2. Brief description of the Russian Federation navigation coverage

At present the basis of the Russian Federation navigation coverage for ATS route flights is formed by non-directional radio beacons (NDB). Beside this, navigation is also performed with the help of VOR and DME, as a rule, co-located in the terminal area. However, VOR/DME do not provide full coverage of the Russian Federation airspace, particularly in sparsely populated and remote areas of the northern Russia. In these areas the dead-reckoning method is used, and in case of the availability of the appropriate on-board equipment the global navigation satellite system (GNSS) is used.

Navigation coverage in terminal areas is characterized by the availability of VOR/DME in a number of international airports, in federal airports and in airports with high air traffic load. Additionally, practically all Russian Federation airports are equipped with NDB, located on the continuation of the runway centre line, which allows for non-precision approach. To perform precision approaches practically all international airports, federal airports and a number of major airports are equipped with ILS.

3. Use of navigation systems for PBN realization

3.1. Use of VOR/DME short-range navigation system

VOR/DME is an angle-distance-measuring system which permits to determine the distance and direction from a radio beacon site on board of an A/C. Knowing VOR/DME coordinates airborne Flight Management System permits to determine A/C coordinates in a given reference frame and then to calculate the deviation from the assigned flight path.

Limitations on VOR/DME navigation infrastructure use are due to the low accuracy of angle measuring equipment of more than ±3°, the average operational accuracy of VOR/DME is ±5°. With the account of Navigation System Errors (NSE) and Flight Technical Error (FTE),

VOR/DME allows to meet the RNAV-5 requirements at distances of not more than 110-115 km from the point of its installation.

3.2. Use of DME/DME short-range navigation system

Accuracy when using two DME is about 0.5 NM, which allows using a navigation infrastructure type DME/DME for RNAV-1.

Presently, DME/DME has not been used for RNAV procedures in the Russian Federation yet. In the near future it is planned to install a necessary number of DME to use the DME/DME method at the Moscow area airports (Unified ATM System) and at a number of other major international airports.

3.3. GNSS use

GNSS includes the currently operating GPS and GLONASS space constellations, as well as augmentation systems. The Russian Federation has its own GLONASS constellation. In 1996 the Russian Federation proposed a GLONASS Standard Accuracy Channel (CSA) to support the needs of the international civil aviation and ICAO Council accepted this proposal. Aviation users can use the GLONASS system free of charge. All GLONASS satellites belong to the second generation. These are GLONASS-M satellites the active service life of which is up to 7 years and which have improved performance characteristics compared to the first generation satellites.

Within the civil aviation of the Russian Federation the concept of the combined use of the GPS and GLONASS existing space constellations is adopted. Thus, along with the high positioning accuracy the enhancement of integrity, availability and continuity of service has been also achieved.

In addition, in the Russian Federation a System of Differential Correction and Monitoring (SDCM), representing an SBAS-type augmentation system is also under development.

4. Choice of PBN specifications for realization in the Russian Federation

Choice of PBN specifications is a key element to determine the requirements for airspace and ATM means.

It is expected to consider the following PBN specifications for the further regulatory approval in the Russian Federation:

RNAV10 (RNP10), RNP4 – for A/C operations on RNAV routes over the open waters, where the Russian Federation is responsible for ATM, as well as on routes located in remote continental areas with navigation using a standalone airborne navigation system and GNSS.

RNAV5, RNAV2, RNAV1, RNP2, Advanced RNP, RNP0.3 – for A/C operations on RNAV routes in continental regions based on navigation using a standalone airborne navigation system, VOR/DME, DME/DME, DME/DME/IRU, INS or IRS, and GNSS.

RNAV2, RNAV1, RPN1, RPN APCH, Advanced RPN, RPN0.3 – for A/C arrival operations, initial and intermediate approach in terminal area based on navigation using DME/DME, DME/DME/IRU, and GNSS.

RPN APCH, RPN AR APCH, Advanced RPN – for final approach based on navigation using GNSS.

5. Major activities regarding PBN implementation

The strategy of PBN implementation in the Russian Federation provides:

- Safety evaluation of the realized actions to implement PBN and safety monitoring after its implementation (in a number of complex cases).
- Transition period, during which both PBN-equipped and PBN-nonequipped aircraft are to be served.

Major activities to implement PBN in the Russian Federation include:

- administrative measures;
- measures for determination of acceptable navigation specifications in the Russian Federation airspace;
- navigation infrastructure and ATM technological means improvement;
- development and introduction of the changes into the normative and legal documents and other required documentation;
- airspace structure improvement to meet navigation specification requirements;
- personnel training and minimization of the human factor influence.

6. Determination of acceptable navigation specifications in the Russian Federation airspace

The Plan, Appendix No.1, Chapter 2 stipulates the measures of determination of acceptable navigation specifications in the Russian Federation with consideration of the spatial separation:

- A/C fleet capability assessment.
- Existing navigation means infrastructure assessment.
- Existing communication system and ATM assessment.
- Initial data compliance to the necessary resolution ability, accuracy and integrity assessment to develop the airspace structure and maneuvering charts.

