PBN SG/9-REPORT

INTERNATIONAL CIVIL AVIATION ORGANIZATION

REPORT OF THE NINTH MEETING OF THE PERFORMANCE BASED NAVIGATION SUB-GROUP

PBN SG/9 Meeting

(Doha, Qatar, 9 – 11 December 2024)

The views expressed in this Report should be taken as those of the PBN Sub-Group and not of the Organization. This Report will, however, be submitted to the MIDANPIRG and any formal action taken will be published in due course as a Supplement to the Report.

Approved by the Meeting
and published by authority of the Secretary General

TABLE OF CONTENTS

Page

PART I – HISTORY OF THE MEETING

1. PLACE AND DURATION

1.1 The Ninth meeting of the Performance Based Navigation Sub-Group (PBN SG/9) was successfully held in Doha, Qatar, from 9 to 11 December 2024.

2. OPENING

2.1 Mr. Nasser Jasim Al-Khalaf, Air Navigation Advisor, Qatar Civil Aviation Authority, delivered an opening speech, and welcomed all the participants to Doha to participate in the PBN SG/9 Meeting.

2.2 Mr. Radhouan Aissaoui, Regional Officer Information Management, ICAO Middle East Office, welcomed all participants to the PBN SG/9 meeting. He expressed his sincere gratitude to the State of Qatar and especially to Mr. Ahmed Eshaq, Director of ATM of the Qatar Civil Aviation Authority for hosting this important meeting in Doha. Mr. Radhouan Aissaoui thanked Qatar CAA for the warm welcome, outstanding hospitality, excellent organisation, and the decent premises provided for this important meeting. He reminded the meeting that 7 December 2024 marks the 80th anniversary of the signing of the Convention on International Civil Aviation in Chicago, a landmark agreement that has become the cornerstone of the global civil aviation system. This historic convention has fostered international cooperation and has been instrumental in enabling the safe, efficient, and sustainable growth of air transport, benefiting nations worldwide. On this significant occasion, Mr. Radhouan Aissaoui commemorated the milestone and extended his warmest congratulations to all ICAO Member States on the celebration of International Civil Aviation Day. He emphasized that this gathering serves as a testament to the unwavering spirit of collaboration within the global aviation community, reinforcing our collective commitment to addressing challenges and advancing the safety, efficiency, and sustainability of global air transport.

2.3 Mr. Radhouan Aissaoui encouraged the delegates to participate in all the activities and discussions, thanked them for their attendance and wishing them successful and productive meeting.

2.4 Mr. Ehab Raslan Mohamed, former General Manager of Research and Development at NANSC, Egypt and Chairman of the PBN SG, warmly welcomed the participants and expressed his hopes for a successful and productive meeting.

3. ATTENDANCE

3.1 The meeting was attended by a total of fifth-one (51) participants from ten (10) States (Egypt, Iran, Iraq, Jordan, Libya, Oman, Qatar, Saudi Arabia, Sudan, UAE and USA) and four (4) Organizations/Industries (ADL, Eurocontrol, IATA and PVS AERO Netherlands). The list of participants is at **Attachment A**.

4. OFFICERS AND SECRETARIAT

4.1 The meeting was chaired by Mr. Ehab Raslan Mohamed, former General Manager of Research and Development at NANSC, Egypt

4.2 Mr. Radhouan Aissaoui, Regional Officer, Information Management was the Secretary of the meeting.

5. LANGUAGE

5.1 The discussions were conducted in the English language and documentation was issued in English.

6. AGENDA

6.1 The following Agenda was adopted:

Agenda Item 1: Adoption of the Provisional Agenda

Agenda Item 2: Follow-up on MIDANPIRG/21 Conclusions and Decisions relevant to PBN

Agenda Item 3: Global and Regional Developments related to PBN

Agenda Item 4: PBAOM: A Comprehensive Overview

Agenda Item 5: PBN Manual Doc 9613, 5th Edition updates

Agenda Item 6: PBN Planning and Implementation in the MID Region

Agenda Item 7: Working Arrangements and Future Work Programme

Agenda Item 8: Any other business

7. CONCLUSIONS AND DECISIONS – DEFINITION

7.1 The MIDANPIRG records its actions in the form of Conclusions and Decisions with the following significance:

a) **Conclusions** deal with matters that, according to the Group's terms of reference, merit directly the attention of States, or on which further action will be initiated by the Secretary in accordance with established procedures; and

b) **Decisions** relate solely to matters dealing with the internal working arrangements of the Group and its Sub-Groups.

8. LIST OF DRAFT CONCLUSIONS AND DRAFT DECISIONS

DRAFT CONCLUSION 9/1: PBN SID/STAR CHARTS HARMONISED AIP PUBLICATION

DRAFT CONCLUSION 9/2: GNSS REVERSION & CONTINGENCY PROCEDURES

DRAFT CONCLUSION 9/3: GUIDANCE MATERIAL ON RNP APPROACH (RNP APCH)

DRAFT CONCLUSION 9/4: PBN AND PANS-OPS SAFETY OVERSIGHT WORKSHOP

PART II: REPORT ON AGENDA ITEMS

REPORT ON AGENDA ITEM 1: ADOPTION OF THE PROVISIONAL AGENDA

1.1 The meeting reviewed and adopted the Provisional Agenda as at Para 6 of the History of the Meeting.

REPORT ON AGENDA ITEM 2: FOLLOW-UP ON MIDANPIRG/21 CONCLUSIONS AND DECISIONS RELEVANT TO PBN

2.1 The meeting noted the status of the MIDANPIRG/21 Conclusions and Decisions relevant to PBN and the follow-up actions taken by concerned parties as at **Appendix 2A**.

REPORT ON AGENDA ITEM 3: GLOBAL AND REGIONAL DEVELOPMENTS RELATED TO PBN

GLOBAL DEVELOPMENTS RELATED TO PBN - ICAO GROUP UPDATES

3.1 The subject was addressed in PPT/3 presented by the Secretariat.

3.2 The meeting was apprised of the activities of the Flight Operations Panel (FLTOPSP), the Instrument Flight Procedures Panel (IFPP), the Navigation Systems Panel (NSP), the Separation and Airspace Safety Panel (SASP) and ICAO Transition to True North Advisory Group (TRUE-AG) progress report.

Magnetic to a True North Reference System

3.3 The UAE presented a detailed case study evaluating the impact of transitioning from Magnetic North to True North.

3.4 The meeting noted that if true north reference for aircraft heading is implemented, it would mean the discontinuation of the existing practice of converting aeronautical data from its original format in true reference into magnetic reference. It would simplify charting and aircraft operations, improve operational safety, and may result in considerable cost savings for air operators, air navigation service providers (ANSPs), aerodromes, avionics manufacturers, and flight procedure designers.

3.5 The meeting was provided with a brief overview of the ICAO survey results regarding the transition from a magnetic to a true north reference system for heading and tracking in aviation operations. It was noted that ICAO has circulated a survey, through State Letter AN 11/57-22/87, to seek feedback from States and their aviation industry on the level of support for ICAO to commence work on changing from a Magnetic to True North reference for heading and track in air operations. The aim of the survey is also to identify any concerns or challenges that may need to be addressed during any transition to True North. The findings from the survey will assist ICAO in determining the viability of moving to True North and may be used to guide ICAO in developing plans and strategies for a future transition.

3.6 The meeting invited States to:

a) acknowledge the transition from magnetic north to true north is a change with significant operational, technical, and regulatory implications;
b) begin assessing and addressing the impact of this transition on air navigation, airport operations, and associated systems in order to establish their national plans; and
c) actively engage with the ICAO MID to share experiences, best practices, and challenges associated with the change.

3.7 It was highlighted that several significant challenges that State need to overcome for a transition to True North to be viable, including:

a) managing the one-time implementation cost vs. the ongoing costs over time of managing MAGVAR;
b) lack of concept of operations (CONOPS) and Transition Plan; and
c) potential unmanaged safety risks introduced during the transition to True North.

3.8 Noting the challenges associated with the transition to True North, the meeting requested that ICAO develops a comprehensive transition plan. This plan should be complemented by tailored guidance and awareness initiatives, including seminars, workshops, and webinars, to support States in overcoming these challenges effectively. The meeting noted that the subject is being addressed at global level.

REPORT ON THE FOURTEENTH AIR NAVIGATION CONFERENCE (AN-CONF/14) AND UPDATES ON GNSS RFI

3.9 The subject was addressed in PPT/4 presented by the Secretariat.

3.10 The meeting was provided with a snapshot of recent GNSS jamming and spoofing events occurring globally. It was noted that GNSS jamming and/or spoofing has shown further increase in the severity of its impact, as well as an overall growth of intensity and sophistication of these events. This issue particularly affects the geographical areas surrounding conflict zones, but it is also encountered in the south and eastern Mediterranean, Black Sea, Middle East, Baltic Sea, and Arctic area. These incidents highlighted the growing challenges faced by the aviation sector due to deliberate and unintentional interference with GNSS signals. The presentation underscored the need for robust mitigation strategies and enhanced international collaboration to address these threats effectively.

3.11 The meeting noted the ICAO's comprehensive activities related to GNSS RFI, including completed, ongoing, and planned initiatives.

3.12 The meeting noted also that the Fourteenth Air Navigation Conference (AN-Conf/14) was held during 26 August –6 September 2024, in the Assembly Hall of the Headquarters of the International Civil Aviation Organization (ICAO) in Montréal, Canada.

3.13 The meeting was apprised of the outcomes of the AN-Conf/14, particularly:

- Recommendation 2.2/2 – Addressing global navigation satellite system interference and contingency planning
- Recommendation 3.2/1 – Phasing out and/or optimizing the use of legacy system

3.14 The meeting acknowledged that the AN-Conf/14, through Recommendation 2.2/2, urged States to develop regional GNSS RFI reporting mechanisms, to the extent feasible, through the mechanism of the planning and implementation regional groups (PIRGs), as described in the Global Navigation Satellite System (GNSS) Manual (Doc 9849). The GNSS Manual provides guidance on reporting GNSS radio frequency interference (RFI) incidents to ICAO including procedures for reporting GNSS anomalies and examples of reporting forms for use by ATS personnel and pilots.

3.15 The meeting was informed that a meeting between ITU and ICAO HQ was held on 5th November 2024, to review the current GNSS RFI reporting procedure and explore potential improvement.

3.16 The meeting noted that the ITU online tool for Satellite Interference Reporting and Resolution System (SIRRS) will be used to report GNSS RFI occurrences, and that new accounts will be created for ICAO HQ and Regional Offices to report and track GNSS RFI by Q1 2025.

3.17 The meeting noted that the Fourteenth Air Navigation Conference (AN-Conf/14) report has been published as ICAO Doc 10209, AN-Conf/14. The document is now available and can be accessed on the ICAO Secure Portal at https://portallogin.icao.int/ . The meeting encouraged States to review it for reference and updates related to air navigation developments.

iPACK FOR MITIGATION OF GNSS RFI

3.18 The meeting was informed that ICAO is in the process of developing an iPACK for the mitigation of GNSS RFI. This iPACK will leverage existing guidance materials from ICAO and other organizations, as well as best practices from various regions. Designed as a 5-day national workshop, the iPACK will undergo validation with a pilot State and is expected to be available by Q2 2025.

EUROCONTROL GNSS RFI MITIGATION

3.19 The subject was addressed in PPT/5 presented by Eurocontrol. EUROCONTROL presented an update on the recent GNSS RFI mitigation activities.

3.20 The meeting noted Eurocontrol methodology for assessing GNSS threats to aircraft operations. This methodology has been evolved into a web-based tool allowing the user to assess the risk of different GNSS threats on their operations. The objective of this GNSS Threat Assessment tool is to allow the individual States to assess the risk to their operations from the loss or interruption of the GNSS signals. Using the set of pre-defined baseline scenarios, individual users can either accept the scenario and assess the output or adjust the scenarios to mirror their own environment. The expectation is that this assessment tool will allow States to draw up a framework of high-risk threats and enable each State to define appropriate mitigation actions to ensure that operations are managed safely in a degraded navigational environment.

UPDATE ON GNSS RFI

3.21 The subject was addressed in PPT/6 presented by the IATA MEA.

3.22 The meeting was provided with an overview of IATA FDX (Flight Data eXchange) as a global aviation data-sharing program developed by the International Air Transport Association (IATA) to enhance safety and operational efficiency. It involves the secure, anonymized collection and analysis of flight data from participating airlines. It helps mitigate safety risks and improve flight efficiency, through:

- Data Collection and Analysis: Airlines share de-identified flight data, including parameters like altitude, airspeed, and deviations from standard procedures. This data is aggregated and analyzed to identify trends and patterns.

- Risk Mitigation: By identifying trends in operational data, IATA FDX helps airlines and stakeholders detect potential safety risks (e.g., unstable approaches, runway excursions) before they lead to incidents or accidents.

- Benchmarking and Insights: Airlines can benchmark their operations against industry standards, identifying areas for improvement and adopting best practices.

- Improved Decision-Making: Data-driven insights help improve decision-making processes for airlines, air navigation service providers (ANSPs), and regulators.

- Collaboration: The program fosters collaboration among airlines, sharing valuable safety and efficiency insights while maintaining data confidentiality.

3.23 The IATA presentation highlighted key insights into GNSS Radio Frequency Interference (RFI) in the MENA region, focusing on its impact on aviation operations. It provided an analysis of GNSS

RFI trends observed during flight, including location-specific occurrences and their growth over time. The presentation detailed the distribution of GNSS RFI incidents across different phases of flight, emphasizing the critical phases where signal loss is most frequent. Additionally, it outlined the typical duration of signal loss, helping to quantify the operational impact on navigation and flight safety in the region.

3.24 The meeting was apprised of the GNSS RFI – Safety Risk Model (SRA) focused on assessing and mitigating the safety risks associated with GNSS Radio Frequency Interference (RFI) in aviation. It introduced a structured Safety Risk Model to evaluate the likelihood and severity of GNSS RFI incidents, highlighting their potential impact on navigation, approach procedures, and overall flight safety. The presentation emphasized the importance of integrating GNSS RFI scenarios into risk assessments and provided a framework for identifying mitigation measures, such as alternative navigation solutions and improved monitoring of interference hotspots. The SRA approach aims to enhance operational resilience and ensure continuity of safety despite GNSS vulnerabilities.

3.25 The presentation concluded with actionable recommendations for Airlines Operators (AOs) and States to address GNSS Radio Frequency Interference (RFI). The meeting also noted the following next steps that IATA will undertake: completing a detailed study on GPS interference by Q4, continuing collaboration with the ICAO NSP to address GNSS interference and follow up on the AN-Conf recommendations, and working with the ICAO MID Region to develop an infrastructure rationalization plan for the Minimum Operational Network (MON) of conventional navigation aids.

GNSS RFI - AN AIR TRAFFIC MANAGEMENT PERSPECTIVE

3.26 The subject was addressed in PPT/7 presented by the FAA.

3.27 The FAA provided an overview of its Air Traffic Management (ATM) strategy, emphasizing efforts to address challenges associated with GNSS interference. The FAA highlighted two platforms currently under development: the Navigation and Operational Planning Agility Suite (NOPAS) and the FAA GPS Automated Portal (FGAP). The toolkits are intended to streamline the monitoring and reporting of GPS interference events, facilitating more effective communication and resolution strategies. Together, these initiatives underscore the FAA's commitment to ensuring robust and resilient navigation systems in the face of evolving challenges.

GNSS RFI - OPERATOR'S PERSPECTIVE AND MITIGATION MEASURES

3.28 The subject was addressed in PPT/8 presented by Qatar Airways.

3.29 Qatar Airways delivered a comprehensive presentation highlighting their GNSS RFI mitigation measures and processes. Key initiatives include a dedicated "GPS interference" topic in crew reports and an automated process to capture and analyze such reports. Interference locations are mapped and consolidated into a monthly report, ensuring continuous monitoring. Additionally, the airline provides a Special Crew Briefing focused on affected FIRs and issues dedicated crew alerts in the Flight Planning System (FPS), including briefing package updates when necessary. The presentation outlined the effects of GNSS RFI on cockpit systems across various aircraft types. These impacts include disruptions to GPWS Look-Ahead Terrain/EGPWS, the Runway Awareness and Advisory System (Boeing RAAS / Airbus ROW/ROP), and critical systems such as Time/Clock synchronization, Air Traffic Control (ATC) data links, and ADS-B functionality.

3.30 The meeting noted also Qatar Airways' GNSS RFI risk assessment and operational mitigation strategies. These included evaluating the potential risks associated with GNSS interference and implementing robust measures to minimize operational impacts, ensuring safety and continuity in their operations.

3.31 The meeting expressed its appreciation for Qatar Airways' insightful presentation and valuable contributions to the discussions

GNSS RFI - State's Perspective and Mitigation Measures

3.32 The subject was addressed in PPT/9 presented by Iraq. The meeting noted the set of procedures and actions that have been taken by the Iraqi Civil Aviation Authority (ICAA) and Iraq's ANSP (GCANS) to address the GNSS vulnerabilities and for preventing and responding to RFI events within Baghdad FIR (ORBB). The meeting noted that in response to the significant increase in the reported GNSS vulnerabilities, Iraq Prime Minister has instructed the key part of Iraq's mitigation strategy for GPS interference includes aerial and ground scanning operations. These methods help detect, locate and address the sources of interference, whether intentional (jamming or spoofing) or unintentional.

3.33 The meeting appreciated the efforts made and the collaboration between Iraqi national aviation stakeholders for preventing and responding to interference.

RNP VPT High Level Overview - ICAO

3.34 The subject was addressed in PPT/11 presented by PVS.

3.35 The meeting noted that the guidance material contained in the ICAO Circular 359, Development of Procedures for Visual Maneuvering with Prescribed Tracks using RNP, has been developed to provide guidance to States and operators when developing instrument flight rules (IFR) procedures, including an RNP instrument path followed by a visual path defined by waypoints, to promote stabilized approach and prescribed visual maneuvering to a designated runway. A visual approach is often substituted by an RNP (VPT) supplemented by the area navigation capabilities of the aircraft. This is often done to improve the safety of the operation by providing track and vertical path guidance, and thereby assisting the safe completion of the approach. This publication will be useful to civil aviation authorities (CAAs) that oversee instrument procedure design as well as charting and publication organizations (both internal and external). It will also assist all stakeholders, including air operators, ANSPs, data houses, procedure design organizations, air traffic control officer (ATCO) and pilot training organizations, charting organizations, and aircraft manufacturers with applicable aspects of the implementation. This circular includes practical considerations for the development of the procedures, whether this is done by the ANSP or following an initiative taken by an operator. It also provides guidance on the authorization process to oversee the development of the procedures.

ICAO Update

3.36 An update on ICAO's documentation and activities that may be of interest to the meeting was provided in IP/4 prepared by the Secretariat.

REPORT ON AGENDA ITEM 4: PBAOM

4.1 The meeting noted that MIDANPIRG/21, through Conclusion 21/6, requested that a Webinar on Performance-Based Aerodrome Operating Minima (PB-AOM) be organized in 2024 to provide a comprehensive understanding of the concept, its implications on aerodrome design and operations, the challenges of operating in very low visibility, and the need to accommodate advanced aircraft at the aerodrome to enhance availability during restrictive weather conditions. Therefore, a dedicated session on PB-AOM was conducted, allowing for an in-depth discussion of these critical aspects, including practical considerations and challenges in the context of aerodrome operations. This approach aimed to ensure a focused and interactive exchange of knowledge among stakeholders on this important subject.

4.2 The session was provided remotely by Capt. Ian Knowles, Chief of the Operational Safety Section, Air Navigation Bureau, ICAO HQ, through his presentation (PPT/12). During the session, Capt. Knowles elaborated on the Performance-Based Aerodrome Operating Minima (PB-AOM) concept. The meeting was informed that PB-AOM involves the use of additional equipment beyond the standard requirements, enabling operational credits that allow for lower operational minima, such as in low-visibility conditions. He explained that the standard aerodrome operating minima are based on aircraft equipped with the minimum required systems (the basic aircraft) for a given approach. These minima are tied to specific types and categories of operations, as well as the corresponding infrastructure requirements (e.g., runway lights, approach lights). Advanced aircraft, however, can utilize existing infrastructure to obtain special authorizations, allowing them to perform enhanced approach operations and achieve lower minima compared to basic aircraft.