For determination of the requirements to the chosen airspace the following activities are considered:

- Collection and analysis of data related to the existing air traffic and its composition, as well as to potential air traffic growth within and immediately beyond the chosen airspace.
- Collection of data related to the existing infrastructure of surveillance, communication and navigation within the chosen airspace.

- Determination of minimum navigation functions necessary to support the operational requirements, and its benchmarking against the equipment of the A/C operating in this airspace.
- Determination of required the ATC routes separation prior to the airspace structure deployment, development of a route or a chart based on the airspace concept general requirements related to the flight safety, capacity and efficiency.

The choice of acceptable navigation specifications for the airspace takes into account needs of the airspace users (IFR operations, VFR operations, as well as civil, government and experimental operations). Together with the choice of acceptable navigation specifications the assumptions related to the air traffic and to the estimated A/C fleet capacity are to be determined which are used during the further development and implementation stages of the airspace concept, which will ensure the compliance with flight safety criteria.

7. Navigation infrastructure upgrade and ATM technologies improvement

Navigation infrastructure upgrade implies the navigation means structural optimization and implementation.

PBN implementation can require ATM technological means improvement to provide the ATC controllers with the necessary information concerning the aircraft capabilities.

Such improvement can include:

- Modification of planning subsystem (FDP) of the automated air traffic control system.
- Modification of radar data processing (RDP) subsystem of the automated air traffic control system.
- modification of the air situation display.
- Modification of processed planning information transfer to ATM units air traffic control system;
- Auxiliary ATM means modification.

Particular attention will be paid to mixed traffic operations. Potentially mixed navigation environment may negatively affect the ATC controller workload, especially in case of high-density traffic en-route or in terminal area. The acceptability of mixed navigation environments also depends on the ATS routes or SID and STAR routes structure complexity, as well as on the availability and functionality of auxiliary means used within the ATM system. In particular, ATS system has to identify the PBN-equipped and PBN-nonequipped A/C to provide every A/C with the required servicing. Thereafter, it can be necessary to review ATS procedures and to improve ATM technological means to obtain the quality planning information.

8. Developing and introducing changes into normative and legal documents concerning PBN implementation in the Russian Federation, including issues of Global Navigation Satellite System implementation for PNB operations

8.1. Existing normative base

Normative and legal documents development concerning RNAV methods prospective implementation into the civil aviation had been started by the Russian Civil Aviation Authorities well before the ICAO Doc 9613 was published. Considering that GNSS usage is one of the essential components of RNAV procedures implementation this sub-chapter discusses the normative and legal base development for PNB (RNAV) as well as for GNSS operation in Russian airspace.

Today in the Russian Federation the following documents are published:

Federal Aviation Service of Russia Letter No.3.10-41 dated 10/10/1997 "Concerning the Enactment of Procedure of A/C operational approval for BRNAV operations in European region"

Federal Aviation Service of Russia Order No.61 dated 04/03/1998 "Concerning the Enactment of on-board GPS receivers to Civil Aviation in the Russian Federation"

CAA Direction No.NA-36-r (HA-36-p) dated 25/01/2002 "Concerning the Enactment of Technical Requirements for provision and conducting of RNAV non-precision approach procedures using a satellite navigation system"

RF Ministry of Transport Direction No.NA-67-r (HA-67-p) dated 26/02/2001 "Concerning the meeting of requirements for the geodesic survey of civil aerodromes and airways aeronautical ground marks"

RF Ministry of Transport Direction No.NA-165-r (HA-165-p) dated 20/05/2002 "Concerning the meeting of requirements for the geodesic survey of the Russian Federation civil aerodromes and airways aeronautical ground marks"

RF Ministry of Transport Direction No.NA-21-r (HA-21-p) dated 04/02/2003 "Concerning the Enactment of Recommendation for preparation of Russian Federation civil A/C and operators for P-RNAV operations in European region in accordance with RNP1 requirements"

KT 34-01 (fourth revision introduced on 01/04/2011) "Satellite navigation airborne equipment"

KT-229 (first revision introduced on 01/04/2011) "GNSS/SBAS airborne equipment"

Federal Aviation Rules "Certification of UATMS facilities" incorporated by Rosaeronavigatsiya Order No.116 dated 26/11/2007

RF Ministry of Transport Order No.242 dated 09/11/2010 "Concerning the approval of types of the required navigation performances for RNAV routes"

RF Ministry of Transport Direction No.IL-37-r (ИЛ-37-р) dated 24/05/2010 "Concerning the publishing of aeronautical information about Russian Federation civil aerodromes, joint civil and military aerodromes and airways aeronautical data"

Rosaviatsiya Order No.269 dated 15/07/2010 "Concerning the publishing of aeronautical information about Russian Federation civil aerodromes, joint civil and military aerodromes and airways aeronautical data"

RF Ministry of Transport Direction No.IL-70-r (ИЛ-70-р) dated 04/07/2011 "Concerning the Enactment of Recommendation of the geodesic survey of aeronautical ground marks and obstacles in earth referenced coordinate system at heliports and landing fields in the Russian Federation"

RF Ministry of Transport Direction No.IL-1-r (ИЛ-1-р) dated 10/01/2012 "Concerning the Enactment of Recommendation of the geodesic survey of aeronautical ground marks and obstacles in earth referenced coordinate system at Russian Federation airports where non-precision approaches are supported"