4.3 It was highlighted that the purpose of Performance Based Aerodrome Operating Minima (PBAOM) is to permit aircraft operations in poorer meteorological conditions than may have been possible hitherto. PBAOM can be used to facilitate successful instrument approaches into aerodromes with reduced facilities, with appropriately equipped aircraft, in meteorological conditions that would otherwise increase the number of missed approaches or diversions. There are numerous benefits to operator, aerodrome, and CNS/ATM (Communications, Navigation and Surveillance / Air Traffic Management) service providers with the adoption of Performance-based Aerodrome Operating Minima (PBAOM). The benefits can be summarized as:

- Increase in efficiency to the aerodrome and the ATM operations in times of marginal weather. Previously, an aerodrome might suspend takeoffs and/or landings when the weather went below the category of minima that the ground infrastructure supported. PBAOM assists controllers in expediting advanced aircraft on a greater variety of instrument approach procedures and destination aerodromes. Localized congestion during marginal weather conditions is expected to decrease as efficiency increases at more aerodromes.
- Increased access benefit to all actors, since advanced aircraft allow more operations during periods of marginal and low-visibility weather and reduce the need for diversions. This regularizes operations and in consequence improves planning for users, aerodromes and operators.
- Infrastructure savings with benefits to operators and aerodromes. The existing AOM concept directly ties lower minima to more visual aids and other facilities on the aerodrome. These visual aids such as centrelines lights, touchdown zone lights, and high intensity approach lighting systems are very expensive to install and expensive to maintain. The operational credits in PBAOM allow operators to achieve similar minima at lesser equipped aerodromes, as long as their aircraft provides the performance to mitigate the traditional visual aid requirements. This provides a large benefit for the aerodrome as well, since they can reduce operational maintenance budgets. The same infrastructure leads to lower minima, or the same minima can be achieved with reduced infrastructure, principally through better situational awareness under all weather conditions.

- Environmental benefit. Increased efficiency at aerodromes means fewer diversions and therefore reduced CO2 emissions from the burning of aviation fuel. Additionally, aerodromes can achieve an environmental benefit with a reduction in the lighting infrastructure. technology.

4.4 It was noted that the CONOPS has been developed aiming to provide information on the proposed concepts of Performance Based Aerodrome Operating Minima. The purpose is also to describe the expected impact for other domains such as aerodromes, air traffic management and navigation systems providers. Thereby, CONOPS is intended as a coordination instrument between the domains affected by attempting to describe all aspects of PBAOM. The PBAOM CONOPS, discusses:

- Operational credits
- Examples of operations with basic and advanced aircraft
- Flight planning aspects: Destination with ops credits, alternates without
- Specific authorisations, when and how
- Inflight considerations
- Safety and risk assessment
- Training and Qualification
- Process to determine the operating minima by the Operator
- Aerodrome aspects
- ATM aspects
- Appendix with a more detailed example of effects on aircraft and airports

4.5 A dedicated session of Q&A was held, providing participants with the opportunity to ask questions and seek clarifications on the PBAOM. This interactive session allowed attendees to address any uncertainties or concerns they had, ensuring a deeper understanding of the subject matter. The session facilitated an open dialogue, enabling participants to engage directly with the expert and receive detailed responses, thereby enriching the overall learning experience and ensuring that all relevant points were thoroughly addressed.

REPORT ON AGENDA ITEM 5: PBN MANUAL DOC9613, 5TH EDITION, UPDATES

5.1 The meeting recalled that the MIDANPIRG/20, through Conclusion 20/23, requested that a Webinar on the new edition of PBN Manual Doc 9613 (ED5) be organized to provide insights on key changes to this edition of the PBN manual. Therefore, a dedicated session on the Edition 5 of the PBN Manual was conducted, allowing for an in-depth discussion on the significant updates. This approach aimed to ensure a focused and interactive exchange of knowledge among stakeholders on this important subject.

5.2 The session was provided remotely by Capt. Ian Knowles, Chief of the Operational Safety Section, Air Navigation Bureau, ICAO HQ, through his presentation (PPT/13). During the session, Capt. Knowles indicated that the Performance-Based Navigation (PBN) Manual (Doc 9613) 5th Edition introduced several significant updates to enhance the implementation and integration of PBN in global aviation operations. Key changes include:

- **Revised Manual Structure**: The manual has undergone a comprehensive restructuring to improve clarity and usability. Notably, Part B—Implementation Guidance and Attachment C on Operational Approval have been removed to streamline the content.
- **Clarification on Free Route Airspace**: The 5th Edition provides clearer guidance on the use of PBN within Free Route Airspace, facilitating more flexible and efficient flight planning.
- **Updated Terminology and Definitions**: There is a revision of PBN terminology to ensure consistency and alignment with current practices. This includes updates to navigation specifications and operational requirements.
- **Enhanced Guidance on RNP AR Procedures**: The manual now includes more detailed information on RNP Authorization Required (RNP AR) procedures, including the introduction of RNP AR departure procedures (RNP AR DP).
- **Integration of Advanced Technologies**: There is an increased focus on integrating advanced technologies, such as GNSS and SBAS, into the PBN framework, reflecting advancements in navigation technology.
- **Alignment with Global Air Navigation Plan (GANP)**: The 5th Edition aligns with the updated ICAO Global Air Navigation Plan (GANP), ensuring that PBN implementation is harmonized with global standards and regional requirements.

5.3 These updates aim to refine and expand the practical application of PBN, facilitating its integration into global air traffic management systems and ensuring its adaptability to evolving aviation technology and operational needs.

5.4 After the presentation, a dedicated session of Q&A was held, providing participants with the opportunity to ask questions and seek clarifications on the new edition of PBN Manual Doc 9613. This interactive session allowed attendees to address any uncertainties or concerns they had, ensuring a deeper understanding of the subject matter. The session facilitated an open dialogue, enabling participants to engage directly with the expert and receive detailed responses, thereby enriching the overall learning experience and ensuring that all relevant points were thoroughly addressed including the ability to choose either RNAV or RNP navigation specifications regardless of the availability of suitable surveillance.

REPORT ON AGENDA ITEM 6: PBN PLANNING AND IMPLEMENTATION IN THE MID REGION

PBN SIDs and STARs Charting

6.1 The subject was addressed in WP/14 presented by Mrs. Pamela Erice, Acting Head of AIM at Air Navigation Department QCAA as the rapporteur PBN SIDs and STARs Charting Ad-Hoc working Group.

6.2 The meeting recalled that the MIDANPIRG/21 meeting had identified discrepancies in PBN SID/STAR charts published in the Aeronautical Information Publications (AIPs) of MID States. These discrepancies, highlighted through a comprehensive data collection campaign, included issues related to chart titles, chart identification, and the PBN Box. Recognizing that the lack of harmonization in PBN SID/STAR charts creates significant challenges for Airspace Users (AUs), leading to potential confusion for both pilots and Air Traffic Control (ATC), the MIDANPIRG/21 meeting, through Decision 21/8, resolved to establish a PBN SID and STAR Charting Ad Hoc Working Group. This Group, in coordination with the AIM Sub-Group, was tasked with developing standardized guidance and specimen PBN SID and STAR charts to address these challenges and promote consistency across the region.

6.3 The meeting was briefed on the outcomes of the PBN SID and STAR Charting Ad-Hoc Working Group. It was noted that, following a virtual meeting with Eurocontrol, the Group reviewed the work conducted by the ICAO EUR/NAT Office and Eurocontrol, highlighting inconsistencies in the presentation of PBN information across SID/STAR charts in the EUR Region as well. This lack of harmonization prompted ICAO EUR/NAT and Eurocontrol to develop a factsheet to address the issue.

6.4 It was noted that the Ad-Hoc Working Group agreed to adopt the factsheet as a regional guideline and emphasized the need for complementary explanatory guidance to ensure its effective implementation. In this regard, Oman generously volunteered to develop and provide the additional guidance to support the application of the factsheet across the region.

6.5 Based on the above and with a view to streamlining efforts, promoting regional harmonization, and aligning with ongoing initiatives, the meeting agreed to the following draft Conclusion:

DRAFT CONCLUSION 9/1: PBN SID/STAR CHARTS HARMONISED AIP PUBLICATION

That, ICAO MID Office:

a) promotes the PBN SID and STAR Charting factsheet at ***Appendix 6A*** *to enhance harmonization in the publication of these procedures across the MID Region, ensuring their widespread dissemination among member states; and*

b) monitors the implementation status of PBN SID/STAR charts and the harmonized AIP publication and provides progress reports to the relevant subsidiary bodies of MIDANPIRG.

6.6 The meeting noted that contributions to the task have so far been limited to Oman, Qatar, Saudi Arabia, Sudan, and the UAE, with several other States yet to participate or provide input. To strengthen collaboration and accelerate progress, the Group welcomed Ms. Hind A. Almohameed, an AIS Inspector at GACA Saudi Arabia, as a new member.

PBN SIDs and STARs Charting factsheet Explanatory Guidance

6.7 The subject was addressed in WP/8 presented by Oman. The Working Paper offered detailed explanatory guidance for MID States on the factsheet for PBN SID/STAR charts within the framework of Harmonized AIP Publication. The guidance aims to support States in understanding the key components and best practices for effective implementation, thereby enhancing the consistency, accuracy, and overall quality of PBN charting across the MID Region.

6.8 The meeting underscored the vital importance of harmonizing PBN SID/STAR charting practices across the Middle East region to improve both operational safety and efficiency. It was noted that the explanatory guidance provided in **Appendix 6B** would support States in achieving a higher level of standardization, bringing substantial benefits to all stakeholders involved in PBN flight operations and fostering greater regional consistency.

GNSS RFI Mitigation and NOTAM GNSS

6.9 The subject was addressed in WP/16 presented by the Secretariat. The working paper presented the revised NOTAM template to be used for GNSS Interference, to facilitate operators in filtering and searching through the NOTAMs.

6.10 It was recalled that States have the responsibility to report the status of air navigation services. If the status of a service changes or is predicted to change, users should be notified via direct communications from ATS and/or via a NOTAM or aeronautical information system as per Annex 15 and the Procedures for Air Navigation Services — Air Traffic Management PANS-ATM, Doc 4444. Therefore, ANSPs must be prepared to act when anomaly reports from aircraft or ground-based units suggest signal interference. If an analysis concludes that interference is present, ANSP must identify the area affected and issue an appropriate NOTAM.

6.11 The meeting also recalled that the MIDANPIRG/20 endorsed through MIDANPIRG Conclusion 20/18 a NOTAM template for GNSS interference. However, in recent times, the Middle East region has experienced an uptick in GPS spoofing events, raising concerns about potential security threats and navigational disruptions. These incidents involve the broadcast of GNSS-like signals that cause avionics to calculate erroneous positions and provide false guidance.

6.12 The meeting acknowledged that based on the recent new entry of GNSS Spoofing, the MIDANPIRG/21 meeting through Conclusion 21/30, invited ICAO and IATA in coordination with AIM SG to develop revised NOTAM template for GNSS interference including jamming and spoofing considering the global and regional developments; by Q4 2024.

6.13 The meeting noted that AN-Conf/14 requested ICAO to continue evaluating the impact of GNSS interference on aviation safety and the continuity of civil aviation operations. ICAO was requested to define appropriate mitigation measures, while reminding States of their obligations in this regard. Additionally, ICAO was tasked with developing guidance material to facilitate the exchange of GNSS RFI information through a centralized repository, as feasible, and to establish procedures for notifying civil aviation of GNSS interference caused by military activities. The conference also called for the introduction of additional NOTAM codes to address GNSS interference events effectively.

6.14 The meeting reviewed and approved the proposed GNSS Radio Frequency Interference (RFI) NOTAM template, provided in **Appendix 6C**, pending the establishment of specific NOTAM codes for GNSS interference events. The template outlines the various fields and values, excluding NOTAM codes, to be used in GNSS NOTAMs in compliance with ICAO formatting rules. To further advance this initiative, the meeting requested the Secretariat to coordinate the template with the AIM Sub-Group for finalization and endorsement.

GNSS reversion & contingency

6.15 The subject was addressed in PPT/17 presented jointly by Eurocontrol and the Secretariat. The presentation addressed the topic of GNSS Reversion/Contingency in the context of PBN operations in all flight phases.

6.16 It was highlighted that Reversion refers to the need to "revert" from primary infrastructure (GNSS) to complementary means (e.g. DME) that contribute to the output of the NAV service in its nominal operation, while the contingency operations refer to a situation when ATM operations cannot continue "normally" (ATM performances might be affected: more staffing, less capacity, etc).

6.17 The meeting noted that, just as controllers and pilots have clearly defined procedures for situations such as loss of surveillance, loss of communication, blocked runways, and adverse weather conditions, similar procedures are essential for the loss of navigation signals. It was emphasized that pilots and controllers require clear and straightforward procedures to handle situations when GNSS becomes unavailable. The relationship between GNSS failure, its operational impact, and the contingency procedures to mitigate this impact must be apparent.

6.18 The meeting discussed the decision-making process which includes layers of involvement, from the ANSP to airspace users and operational personnel. In the event of a GNSS outage, a simple decision could be made to shut down operations, which, while "safe", would be extremely unlikely and unacceptable in terms of business continuity. This highlighted the importance of defining the level of service to be provided during contingency operations.

6.19 Key considerations were outlined for GNSS contingency planning, focusing on capacity, efficiency, and access, all while maintaining required safety levels. Three possible reversion scenarios characterized just like a tap:

- **Scenario 1**: Tap Full off–no traffic flow at all. Capacity restrictions are applied, and operations will cease once the aircraft are either on the ground or have been passed onto the next unaffected ATC unit. A zero-traffic flow is applied in the affected airspace until GNSS services are restored, then full operations will gradually resume.
- **Scenario 2**: Tap full on - no reduction in traffic flow. State or provider can safely maintain the same level of service and throughput of traffic through its airspace. No capacity restrictions are applied within the State's airspace by the service provider and full operations are achieved.
- **Scenario 3**: Tap partially closed – A reduced traffic flow. State or service provider is to limit capacity to maintain a safe throughput of traffic through its airspace. Capacity restrictions are applied, and operations are limited.

6.20 It was highlighted that developing such contingency procedures will require each State and its service provider(s) to evaluate how they would manage air traffic in a degraded operational environment. A critical aspect of this process is the availability of reversionary infrastructure to support future operations, whether based on Performance-Based Navigation (PBN) or conventional navigation. The meeting emphasized that the availability and coverage of this reversionary infrastructure will be key to maintaining traffic flow in the event of satellite signal degradation or loss.

6.21 The meeting was informed that a GNSS Reversion planning tool has been designed by Eurocontrol to support State and ANSP planners in considering the possible options if a GNSS outage occurs or if the signals from space are unreliable or unusable. The tool is available at GNSS Reversion Strategic Decision Making

6.22 Allied to the GNSS Reversion Decision Making tool, the meeting noted that EUROCONTROL has also developed a web-based tool for assessing GNSS threats to aircraft operations. The objective of this tool is to allow the individual States and service providers to assess the risk to their operations from the loss or interruption of the GNSS signals. A set of pre-defined baseline scenarios have been developed which individual users can review or adjust to mirror their own environment. It is hoped that this assessment tool will enable States to draw up a framework of high-risk threats and enable each State to define appropriate mitigation actions to ensure that operations are managed safely in a degraded navigational environment. Access to the GNSS Threat Assessment tool can be found at GNSS Threat Assessment Tool.

6.23 The meeting recalled the requirements of Annex 11 – Air Traffic Services Chapter 2, Section 2.31 which states that ″Air traffic services authorities shall develop and promulgate contingency plans for implementation in the event of disruption, or potential disruption, of air traffic services and related supporting services in the airspace for which they are responsible for the provision of such services. Such contingency plans shall be developed with the assistance of ICAO as necessary, in close coordination with the air traffic services authorities responsible for the provision of services in adjacent portions of airspace and with airspace users concerned″ and those of PANS-ATM Chapter 15 Section 15.6 stipulating that ″The various circumstances surrounding each contingency situation preclude the establishment of exact detailed procedures to be followed″.

6.24 Considering the foregoing, the meeting strongly encouraged States to undertake an awareness campaign on GNSS contingency. Furthermore, the meeting encouraged States to develop Reversion Scenarios and associated Contingency Procedures in the event of GNSS being unusable.

6.25 Based on the above, the meeting agreed to the following Draft Conclusion:

DRAFT CONCLUSION 9/2: GNSS REVERSION & CONTINGENCY PROCEDURES

That:

a) *States are strongly encouraged to raise awareness among Air Navigation Service Providers (ANSPs) and Aircraft Operators (AOs) on GNSS contingency planning to enhance preparedness and operational resilience; and*

b) *Air Navigation Service Providers (ANSPs) and Aircraft Operators (AOs) are urged to develop reversion scenarios and associated contingency procedures to maintain safe and efficient operations in the event of GNSS unavailability.*

Navigation Minimal Operating Networks (NAV MON)

6.26 The subject was addressed in PPT/18 presented jointly by Eurocontrol and the Secretariat. The presentation addressed the topic of the minimum subset of CNS infrastructure required to maintain acceptably safe and secure operations in case of the reversion from the primary infrastructure to an alternative infrastructure, supporting continued normal operations, as well as contingency.

6.27 The meeting recalled MIDANPIRG/21 Conclusion 21/26, which tasked the CNS SG, in coordination with the ATM SG and PBN SG, to review and update, as deemed necessary, the NAV MON Plan Template to be presented to MIDANPIRG/22 for endorsement. The meeting reviewed the template developed by the NAV MON Plan Ad-Hoc Action Group and noted that there were no comments. The updated version is provided in **Appendix 6D**.

RNP APCH guidance material

6.28 The subject was addressed in WP/19 presented by the Secretariat. The Working Paper presents the EUR Doc 025 EUR RNP APCH Guidance Material and proposes the alignment of regional practices and the adoption of best practices for enhanced aviation safety and efficiency.

6.29 The meeting recalled that the MID-RASP 2023-2025 Edition identifies MID Region Safety Performance Measurement and Monitoring (SPMM) with specific safety targets in line with GASP and the RASG-MID continuously monitors the implementation of the Safety Enhancement Initiatives (SEIs) and measures safety performance of regional civil aviation, to ensure the intended targets are achieved using the MID Region SPMM. The MID Region SPMM includes six (6) Goals in line with GASP 2023-2025 Edition. For each Goal established in the MID Region SPMM, identified SEI(s) be mapped to it including their respective actions. Thus, to address regional operational risks, organizational issues, and emerging risks; 24 SEIs and 61 safety actions have been identified, developed and proposed.

6.30 It was also recalled that the G1-SEI-04A1 related to the Controlled Flight into Terrain (CFIT) includes an Action to develop and promote Guidance for designing RNP Approach.

6.31 The meeting noted that the ICAO EUR/NAT Office has developed the RNP APCH Guidance Material, published as EUR Doc 025 at **Appendix 6E**. The guidance describes the generic steps that an ANSP and/or Airport should undertake to introduce such operations together with the applicable standards and relevant documentation that is available. The guidance also addresses aircraft operators by including an overview of the available standards that can be used to obtain airworthiness certification and operational approval.

6.32 Based on the above, and with the aim of saving time and effort, avoiding duplication, supporting the alignment of regional practices, and facilitating the adoption of best practices to enhance aviation safety and efficiency, the meeting agreed to the following Draft Conclusion:

DRAFT CONCLUSION 9/3: GUIDANCE MATERIAL ON RNP APPROACH (RNP APCH)

*That, ICAO MID promotes the guidance material on RNP Approach (RNP APCH) outlined in EUR Doc 025, **at Appendix 6E**, and ensuring its widespread dissemination among MID States.*

GNSS Information in States AIPs

6.33 The subject was addressed in PPT/20 presented by the Secretariat. The presentation provided information concerning the publication of GNSS elements in MID States' AIPs.

6.34 The meeting recalled the ICAO Standards and Guidelines for Publishing GNSS Information in State AIP particularly in AIP parts AD 2.19 Radio navigation and landing aids and ENR 4.3 Global navigation satellite system (GNSS). It was also recalled that ICAO Doc 9849, GNSS Manual, indicates that a State Aeronautical Information Publication (AIP) covering the implementation and uses of

GNSS should include the following aspects:

- a clear statement of terms and conditions, procedures and such things as training requirements;
- background information about GNSS technology and its operational applications;
- current information that can assist AOs in planning for the acquisition of avionic;
- information updates; and
- WGS-84 coordinate system

6.35 The meeting noted that the Secretariat conducted a review of several MID States' AIPs and found that only one State had published the relevant GNSS information. Additionally, the review revealed a lack of uniformity in how States present GNSS data, with inconsistencies observed across different AIP sections. These findings underscore the urgent need to promote harmonization and standardization in the publication of GNSS information to ensure compliance with ICAO provisions and facilitate seamless aeronautical operations.

6.36 Given the importance of this issue, the meeting agreed that the subject should be elevated to the AIM SG for further discussion and appropriate action. The AIM SG is expected to assess the current challenges, provide guidance to States, and develop necessary measures to ensure the consistent and standardized publication of GNSS data across MID States' AIPs.