RF Ministry of Transport Direction No.MS-34-r (МС-34-р) dated 17/04/2013 "Concerning the administration of design (development) of A/C maneuvering charts at Russian Federation Civil airports and of quality assurance"

Federal Aviation Rules "In-flight checks of radio-technical ground aids to support flight operations, aeronautical telecommunications and lighting navigational aids of civil airports" incorporated by RF Ministry of Transport Order No.1 dated 18/01/2005

Federal Aviation Rules "Radiocommunication procedures" incorporated by RF Ministry of Transport Order No.362 dated 26/09/2012

RF Ministry of Transport Order No.35 dated 13/02/2012 "Concerning civil A/C equipage by GLONASS or GLONASS/GPS equipment"

Federal Aviation Rules "Air Traffic Management in Russian Federation" incorporated by RF Ministry of Transport Order No.293 dated 25/11/2011

8.2. Developing and introducing changes into normative and legal documents

The following measures are to be taken in course of developing and introducing changes (amendments) to normative and legal documents:

Development of RF Ministry of Transport Draft Order considering the implementation in the Russian Federation of navigation specifications described in Chapter 4 of this Plan.

Development of RF Ministry of Transport Draft Formal Notes stipulating introduction of the following ICAO documents for usage in the Russian Federation: Doc 9613 "Performance Based Navigation (PNB) Manual", Doc 9992 "Manual on the Use of Performance-Based Navigation (PBN) in Airspace Design", Doc 9993 "Continuous Climb Operations (CCO) Manual", Doc 9997 "Performance-Based Navigation (PBN) Operational Approval Manual".

Development of documents stipulating the procedures of airspace structure and maneuvering charts approbation, and of RNP AR APCH charts approval policy.

Development of the flight safety level assessment methodology based on ICAO navigation specifications requirements.

Development of changes (amendments) to the Russian Federation FAR "Flight operations of civil aircraft in the Russian Federation", FAR "Radio and technical support to flight operations and aeronautical telecommunication" (GNSS must be attributed to aeronautical means supporting airspace users in the Russian Federation).

Development of Draft FAR "Reporting on aeronautical data in order to provide support for aircraft operation in the Russian Federation", where AIP publications issues related to GNSS usage must be addressed.

Development of changes (amendments) to ATS controllers work methods and FOMs of aircraft operators.

9. Airspace structure upgrade in accordance with the navigation specifications requirements

9.1. Airspace structure development

The stage of airspace structure development in accordance with navigation specifications includes:

- Analysis of the airspace structure with the purpose of selected parameters verification for further realization.
- Analysis of the A/C fleet using the chosen airspace in order to identify their level of compliance with the navigation performance.
- Analysis of the ground navigation aids infrastructure in order to assess whether the navigation aids coverage is sufficient to provide support of the planned structure.
- Analysis of the proposed ATS routes and holding procedures in order to identify whether it is possible to practically use them with consideration of navigation performances, available navigation aids coverage, ATS route segregation criteria, and limitations due to the obstacles, prohibited areas and areas with the flight limitations.

During the development of the airspace structure it is necessary to take into account the A/C fleet capabilities.

It is economically unreasonable to require retrofitting of a significant part of the A/C fleet with RNAV systems and sensors in order to ensure a specific functional capability.

Therefore, it is necessary to study the issue of using the mixed navigation conditions, which consider the implementation of several PBN specifications and use of conventional navigation means (by some A/C). It should be taken into account though that the mixed navigation conditions can have a negative impact on the ATC controllers workload especially in the en-route airspace or high-density traffic aerodromes. The acceptability of the mixed navigation conditions depends on the complexity of the ATS routes structure or terminal procedures, peculiarities of the procedures, and the auxiliary ATS means availability and capability.

9.2. Airspace structure and maneuver charts validation and approbation

After the airspace structure development its complex approbation and check is required. The approbation implies the check of the suitability of the airspace structure for ATS operations in order to maintain the preset flight safety level. The approbation includes the following activities:

- Assessment of the possibility to reach the strategic objectives as a result of the airspace structure development and the airspace concept realization.
- Proving of the justification of the airspace structure from the ATM point of view.
- Identification of the potentially weak links of the developed structure and identification of the measures for their elimination or optimization.
- In a number of cases, proving the flight safety assessment.

For the airspace approbation the following methods may be used:

- airspace modeling
- fast-time simulation (FTS)
- real-time simulation (RTS)
- simulation by means of the ATC controller simulator
- simulation by means of the flight simulator
- collision risk modeling
- aviation noise modeling
- statistical analysis
- analytical tools for data assessment

Depending on the complexity of the chosen structure of the airspace and of the proposed concept, not all of the abovementioned methods may be used for approbation.

The schedule of the airspace structure approbation must provide sufficient time to conduct the necessary level of assessment, as the results of one approbation method can influence the next step or cause a halt in the approbation process and entail the modification (re-work) of the proposed airspace structure.

The airspace structure development process is completed by the successful results of the validation and approbation.