Revised MID Air Navigation Strategy and Implementation status of the APTA THREAD BLOCK 0 & 1 in MID Region

6.37 The subject was addressed in PPT/21, presented by the Secretariat. The presentation provided an overview of the revised MID Air Navigation Strategy, with a particular focus on the sections related to the APTA Thread, as well as the implementation status of its key elements.

6.38 The meeting recalled that the MIDANPIRG/21 meeting reviewed and endorsed, through MIDANPIRG CONCLUSION 21/2, the MID Region Air Navigation Strategy, Edition, February 2024. The MID Region Air Navigation Strategy edition February 2024 is available at: https://www.icao.int/MID/MIDANPIRG/Documents/eDocuments/MID%20Doc%20002%20-%20MID%20Air%20Navigation%20Strategy%20-%20Apr%202024.pdf

6.39 The meeting noted that following multiple emails, a State letter Ref: ME 3/2.4 & AN 6/28 – 24/173 dated 7 November 2024, issued by the ICAO MID Office, Iran, Kuwait, Lebanon, Syria and Yemen have not provided the status of PBN implementation in their respective States, using the standard reporting format. The meeting urged those States to provide the required data promptly. The meeting also strongly encouraged States to submit the necessary information for the air navigation Report 2024, in accordance with the ICAO MID State letter Ref: AN 1/7 – 24/185 dated on 28 November 2024 concerning the provision of data for the development of the MID Region Air Navigation Report-2024, to ensure comprehensive and accurate regional reporting.

Implementation status of Resolution A37-11 and APTA THREAD BLOCK 0 & 1 in MID Region

6.40 The meeting recalled the key requirement of ICAO Assembly Resolution A37-11, which resolved that States to complete a PBN implementation plan as a matter of urgency to achieve:

a) implementation of approach procedures with vertical guidance (APV) (Baro-VNAV and/or augmented GNSS), including LNAV-only minima, for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016 with intermediate milestones as follows: 30 per cent by 2010, 70 per cent by 2014; and

b) implementation of straight-in LNAV-only procedures, as an exception to a) above, for instrument runways at aerodromes where there is no local altimeter setting available and where there are no aircraft suitably equipped for APV operations with a maximum certificated takeoff mass of 5 700 kg or more;

6.41 The implementation of approach procedures with vertical guidance (APV) (Baro-VNAV and/or augmented GNSS), including LNAV-only minima, is well under way in the MID Region. The meeting noted that the percentage of States in MID Region meeting the resolution Targets is 76.6 percent.

6.42 The meeting recalled that ICAO Assembly Resolution A37 urged States to complete their PBN implementation plans by 2009. The meeting noted that, seven out of the fifteen MID States have submitted their plans to the ICAO MID Office.

6.43 The meeting invited States that have yet to develop and submit PBN implementation plans to do so. States with existing plans should ensure that their plans are robust and are aligned with the MID Region PBN Implementation Plan (MID Doc007) and ICAO PBN requirements.

6.44 The meeting discussed the flexibility of the PBN plan, noting that it could either be developed as a standalone document or integrated into the State's Air Navigation Plan (NANP). This approach allows States to tailor the structure of their planning documents based on their specific needs and existing frameworks, ensuring alignment with ICAO requirements while promoting efficiency in the implementation and management of PBN-related initiatives. Both options provide the necessary flexibility to address the diverse operational and regulatory needs of individual States within the MID Region.

6.45 The meeting reviewed and updated the implementation status of APTA THREAD Blocks 0 and 1 in the MID Region, as summarized in the table below and detailed in **Appendix 6F**.

Element	APTA B0/1	APTA B0/2	APTA B0/4	APTA B0/5	APTA B0/7
Status of Impl in MID	75%	56.5%	65.2%	65.2%	86.6%

6.46 The meeting highlighted the following:

- The status of implementation of the APTA B0/1 related to PBN Approaches (with basic capabilities) reached 75% behind the regional target of 100% by Dec. 2018.
- The status of implementation of the APTA B0/2 related to PBN SID and STAR procedures (with basic capabilities) is 56.5% behind the regional target of 70% by Dec. 2022.
- The status of implementation of the APTA B0/4 and B0/5 reached 65.2%; each element is far behind the regional target of 100% by Dec. 2022.
- The status of implementation of the APTA B0/7 related to Performance based aerodrome operating minima – Advanced aircraft which reached 86.6% above the regional target of 80% by Dec. 2025.

6.47 The meeting reiterated that, in accordance with regional requirements, RNP10 (RNAV10) should be implemented in oceanic airspaces. For continental en-route operations, the implementation of RNAV 5 is expected to be completed by December 2024. Furthermore, States may choose to implement RNAV 1 routes to improve airspace efficiency and enable closer route spacing, provided that adequate communication and surveillance coverage are available.

6.48 The meeting urged those States behind Global and Regional targets to expedite implementation of PBN to achieve the global targets of the Assembly Resolution A37-11 and the regional targets of the MID Air Navigation Strategy.

MID eANP Volume III

6.49 The meeting reviewed and updated the MID eANP Volume III (APTA Tables), as at **Appendix 6G**.

RNP AR feasibility study in Khasab

6.50 The subject was addressed in PPT/22, presented by Oman. The presentation included a feasibility study on the implementation of RNP AR at Khasab Airport.

6.51 The meeting noted that Khasab Airport currently operates solely under VFR conditions, with no published instrument approach procedures. Surrounded on three sides by mountainous terrain, the airport's geography poses significant challenges to the development of conventional instrument approach procedures. To address these limitations, the Oman CAA is evaluating the feasibility of RNP AR implementation at RWY19 aimed at improving airport accessibility and optimizing operations.

6.52 The meeting was informed that the application of RNP-AR procedures to terminal area and approach operations leverages the advanced capabilities and performance of modern aircraft to enhance safety, efficiency, capacity, and accessibility. By incorporating high levels of navigational accuracy, integrity, and functional capability, RNP-AR enables precise operations in conditions where other approach types may be inadequate or unfeasible.

6.53 Furthermore, the meeting noted that the accessibility of Khasab Airport could be significantly enhanced through the implementation of RNP-AR procedures. RNP-AR enables operations in challenging environments, such as mountainous terrain or densely populated areas, where traditional approaches may be limited. This capability enhances access to the airport, even under adverse weather conditions, thereby increasing operational availability and ensuring continuity of service.

PBN Instrument Flight Procedures in Aqaba with DME/DME

6.54 The subject was addressed in WP/23, presented by Jordan. The Working Paper highlighted the challenges faced by Aqaba Airport due to its complex terrain and susceptibility to GNSS interference. It proposed integrating DME/DME navigation as a backup for RNP 1 procedures to enhance resilience. Additionally, the paper explored the feasibility of expanding DME coverage to support RNAV 1 and RNAV 5 navigation throughout the Country. The paper outlined the project's achievements, identified current challenges, and emphasized the need for collaborative efforts to ensure robust and reliable navigation solutions.

6.55 It was noted that support is needed in several key areas, including providing technical guidance on DME/DME integration, developing assessment methodologies for terrain and infrastructure challenges, and offering recommendations for optimizing DME network design to meet RNP and RNAV requirements. This collaboration is essential to ensure the successful planning and implementation of the study, aligning with international best practices and enhancing the region’s navigation capabilities.

6.56 To ensure a reliable backup in case of GNSS failure, it was pointed out that it is essential to conduct a comprehensive coverage study to verify that DME/DME can consistently meet RNP 1 navigation specifications. This study will be critical in confirming the effectiveness of DME/DME as a navigation solution, particularly in GNSS-compromised scenarios. To support this effort, guidance is requested on how to conduct the DME coverage study, including the technical standards, methodologies, and ICAO regulatory requirements necessary to ensure RNP 1 accuracy when using DME/DME as an alternative navigation system.

6.57 The meeting noted that CARC feasibility study will include the evaluation of the integration of DME/DME systems as a backup for RNP 1 procedures at Aqaba Airport. The study should assess the potential for expanding DME coverage to support RNAV 5 operations at ENR phase of flight and identify the necessary modifications to existing infrastructure as well as guidance on technical standards, publication processes, and the readiness of airline fleets to adopt DME/DME/IRU-based navigation, ensuring a seamless transition and enhanced system resilience.

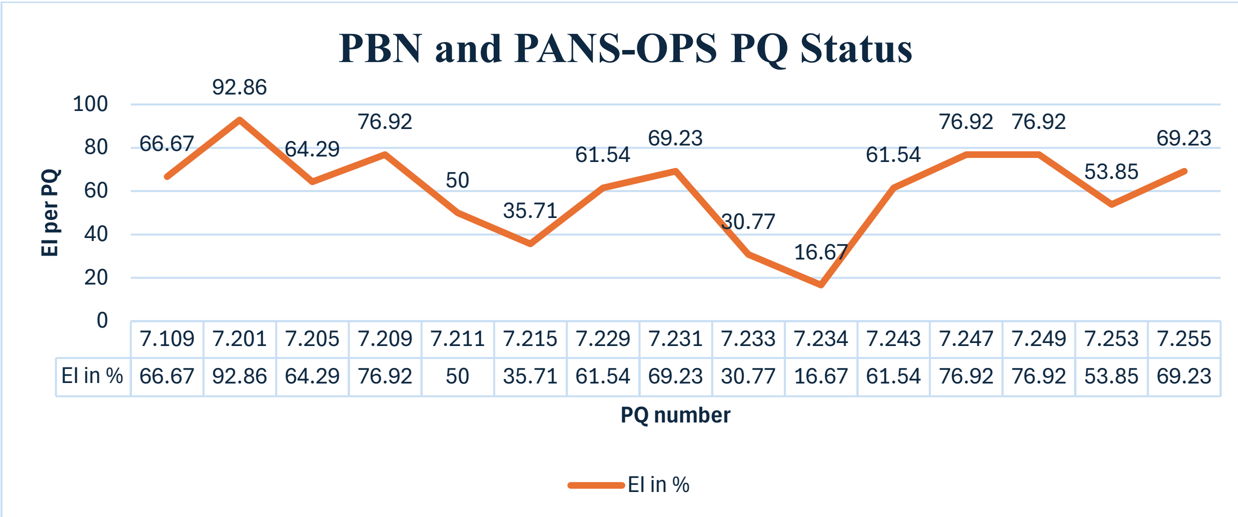
6.58 The meeting expressed its appreciation for the commitment of Oman and the Secretariat to support Jordan's initiatives in these areas. The outcomes of this collaborative effort, including advancements in DME/DME integration and the optimization of the DME network, will be presented at the PBN SG/10 meeting. These results will offer valuable insights for all States, promoting the sharing of experiences and lessons learned. The meeting also extended its gratitude to Jordan for presenting the case study, which will make a significant contribution to enhancing regional expertise and advancing collective efforts in navigation improvement.