9.3. Airspace structure implementation with consideration of approved navigation specifications requirements

By the results of the approbation a decision on the transition to the implementation stage shall be adopted based on the following factors:

- ATS routes projects and maneuvering procedures answer the necessities of the airspace and flight operations.
- Navigation performance and flight safety requirements are met.
- Activities on the changes to the processes of the flight plans processing, computerization and AIP publication has been completed.

- Requirements to pilots' and ATC controllers' training are met.

10. Flight and air traffic personnel training issues under the conditions of PNB operations

One of the important issues of PBN implementation is the flight crew and ATC controllers training in the field of PBN operations.

The operator has to have a training program on the operational practice, rules and PBN operations peculiarities training (e.g. initial training, advanced training or conversion training of the flight crews, flight dispatch personnel or maintenance personnel).

Only the flight personnel who have passed the specialized training are entitled to perform en-route and terminal PBN operations.

The operator shall develop the personnel training program and flight personnel admission program providing for the ground and flight training, and incorporates this program into the Operations Manual.

The air traffic PBN servicing of the ATS routes and in terminal areas can be provided only by the ATC controllers, who have passed the basic and specialized training.

The basic training incorporates the following:

- RNAV systems including the functional capabilities and limitations of this navigation specification.
- Accuracy, integrity, operational readiness and continuity including the on-board performance monitoring and alert system.
- GNSS receiver, RAIM and FDE functions and other integrity alert methods.
- Comparison of the fly-by concept and fly-over concept (and different methods of turns performance).
- Requirements to flight plan.
- ATS rules: separation minima, ATS emergency rules, multi-type equipment environment, transition from one environment to another, phraseology.

Specialized training includes:

- STAR, SID on the specification and corresponding ATS procedures: open and closed STAR, altitude limitations, descent/climb clearance.
- Radar guidance methods (where applicable).
- Approach to landing in accordance with the specification and corresponding charts.
- Phraseology connected with the specification.
- Consequences of the request for route change during the procedure execution.

The training program has to be developed, approved and it must be unified for all ATC personnel.

11. Flight safety assessment of PBN implementation

One stage of PBN implementation is the development of flight safety plan that considers the flight safety assessment algorithm for the anticipated RNAV or RNP implementation.

Safety assessment is conducted due to the significant changes made to the airspace and ATM rules provision, as well as due to the new equipment (systems or aids) introduction, as minimum, for the following cases:

- Reduced separation minima to be used in the airspace or at the airport.
- New operation rules, including air traffic service procedures to be used in the airspace or at the airport.
- Restructuring of ATS routes.
- Re-sectorization of the airspace.
- Physical changes to the RWY and/or TWY configuration.
- Introduction of new communication, surveillance systems and facilities, as well as other systems and equipment vital for the flight safety, including those providing new functions and/or capabilities.

Safety assessment methods depend on the level of changes made in the existing air traffic management system under PBN procedures implementation.

It is necessary to identify the following levels of these changes:

- Introduction to the existing structure of a given airspace of one or more RNAV-type routes / paths of area navigation. In this case, to assess flight safety it is proposed to use a method based on the analysis of the difference between the existing and proposed systems.
- Full replacement of existing procedures for area navigation procedures, as well as changes related to spatial separation minima reduction. In this case it is necessary to assess the target level of flight safety.

Flight safety assessment assumes wide use of methods of mathematical and semi-natural simulation.

Flight safety assessment should be conducted for the airspace concept approbation.

During the RNP APCH, RNP AR APCH procedures implementation the flight safety assessment includes the following:

- Flight safety operational assessment.
- Risk factors.
- On-board equipment failures.
- A/C performance.
- Navigation service.
- ATS operations.
- Flight crew operations.
- Infrastructure.
- Operational environment.

After PBN implementation it is necessary to monitor the system to ensure that system safety is maintained, and to determine if strategic goals are achieved. In the case of unexpected events after implementation, it is necessary to take immediate corrective actions. In

exceptional cases this may require a cessation of RNAV or RNP operations until specific problems are resolved.

After the implementation it is necessary to perform flight safety assessment of ATM system and to collect evidence to illustrate that ATM system safety is guaranteed.

12. Status of activities concerning PBN implementation

First trials of non-precision approaches by GNSS using RNAV methods were carried out at Samara airport.

Starting from 01/01/2010 the work has been initiated on the implementation of area navigation routes RNAV5 in the Russian Federation on the following segments of routes:

Norilsk-Nigora

Serov-Ginom

Tobolsk-Darney

Tyumen-Nigora

In 2008-2013, SID, STAR and non-precision approach procedures by GNSS in area navigation mode at 22 Russian airports have been published in Aeronautical Information Publications (AIP).

Activities are also underway to support helicopters operations by GNSS using area navigation methods combined with ADS-B, in particular, in the areas of hydrocarbon production.

Today some activities are conducted for modernization of Moscow, St. Petersburg, Rostov, Samara and Yekaterinburg areas of UATMS airspace structure using RNAV5 specifications for ATS routes, RNAV1 for departure and arrival (SID/STAR) routes and RNP APCH for approaches to landing, as well as using existing conventional navigation aids available at the airports.