IFP provisions and oversight capability in MID Region

6.59 The subject was addressed in PPT/24 presented by the Secretariat. The presentation provided information concerning the IFP provisions and oversight capabilities in MID Region.

6.60 The meeting noted the importance of the State Safety Oversight function, specifically the implementation of the eight critical elements (8 CEs), as a foundational framework for ensuring safety in aviation operations. Additionally, the meeting highlighted the role of service providers in establishing robust processes and procedures for Instrument Flight Procedure (IFP) development, including the creation of operational and quality manuals. Emphasis was placed on the provision of services, which encompasses designing and publishing procedures based on State-specific criteria, conducting periodic reviews, ensuring continuous maintenance, implementing quality assurance measures, providing comprehensive training and qualification programs, and integrating a Safety Management System (SMS) to uphold safety and efficiency standards.

6.61 The meeting noted also the following Chart illustrating the effective implementation of each Protocol Question (PQ) related to PBN and PANS-OPS within the Middle East (MID) Region. This graphical representation provides a clear overview of the progress and areas requiring further improvement, supporting the region's efforts to enhance compliance and operational efficiency in accordance with ICAO standards and recommended practices.



6.62 The meeting highlighted the need for States to ensure compliance with ICAO provisions and enhance regional capabilities in Performance-Based Navigation (PBN) and Instrument Flight Procedure Design (IFPD). States were urged to establish or ensure the availability of IFPD services in compliance with ICAO Annex 11 requirements, identify gaps in their current services, and develop action plans to address these gaps effectively.

6.63 Recognizing the importance of robust safety oversight, the meeting encouraged States to prioritize building safety oversight capabilities for PBN and PANS-OPS operations. This includes allocating resources for training and certification programs for safety inspectors and procedure designers to align with global safety standards.

6.64 On the other hand, the meeting agreed to organize a regional workshop dedicated to PBN implementation, IFPD services, and safety oversight practices in IFP. States and stakeholders were encouraged to actively participate in the workshop, with the aim of exchanging experiences, addressing challenges, and promoting greater collaboration across the region. Therefore, the meeting agreed to the following Draft Conclusion:

DRAFT CONCLUSION 9/4: PBN AND PANS-OPS SAFETY OVERSIGHT WORKSHOP

That,

a) A PBN and PANS-OPS Safety Oversight Workshop be organized in 2025; and

b) States and stakeholders are encouraged to actively participate in the workshop to exchange experiences, address challenges, and foster collaboration.

Smart Procedure Validation – IFPDAVA

6.65 The subject was addressed in PPT/25 presented by the PVS Aero, as a member of IFPDAVA.

6.66 The meeting noted that the upcoming change in ICAO Doc 9906 Vol 5 Edition 2 will provide a clearer structure of the possibilities perform procedure validation. So-called “Flight Validation” means commencing validation either with an aircraft or with a simulator or a combination of both in the most resourceful way. This exactly enables the shortening of the validation timeframe, supports the sustainability, and enhances efficiency.

6.67 It was highlighted that the reinforced implementation of **Simulator Flight Validation** is an important step to keep significant benefits for upcoming validation processes:

- **Procedure validation fitting** with **daily aerodrome flight ops** independent from operational peaks
- **NO live traffic interference**
- **independent** of any **WX influence**
- fly procedure under **realistic marginal WX minima**, difficult to experience in a real aircraft with real WX
- **perfect realism** concerning **human factors** and **pilot's** realistic **workload management** issues
- **proper aircraft types** in validation process
- **enhanced GPWS** in terrain database in threating environment

6.68 The meeting appreciated the insightful presentation delivered by PVS Aero. Participants acknowledged the valuable information and perspectives shared, which significantly contributed to the discussions and enhanced understanding of the Flight Validation.

Data collection and validation for IFP Design

6.69 The subject was addressed in PPT/27 presented by the ADL, as a member of IFAIMA. The meeting noted that Aeronautical Surveying agencies originates the data related to geographical location of NAVAIDS, Aerodrome features like RWY, TWY, etc., Obstacles and Terrain. These agencies are not trained enough to understand the usability of this data from procedure design perspective. This leads to reduce the confidence of procedure designer on the data provided. Due to that the designer has to set few assumptions and that reduces efficiency of the design.

6.70 It was highlighted that to overcome this scenario, the solution was presented in two steps:

1. **Design the CAR** which will outline following points:
   a. Frequency of Survey for every aerodrome (Initial + Check Survey)
   b. Fixing Datum
      (WGS 84 - Horizontal & EGM - Vertical)
   c. List of Deliverables for each survey data and survey report:
      i. Format
      ii. Accuracy
      iii. Uniformity Geographic extends
2. **Certification of agencies** for Aeronautical Survey by two steps :
   a. Call for online Application from agencies - **Step 1**
      i. Team Details (Education, Training, KRA) - Competency mapping
      ii. Process (SMS / QMS, Methodology, Approach)
      iii. Technology (Software, Equipments, Maintenance)
   b. Physical Audit - **Step 2**
      i. Verification
      ii. Setting up expectations

iii. Interview of team
iv. Experience of systems

6.71 The meeting noted that team members from the IFP oversight unit should be involved in the design of the Certification and Authorization Requirements (CAR) and the certification process for agencies. It was emphasized that only data from certified agencies should be accepted by the regulator from aerodrome operators. Additionally, certified agencies must undergo audits at regular intervals, ideally every 24 to 36 months, to maintain compliance and ensure high standards.

6.72 The benefits of this approach include achieving uniformity across the State in data presentation, which enhances consistency and standardization. It also increases the confidence of procedure designers, knowing that the data provided meets certified standards. Furthermore, it fosters greater awareness among surveyors by highlighting the perspective and expectations of end users.

6.73 The meeting expressed its appreciation for the comprehensive presentation delivered by ADL, member of IFAIMA, on data collection and validation for IFP design.

MID FPP Sustainability

6.74 The subject was addressed in WP/26 presented by the Secretariat. The Working Paper provided an update on the MID FPP achievements, challenges, and the future of the Programme (sustainability).

6.75 The meeting recalled that the Seventh Meeting of the Directors General of Civil Aviation-Middle East Region (DGCAMID/7) held the Kingdom of Saudi Arabia in Riyadh, on 19 and 20 May 2024, agreed through DGCA-MID/7 Conclusion 7/2, that:

a) the ICAO MID Office and the MID FPP SC further explore possible options for the continuation of the MID FPP with a different business model, focusing only on capacity-building activities;
b) the MID FPP Funding Mechanism be revised;
c) the MIDANPIRG/22 take the final decision with regard to the future of the MID FPP; and
d) a briefing report on the MID FPP be presented to the DGCA-MID/8 meeting.

6.76 The meeting noted that considering the outcomes of the DGCA-MID/7 meeting, the Sixth meeting of the MID Region Flight Procedures Programme Steering Committee (MID FPP SC/6) held virtually, on 20 August 2024, recognized that the financial shortfall has become a persistent barrier hindering progress and impacting the achievement of the MID FPP's objectives. In light of these challenges, the meeting agreed that in order to ensure the continued success and sustainability of the programme, it is necessary that a volunteer State host the MID FPP and provide the necessary support for the management of the programme (provision of a MID FPP Manager and necessary facilities and tools, etc.); similar to the APAC experience with China as the Host State providing significant support.

6.77 The meeting was also informed of an alternative approach to ensure the continued sustainability of the MIDFPP, which involves ICAO MID maintaining the management of the programme. This could be achieved through agreements with one or more ICAO-approved PANS-OPS design organizations to oversee Instrument Flight Procedure (IFP) projects within the MID Region. Furthermore, partnerships could be established with other Flight Procedure Programmes (FPPs) and the École Nationale de l'Aviation Civile (ENAC) in Toulouse to offer training tailored to the specific needs of MID States. This strategy aims to enhance the programme's capacity and effectively address regional requirements.

6.78 The meeting will be kept informed of the progress and the options to be implemented through regular updates. A detailed overview of the developments will be presented during the MIDANPIRG/22 and PBN SG/10 meetings, where further discussions/Decisions will take place.

REPORT ON AGENDA ITEM 7: Future Work Programme

ELECTION OF THE CHAIRPERSON, REVISION OF TOR AND FUTURE WORK PROGRAMME

7.1 The subject was addressed in WP/28 presented by the Secretariat.

7.2 The election of chairpersons, originally anticipated as part of the agenda, did not take place. Following extensive discussions, the meeting agreed to defer this process to the upcoming PBN SG/10 meeting, scheduled for 2025. This decision was made to allow sufficient time for thorough preparation and to ensure the involvement of all key stakeholders in the election process.

7.3 The meeting reviewed and updated the PBN SG Terms of Reference (TORs) and no proposed changes were provided.

7.4 The meeting noted with appreciation the generous offer received from Saudi Arabia to host the PBN SG/10 meeting and the IFP oversight Workshop.

7.5 Therefore, the meeting agreed that the PBN SG/10 meeting be held in Saudi Arabia during Q4 2025 back-to-back with the IFP oversight Workshop. The exact venue/dates will be communicated with the PBN SG members in due time.

REPORT ON AGENDA ITEM 8: ANY OTHER BUSINESS

8.1 Nothing has been discussed under this Agenda Item.

APPENDICES

APPENDIX 2

FOLLOW-UP ON MIDANPIRG/21 CONCLUSIONS & DECISIONS

No.	Conclusions and Decisions	Concerns/ Challenges (Rationale)	Deliverable/ To be initiated by		Target date	Status/Remarks
C.4	**RISKS RELATED TO ALTIMETER SETTING ERRORS DURING APV BARO-VNAV AND NON-PRECISION APPROACH OPERATIONS**					**Completed**
	That, ICAO MID promotes the EUR OPS BULETIN at Appendix 3B on Risks related to altimeter setting errors during APV Baro-VNAV and non-precision approach operations and ensures the widespread dissemination of this bulletin among member States.	Raise awareness and set of recommendations to mitigate altimeter setting errors	SL	ICAO MID	2024	SL Ref: AN 8/4.1 – 24/095 3 June 2024
C.21/2	**MID REGION AIR NAVIGATION STRATEGY, EDITION, FEBRUARY 2024**					**Completed**
	That, the MID Region Air Navigation Strategy, Edition February 2024 (ICAO MID DOC 002), is endorsed and be published by the ICAO MID Office.	To harmonize the implementation within the Region	Revised version of MID Doc 002	ICAO MID	Feb 2024	ICAO MID DOC 002 posted at https://www.icao.int/MID/MIDANPIRG/Documents/eDocuments/MID%20Doc%20002%20-%20MID%20Air%20Navigation%20Strategy%20-%20Apr%202024.pdf
C.21/3	**NATIONAL AIR NAVIGATION PLAN (NANP)**					**Actioned to be closed**
	That, the MID States with support of ICAO MID Office develop their National Air Navigation Plan (NANP) by end of December 2024.	Implementation of RANP within the MID Region	National Air Navigation Plans	MID States	Dec 2024	Kuwait ANP developed Jordan ANP ongoing Requests from Iran and Qatar
C.21/4	**MID AIR NAVIGATION REPORT - 2023**					**Completed**
	That, the MID Air Navigation Report-2023 is endorsed and be published by the ICAO MID Office.	Reflect the implementation Status of RANP within the MID Region	MID Air Navigation Report 2023	ICAO MID	March 2024	ANR 2023 posted at https://www.icao.int/MID/MIDANPIRG/Documents/Air%20Navigation%20Report/MID%20AN%20Report-2023%20rev.%20Apr%202024.pdf

No.	CONCLUSIONS AND DECISIONS	CONCERNS/ CHALLENGES (RATIONALE)	DELIVERABLE/ TO BE INITIATED BY		TARGET DATE	STATUS/REMARKS
C.21/6	**WEBINAR ON PERFORMANCE-BASED AERODROME OPERATING MINIMA (PBN-AOM)**					**Completed**
	That, a Webinar on the Performance-Based Aerodrome Operating Minima (PB-AOM) be organized in 2024.	To provide a deep understanding of the PBAOM and its concept of operations.	Webinar	ICAO	2024	The webinar has been replaced by a dedicated session on the subject, which was conducted during the PBN SG/9 meeting.
C.21/7	**WORKSHOP ON PBN/GNSS**					**On-going**
	That, ICAO, jointly with ACAO organize a Workshop on PBN/GNSS in 2024.	To provide a forum for sharing the current developments and future evolutions related to GNSS along with implementation of different GNSS elements/options and associated challenges.	Workshop	ACAO and ICAO	2024	ACAO/ICAO Workshop on PBN/GNSS is postponed to 2025
C.21/8	**PBN SID AND STAR CHARTING AD HOC WORKING GROUP**					**Completed**
	That a PBN SID and STAR Charting Ad Hoc Working Group, *a) be established to develop guidance/Specimen of PBN SID and STAR Charts, in coordination with the AIM Sub Group.* *b) be composed of:* *— Chairpersons of the PBN SG and the AIM SG* *— Mr. Taha Mohamed Taha (Egypt)* *— Rohallah Salehi (Iran)* *— Mohammad Mahanpour (Iran)* *—Mr. Raed Ghazawi (Jordan)* *— Mr. Sulaiman Selmi (Oman)*	To develop guidance/Specimen of PBN SID and STAR Charts to promote harmonization and consistency in the publication of PBN charts	Guidance/Specimen of PBN SID and STAR Charts	*PBN SID and STAR Charting Ad Hoc Working Group*	2024	

No.	CONCLUSIONS AND DECISIONS	CONCERNS/ CHALLENGES (RATIONALE)	DELIVERABLE/ TO BE INITIATED BY		TARGET DATE	STATUS/REMARKS
	— Mr. Suwarn Raj Upadhyay (Oman) *— Mrs. Pamela Erice (Qatar)* *— Mr. Muhammad Aljuhani (KSA)* *— Mr. Ayed Murfat (KSA)* *— Mr. Saqr Obaid Al Marashda (UAE)* *— Mr. Kedari Manthanwar (UAE)* *— ICAO Secretariat* *c) presents its outcome to the PBN SG/9 and AIM SG/11 meetings.* *d) be dissolved upon the successful completion of its assigned tasks.*					
C.21/22	**FREE ROUTE AIRSPACE (FRA) IMPLEMENTATION WORKSHOP**					**Completed**
	That, the ICAO MID Office organize Workshop in 2024 with support of IATA and concerned States and Stakeholder, to foster the implementation of FRA in the MID Region.	Foster the implementation of FRA within the Region	FRA Workshop	ICAO MID	2024	Free Route Airspace Workshop conducted (Doha, Qatar, 30 September 2024)
C.21/26	**NAV MON PLAN TEMPLATE**					**Completed**
	That, the CNS SG in coordination with ATM SG and PBN SG review and update, as deem necessary, the NAV MON Plan Template to be presented to MIDANPIRG/22 for endorsement.	Consultation for the implementation methodology and criteria related to the regional Navigation MON.	Updated MON NAV plan template	States	2025	
C.21/30	**REVISED NOTAM TEMPLATE FOR GNSS INTERFERENCE**					**On going**
	That, *a) ICAO and IATA in coordination with AIM SG Chairpersons to develop revised*	To provide States with a standard NOTAM template to be used for GNSS Interference	NOTAM template for GNSS RFI	ICAO and IATA	2024	

No.	CONCLUSIONS AND DECISIONS	CONCERNS/ CHALLENGES (RATIONALE)	DELIVERABLE/ TO BE INITIATED BY		TARGET DATE	STATUS/REMARKS
	NOTAM template for GNSS interference including jamming and spoofing considering the global and regional developments; by Q4 2024 and *b) ICAO MID Office circulate the revised NOTAM Template for GNSS interference through State Letter for implementation by States.*	to facilitate operators in filtering and searching through the NOTAM on GNSS Interference				
C.21/27	**GNSS RFI Mitigation**					**On going**
	That, *a) States affected with GNSS RFI take necessary mitigation measures and provide update to the ICAO MID Office by* ***30 May 2024****; and* b) *the ATM SG in coordination with AIM, CNS and PBN SGs to address the reported occurrences and review the MID RSA 014 on GNSS Vulnerabilities as deemed necessary to be presented to MIDANPIRG/22 – RASG-MID/12 for endorsement*	Safety risk associated with GNSS interference	Revise MID RSA014	States	2025	
D.21/33	**MIDANPIRG REVISED STRUCTURE**					**On going**
	That, the revised MIDANPIRG Structure 2024 is endorsed to be included in MIDANPIRG Procedural Handbook.	Consistency in establishment of experts groups	Revised MIDANPIRG structure	MIDANPIRG	2025	

EUROCONTROL

PBN SID/STAR charts Harmonised AIP Publication

v1.0
29 January 2024

SUPPORTING EUROPEAN AVIATION

CONSORTIUM COORDINATOR sesar DEPLOYMENT MANAGER

FOUNDING MEMBER sesar JOINT UNDERTAKING

NETWORK MANAGER

Introduction

EUROCONTROL monitors the implementation of Performance-Based Navigation (PBN) procedures in ECAC using the PBN Map tool, integrating data from national AIPs and implementation plans derived from PBN Transition plans produced by ATM/ANS providers.

Each AIRAC cycle prompts a thorough examination of national AIPs, with a specific focus on identifying new PBN procedures, particularly Standard Instrument Departures (SIDs) and Standard Instrument Arrivals (STARs).

It was identified that PBN information is dispersed across various sections of SID/STAR charts, varying by country or airport, contrary to the specific promulgation principles outlined by ICAO. This inconsistency prompted EUROCONTROL to address the lack of harmonization in European PBN SID/STAR charts in various stakeholder groups. The need for harmonization was agreed, with the support for creating a factsheet, especially given the mandate by the European PBN implementing regulation (EU 1048/2018) that necessitates the implementation of PBN SID/STAR at every instrument runway where these procedures are published.

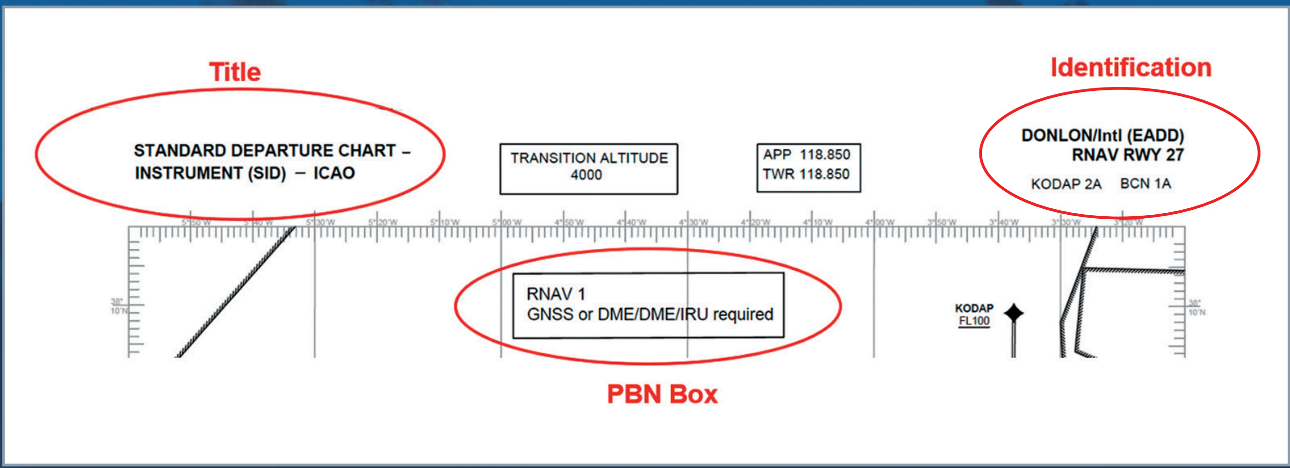
This factsheet, designed for specialists responsible for chart origination, includes illustrative examples and corresponding references to ICAO documentation. It is essential to note that this resource is intended to enhance understanding and promote harmonization but does not seek to replace or override state regulations or ICAO requirements regarding AIP publication and charting.

Objective

The development of this factsheet aims to heighten awareness regarding the charting of PBN SID/STAR in accordance with ICAO principles. The primary objective is to foster harmonization in the publication of these procedures across Europe, especially in anticipation of the increased number of PBN SID/STAR charts due to the PBN Implementing Regulation (EU 1048/2018).