13. Brief description of the PBN implementation strategy

Proposals to amend the Draft PBN Implementation Plan within the airspace of the Russian Federation have been identified taking into account the realization of the Transport Strategy of the Russian Federation by 2020, Federal Target Program "Modernization of the Unified ATM System of the Russian Federation (2009-2020)", ICAO forecast on the amount of flights for the period up to 2025, as well as taking into account the vision of the airspace structure development and Extended ATM Centers.

The strategy of PBN implementation in the Russian Federation envisages two stages:

short-term – 2013-1016, and

long-term – after 2016.

13.1. Short-term (2013-2016) PBN implementation stage

<u>In oceanic airspace and on remote continental routes</u>

Support of RNAV10 for A/C operations on area navigation routes over the open waters, where the Russian Federation is responsible for ATM as well as on ATS routes located in remote continental areas based on navigation using a standalone airborne navigation system and GNSS.

In continental airspace

Implementation of RNAV5 for A/C operations on area navigations routes in continental regions based on navigation using a standalone airborne navigation system, VOR/DME, DME/DME and GNSS. ATS routes for which the usage of PBN is planned are located in the European part of the Russian Federation. The implementation is connected to the new structure of the Moscow area of the ATM Center. All ATS routes have RNAV5 specification and are supported by the operational capabilities of the ATS system, which provides accuracy, integrity and continuity. Aside from that the ATS routes with RNAV5 specification will be introduced in the upgraded airspace structure of St. Petersburg, Rostov, Samara and Yekaterinburg areas of the ATM Center, neighboring the Moscow area.

In order to introduce the area navigation routes the technical ground navigation aids are now being installed, which will provide for the navigation coverage above the territory of the European part of the Russian Federation. In 2013-2016 it is planned to install 126 VOR/DME, DVOR/DME, DME/DME navigation systems.

The use of the PBN concept (RNAV5 routes) will allow increasing of the capacity of the airspace of the European part of the Russian Federation at the required flight safety level. As soon as at present increasing of the airspace capacity in Siberia and Far East is not a primary issue, it is suggested to start appropriate actions in these regions after 2016.

Beside this it seems reasonable to develop RNAV5 routes integrated with the existing ATS routes.

Proposals on the timeframe of RNAV/RNP procedures implementation in 2013-2016 on ATS routes of the Russian Federation are given in Appendix 2.

In terminal area

Implementation of SID/STAR operations at airports using RNAV1 specification for aircraft equipped with DME/DME and GNSS. At the same time conventional maneuvering procedures are retained and ATM in mixed environments is provided. The timeframe for the implementation of SID (RNAV1) and STAR (RNAV1) at the aerodromes of the Russian Federation are given in Appendix 3.

If it is reasonable then the RNAV1 SIDs and STARs can be developed as integrated with the existing SIDs and STARs in terminal area.

Approach to landing

Implementation of non-precision approaches (LNAV) using the RNP APCH navigation specification based on use of GNSS as well as implementation of non-precision approaches with vertical guidance based on BaroVNAV (LNAV/VNAV) using the navigation specification

(RNP APCH/BaroVNAV) will be continued with a vision to cover international and significant part of other aerodromes of the Russian Federation.

Implementation of the approaches to landing with vertical guidance using the RNP APCH/LPV specification will be initiated depending on the time of entry into service of the augmentation and monitoring system.

At certain aerodromes it can be proposed to implement the RNP AR APCH procedures for supporting the operations under the conditions of challenging terrain, as well as for solution of problems related to airspace restrictions and minimization of the aircraft noise and emission.

The timeframe of LNAV, LNAV/VNAV, RNP AR APCH approaches implementation at the aerodromes of the Russian Federation is given in Appendix 3.

13.2. Long-term PBN implementation (after 2016)

In oceanic airspace and on remote continental routes

RNAV10 (RNP10) will be implemented for A/C operations on routes over the open waters, where the Russian Federation is responsible for ATM as well as on ATS routes located in remote continental areas, based on the use of a standalone navigation airborne system and GNSS.

In continental airspace

Continued implementation of RNAV5 on the routes of the Russian continental airspace, based on navigation using a standalone airborne navigation system, VOR/DME, DME/DME and GNSS. In the period from 2016 and further (2016+ stage) it is planned to introduce the ATS routes which will provide for the use of navigation specifications used in the Russian Federation. Moreover at 2016+ stage the RNAV5 routes will be implemented in the Siberian and Far East airspace.

In order to support the PNB operations in these areas it seems unreasonable to expand the navigation aids ground infrastructure. During the above period re-routing of RNAV/RNP routes will be introduced for GNSS as the main navigation aid.

The timeframe of RNAV/RNP procedures introduction for the period 2016+ to the ATS routes of the Russian Federation is given in Appendix 2.

In terminal area

Further implementation of air operations at airports on SID/STAR in RNAV-1 environments for aircraft, equipped with DME/DME and GNSS. Herewith the conventional maneuvering charts will be retained and ATM will be provided in mixed environment conditions. In the period from 2016 and further (2016+ stage) ATM routes navigation specifications those are in usage Russian will be implemented.

Approach

Implementation of RNP APCH based on BaroVNAV at international airports, and on APV using SBAS (if the Russian SDCM system is capable to support these procedures). At the same time conventional navigation equipment and conventional approach procedures will be retained.

Helicopters operations support

Operational approval for air operations en route, maneuvering in terminal/landing area and approach in RNAV1 and RNP 0.3 environments for helicopters equipped with GNSS.

Implementation of ADS-B infrastructure as means of surveillance in the areas of helicopters intensive flights, including the areas of hydrocarbon production.

List of
implementation activities for PBN in the Russian Federation airspace

	Activities	Responsible entities	Implementation timescales
	1. Organizational arrangements		
1.1	Take a decision on the beginning of transitional to PBN period during which both aircraft equipped with area navigation systems and aircraft using conventional navigation aids are to operate in the Russian Federation airspace. Determine the date of the transition.	Aviation Administration	Two phases: Short term (2013-2016) Long term (2016 and beyond)
1.2	Develop Russian Ministry of Transportation draft order "About authorization of navigation specifications types of Performance Based Navigation (PBN)" and suggestions on Russian Ministry of Transportation order "About authorization of required navigation performance types for area navigation routs" of November 11 2010 repeal	Aviation Administration **Research Institute**	2nd quarter of 2014
1.3	Develop materials to publish aeronautical information (aeronautical information circular, AIP amendments) associated with PBN usage	Aviation Administration	2nd quarter of 2014
1.4	Determine the airspace structure and flight procedures validation and test process and navigation performance authorization required (RNP AR) procedures approval process as well	Aviation Administration **Research Institute**	3rd quarter of 2014
1.5	Determine safety evaluation method compatible with navigation specifications requirements according to ICAO requirements	Aviation Administration **Research Institute**	3rd quarter of 2014
1.6	Put the working group documents on the FATA website	Aviation Administration	Permanently
	2. Activities to determine the acceptable navigation specifications for the Russian Federation airspace		
2.1	Assess civil aviation fleet capabilities to meet ICAO navigation specifications.	Aviation Administration Operators **Research Institute**	Permanently

	Activities	Responsible entities	Implementation timescales
2.2	Assess the existing NAVAID infrastructure required to support ICAO navigation specifications.	Aviation Administration **Research Institute** **Provider**	Permanently
2.3	Assess the existing communications system and ATM to support ICAO navigation specifications.	Aviation Administration **Provider**	Permanently
2.4	Assess the reference data in terms of its compatibility with the resolution, accuracy, and integrity required to design the airspace and flight procedures	**Research Institute**	Permanently
2.5	Determine the acceptable ICAO navigation specifications considering the airspace sectorization	Aviation Administration **Provider**	Permanently
2.6	Develop requirements for the aircraft operators to be granted operational approval to operate according to the navigation specifications requirements.	Aviation Administration Operators	2nd quarter of 2014
2.7	Conduct geodetic surveying for the aerodromes that do not usy the national geodetic system	Aviation Administration **Research Institute**	Permanently
3. Developing NAVAID infrastructure and modernizing ATS facilities			
3.1	Develop NAVAID infrastructure optimization Plan and modernize ATS facilities by reference to their optimal utilization	Aviation Administration **Research Institute** **Provider**	3rd quarter of 2014
3.2	Implement NAVAID infrastructure optimization Plan and modernize ATS facilities	Aviation Administration **Provider** **Research Institute**	Permanently
4. Developing and introducing amendments to the laws and regulations and internal documents			
4.1	Determine legal questions associated with PBN implementation and develop common fit-for-purpose solutions for the legal questions associated with PBN implementation	Aviation Administration **Research Institute** **Provider** **Operators**	2nd quarter of 2014
4.2	Develop and submit to the Russian Ministry of Transportation by reference to the approved procedure suggestions on introducing amendments and additions to the laws and regulations	Aviation Administration	Permanently
4.3	Implement the suggestions on introducing amendments and additions to the laws and regulations	Aviation Administration	Permanently
4.4	Introduce the appropriate amendments to the Standard Operating Procedures for ATS (flight control) controllers providing air navigation service to the Russian Federation airspace user	**Provider**	Permanently
4.5	Introduce amendments to the aircraft operators FOMs	Operators	Permanently

	Activities	Responsible entities	Implementation timescales
5. Enhancing airspace structure according to the navigation specifications requirements			
5.1	Develop suggestions for altering restricted and prohibited areas within the designated airspace in accordance with the selected navigation specifications types	Aviation Administration **Provider** **Research Institute**	Permanently
5.2	Develop suggestions for establishing RNAV 5 routes based on the existing air route network	**Provider** **Research Institute**	Permanently
5.3	Develop flight procedures for aerodromes and heliports	**Provider**	Permanently
5.4	Validate and test flight procedures according to the airspace and flight procedures validation and test process and to approve navigation performance authorization required (RNP AR) procedures	Aviation Administration **Provider** **Research Institute**	Permanently
5.5	Design GNSS approach procedures with vertical guidance	Aviation Administration **Provider** **Research Institute**	Permanently
5.6	Develop amendments to the Russian Federation aeronautical information documents	Aviation Administration **Provider**	Permanently
6. Personnel training and human factors mitigation measures			
6.1	Develop upgrade flight crew training programmes and methods.	Aviation Administration	2nd quarter of 2014
6.2	Develop upgrade training programmes and methods for controllers to provide en-route and terminal control service according to the navigation specification requirements and in mixed environment as well Develop planning personnel upgrade training programmes and methods	Aviation Administration **Provider**	2nd quarter of 2014
6.3	Provide flight crew training in particular using flight simulators	Operators	Permanently
6.4	Provide ATC controller training in particular using aircraft control trainer	**Provider**	Permanently

Plan of navigation specifications-based routes implementation in the Russian Federation airspace

Airspace	Navigation specification type	Implementation timescales	Implementation area
Oceanic and remote continental en-route	RNAV 10	2013-2016	-
Continental	RNAV 5	2013-2016	Moscow area of UATMS St. Petersburg area of UATMS Rostov area of UATMS Samara area of UATMS Ekaterinburg area of UATMS Develop RNAV 5 routes based on the existing ATS routes
Oceanic and remote continental en-route	RNAV 10	2016 and beyond	Over high seas where the Russian Federation is responsible for ATM and also to operate on ATS remote continental routes
Continental	RNAV 5	2016 and beyond	Siberia and Russian Far East

Plan of implementing LNAV, LNAV/VNAV approaches and RNP AR APCH at the Russian federation aerodromes

##	RWy	Geodetic surveying PZ 90	Aerodrome	RWy	SID (RNAV-1)	STAR (RNAV-1)	LNAV (RNP APCH)	LNAV/VNAV (RNP APCH/ BaroVNAV)	APV (RNP APRH /SBAS)	RNP AR
1	2	3	4	5	6	7	8	9	10	11
1.	1. 2.	available	Magnitogorsk USCM international	01 19	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*
2.	3. 4.	available	Barnaul n.a. German Titov international	06 24	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*
3.	5. 6.	available	Chita (Kadala) UIAA international federal	29 11	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*
4.	7. 8.	available	Krasnoyarsk (Emelyanovo) UNKL international	11 29	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*
5.	9. 10.	available	Yuzhno-Sakhalinsk (Khomutovo) UHSS, international federal	01 19	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*
6.	11. 12.	available	Khanty-Mansiysk USHH international	06 24	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*
7.	13. 14.	available	Arkhangelsk (Talaghy) ULAA international federal	08 26	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*
8.	15. 16.	available	Syktyvkar UUYY international	01 19	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*

1	2	3	4	5	6	7	8	9	10	11
9.	17.	available	St Petersburg (Pulkovo) ULLI international	10R	2014 (GNSS) available in AIP	2014 (GNSS) available in AIP	2014	2016+	*2)*	*1)*
	18.			28L						
	19.			10L						
	20.			28R						
10.	21.	available	Petrozavodsk (Besovets) ULPB international	01	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*V*
	22.			19						
11.	23.	available	Murmansk ULMM international federal	13	2014 (GNSS) available in AIP	2014 (GNSS) available in AIP	2014	2016+	*2)*	*1)*
	24.			31						
12.	25.	available	Rosto-on-Don URRR international federal	04	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*
	26.			22						
13.	27.	available	Anapa (Vityazevo) URKA international federal	04	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*
	28.			22						
14.	29.	not available	Volgograd (Gumrak) URWW international federal	11	2014	2014	2016+	2016+	*2)*	*1)*
	30.			29						
15.	31.	available	Krasnodar (Pashkovsky) URKK international federal	05R	2014 (GNSS)	2014 (GNSS) available in AIP	2014	2016+	*2)*	*1)*
	32.			23L						
16.	33.	available	Samara (Kurumoch) UWWW international federal	05	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*
	34.			23						
	35.			15						
	36.			33						
17.	37.	PZ 90	Kazan UWKD international federal	11L	2014 (GNSS) available in AIP	2014 (GNSS)	2014	2016+	*2)*	*1)*
	38.			29R						
18.	39.	available	Ufa UWUU international	14R	2014 (GNSS) available in AIP	2014 (GNSS)	2014	2016+	*2)*	*1)*
	40.			14L						
	41.			32R						
	42.			32L						
19.	43.	available	Ekaterinburg (Koltsovo) USSS international federal	08L	2014 (GNSS) available in AIP	2014 (GNSS)	2014	2016+	*2)*	*1)*
	44.			26R						
	45.			08R						
	46.			26L						

1	2	3	4	5	6	7 '	8	9	10	11
20.	47. 48.	available	Perm (Bolshoye Savino) USPP international federal	21 03	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*
21.	49. 50.	available	Chelyabinsk (Balandino) USCC international federal	27 09	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*
22.	51. 52. 53. 54.	available	Moscow (Vnukovo) UUWW international federal	01 19 06 24	2015 (GNSS) available in AIP	2015 (GNSS) available in AIP	2015	2015	*2)*	*1)*
23.	55. 56. 57. 58.	available	Moscow (Sheremetyevo) UUEE international federal	07R 25L 25R 07L	2015 (GNSS) available in AIP	2015 (GNSS) available in AIP	2015	2015	*2)*	*1)*
24.	59. 60. 61. 62.	available	Moscow (Domodedovo) UUDD international federal	14R 32L 14L 32R	2015 (GNSS) available in AIP	2015 (GNSS) available in AIP	2015	2015	*2)*	*1)*
25.	63. 64.	available	Ostafyevo UUMO international	26 08	2015 (GNSS) available in AIP	2015 (GNSS) available in AIP	2015	2016+	*2)*	*1)*
26.	65. 66.		Saratov UWSS international	12 30	2015 (GNSS)	2015 (GNSS)	2015	2016+	*2)*	*1)*
27.	67. 68.	available	Sochi URSS international federal	02 06	2013 (GNSS) available in AIP	2013 (GNSS) available in AIP	2013	2016+	*2)*	Developed but not implemented
28.	69. 70. 71. 72.	available	Khabarovsk (Novy) UHHH international federal	05R 23L 05L 23R	2015 (GNSS)	2015 (GNSS)	2015	2016+	*2)*	*1)*

1	2	3	4	5	6	7	8	9	10	11
29.	73. 74.	available	Petropavlovsk-Kamchtsky (Yelizovo) UHPP international federal	34R 16L	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
30.	75. 76. 77. 78.	available	Novosibirsk (Tolmachevo) UNNT international federal	07 25 16 34	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*
31.	79. 80. 81. 82.	available	Tyumen (Roschino) USTR international federal	03 21 12 30	2013 (GNSS) available in AIP	2013 (GNSS) available in AIP	2013	2016+	*2)*	*1)*
32.	83. 84.		Providenya Bay UHMD international	01 19	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
33.	85. 86.	available	Magadan UHMM international federal	10 28	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
34.	87. 88.		Anadyr UHMA international federal	01 19	2016 (GNSS)	2016 (GNSS)	2016	2016+	*2)*	*1)*
35.	89. 90.	PZ 90	Orenburg (Tsentralny n.a. Jury Gagarin) UWOO international	08 26	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
36.	91. 92.	PZ 90	Ulyanovsk (Vostochny) UWLW international	02 20	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
37.	93. 94.		Orsk UWOR international	25 07	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*

1	2	3	4	5	6	7	8	9	10	11
38.	95. 96.	Navaids survey has not been conducted	Cheboksary UWKS international	06 24	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
39.	97. 98.	available	Astrakhan (Narimanovo) URWA international	27 09	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
40.	99. 100.	PZ 90	Bratsk UIBB international	12 30	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
41.	101. 102.	PZ 90	Ulan-Ude UIUU international federal	26 08	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
42.	103. 104.	PZ 90	Omsk (Tsentralny) UNOO international federal	07 25	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
43.	105. 106.	PZ 90	Yakutsk UEEE international federal	23L 05R	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
44.	107. 108.	Navaids survey has not been conducted	Nizhniy Novgorod (Strigino) UWGG international federal	18 36	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
45.	109. 110.	available	Irkutsk UIII international federal	12 30	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
46.	111. 112.	PZ 90	Mineralnye Vody URMM international federal	12 30	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
47.	113. 114. 115. 116.	available	Vladivostok (Knevichy) UHWW international federal	07L 07R 25R 25L	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
48.	117. 118.		Abakan UNAA, international federal	02R 20L	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*

1	2	3	4	5	6	7	8	9	10	11
49.	119. 120.		Voronezh (Chertovitskoye) UUOO international	12 30	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
50.	121. 122.		Begishevo UWKE international	03 21	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
51.	123. 124.	**Navaids survey has not been conducted**	Nizhnevartovsk USNN international	03 21	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
52.	125. 126.	ПЗ 90	Yaroslavl (Tunoshna) UUDL international	23 05	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
53.	127. 128.		Belgogod UUOB international	29 11	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
54.	129. 130.		Blagoveschensk UHBB international federal	36 18	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
55.	131. 132.		Vladikavkaz (Beslan) URMO international	10 28	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
56.	133. 134.	available	Kaliningrad (Khrabrovo) UMKK international federal	24 06	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
57.	135. 136.	PZ 90	Kemerovo UNEE international	23 05	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
58.	137. 138.		Grozny (Severny) URMG international	26 08	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
59.	139. 140.	PZ 90	Makhachkala URML international federal	14 32	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*

1	2	3	4	5	6	7	8	9	10	11
60.	141. 142.	available	Elista URWI international	09 27	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
61.	143. 144.	available	Bryansk UUBP international	34 16	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
62.	145. 146.	available	Surgut USRR international federal	07 25	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
63.	147.		Nalchik URMN international	24	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
64.	148. 149.	PZ 90	Stavropol (Shpakovskoye) URMT international	07 25	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
65.	150. 151.	available	Kursk (Vostochny) UUOK international	12 30	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
66.	152. 153.	available	Pskov ULOO international	01 19	2016+ (GNSS)	2016+ (GNSS)	2016+	2016+	*2)*	*1)*
67.	154. 155.	available	Kirov	03 21	2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*
68.	156. 157.	available	Izhevsk		2014 (GNSS)	2014 (GNSS)	2014	2016+	*2)*	*1)*

Note: *1)* – RNP AR APCH implementation practicability shall be further determined,
2) – according to the augmentation and monitoring system implementation timescales.