Specifically, this factsheet concentrates solely on three key chart elements:

- Title
- Identification
- PBN box

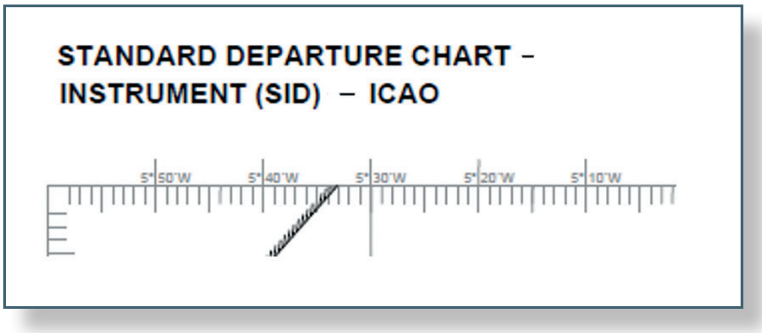


PBN SID/STAR - Chart Title

According to ICAO Doc 8697 Aeronautical Chart Manual, chapter 7.9 (SID):

Title
*"The title must be "**Standard Departure Chart - Instrument (SID) - ICAO**". Such title must not include "ICAO" unless the chart conforms with all Standards specified in Annex 4, Chapters 2 and 9. The chart title is placed at the top left corner of the chart in bold upper-case type".*

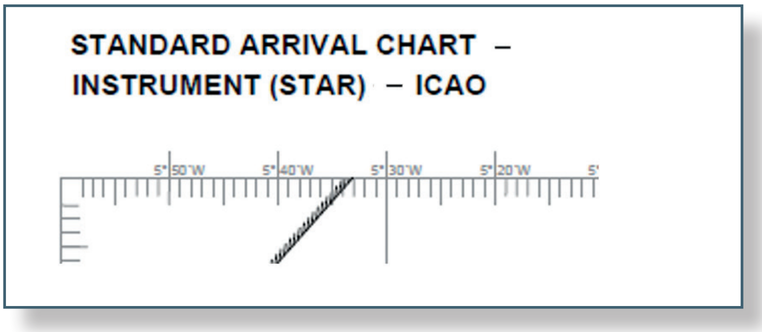
Example:



According to ICAO Doc 8697 Aeronautical Chart Manual, chapter 7.10 (STAR):

Title
*"The title must be "**Standard Arrival Chart - Instrument (STAR) - ICAO**". Such title must not include "ICAO" unless the chart conforms with all Standards specified in Annex 4, Chapters 2 and 10. The chart title is placed at the top left corner of the chart in bold upper-case type."*

Example:



PBN SID/STAR - Chart Identification

According to ICAO Doc 8168 PANS-OPS Vol II, Part III, Section 5, Chapter 1.3.2 "Chart Identification":

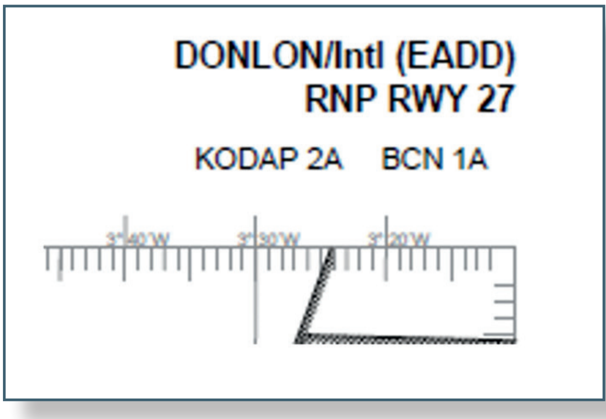
"The chart shall be identified in accordance with Annex 4, 9.5 for departures and 10.5 for arrivals and ***shall include the term RNAV or RNP, depending on the navigation specification****."*

According to ICAO Doc 8697 Aeronautical Chart Manual, chapter 7.9 (SID) and 7.10 (STAR) "Identification":

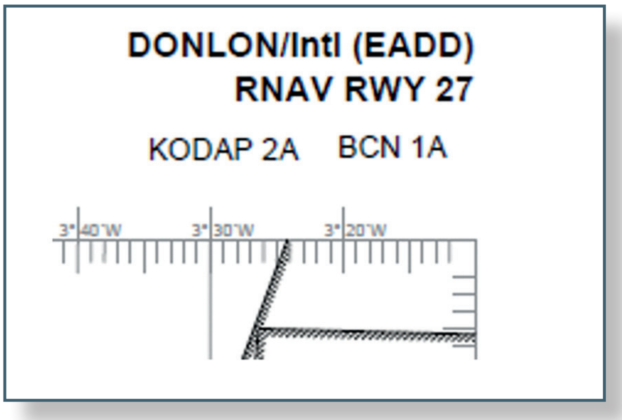
"The chart must be identified by the name of the city or town, or area, that the aerodrome serves, the name of the aerodrome, and the identification of the standard departure/arrival route(s) — instrument as established in accordance with the PANS-OPS, Volume II, Part I, Section 3. The identification of the standard departure/arrival route(s) — instrument is provided by the procedures specialist.

The ICAO location indicator may also be included with the name of the aerodrome. ***The chart identification is placed at the top right corner of the chart in bold upper-case type****."*

Example for PBN SID/STAR based on RNP:



Example for PBN SID/STAR based on RNAV:



PBN SID/STAR - PBN BOX

According to ICAO Doc 8168 PANS-OPS Vol II, Part III, Section 5, Chapter 1.3.4 "Chart notes":

"Additional procedure requirements shall be provided as chart notes. ***PBN items shall be separated out and published in a PBN requirements box on the plan view of the chart*** *immediately below the chart identifier.* ***The PBN requirements box shall include the identification of the navigation specification used in the procedure design, any navigation sensor limitations (e.g. GNSS required, GNSS or DME/DME/IRU required), and any required functionalities (e.g. RF required)*** *that are described as options in the navigation specification, that is, not included in the core navigation specification."*

Examples of PBN boxes:

RNAV 1
GNSS or DME/DME/IRU required

RNP 1
RF required

RNAV 1
GNSS required

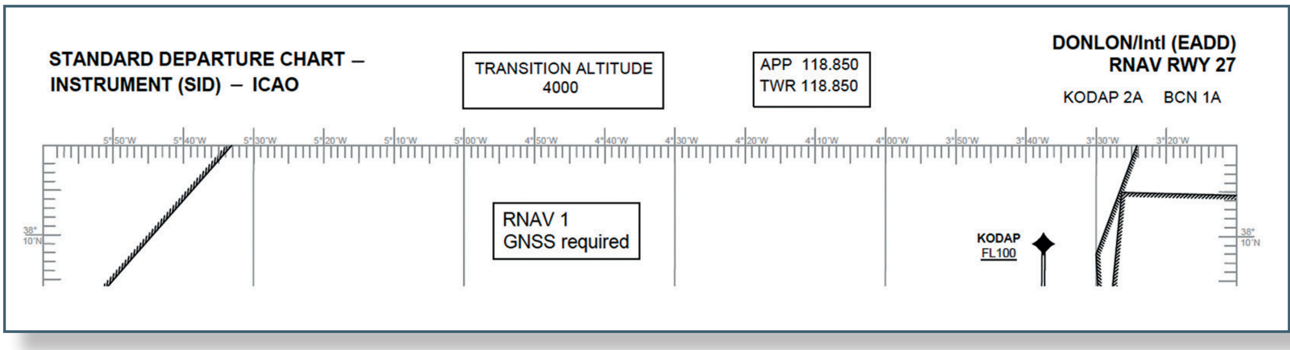
RNP 0.3

Advanced RNP

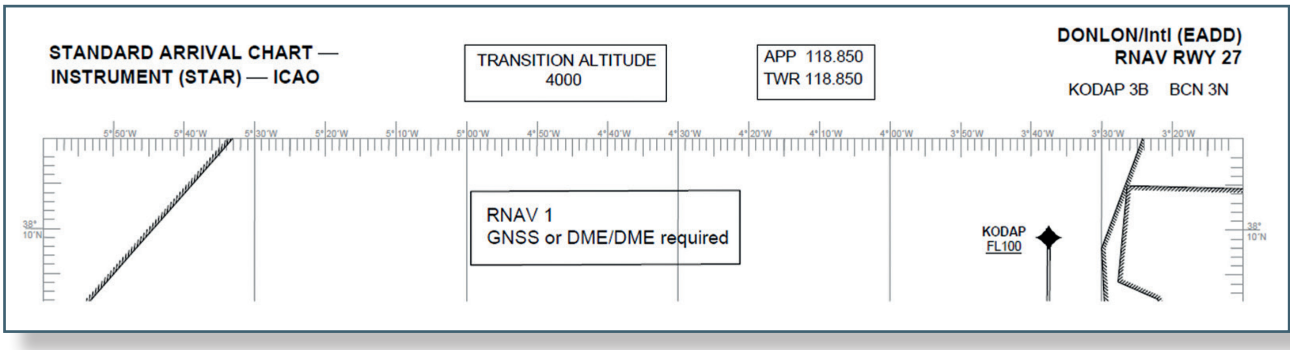
RNAV 5
GNSS or DME/DME required

PBN SID/STAR EXAMPLES

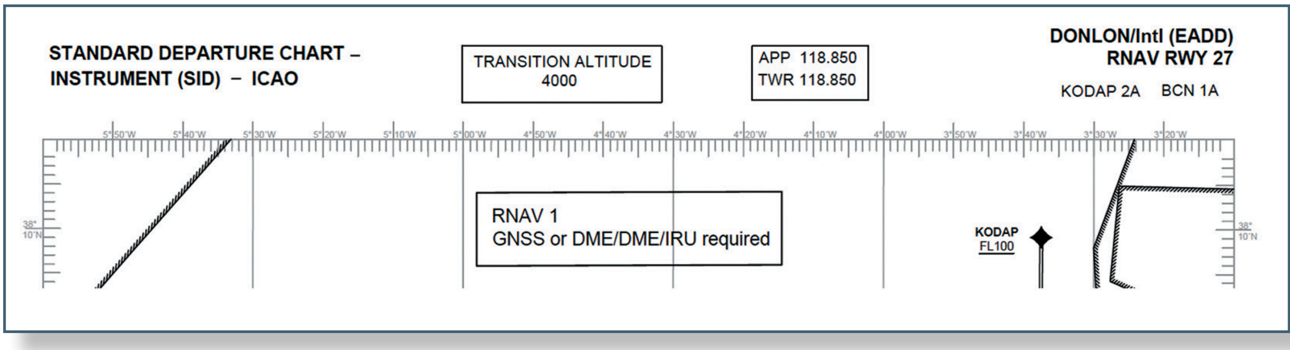
Navigation specification: ***RNAV 1***
Navigation sensor limitations: ***GNSS required*** *(DME/DME is not available)*
Functional requirement: ***None***



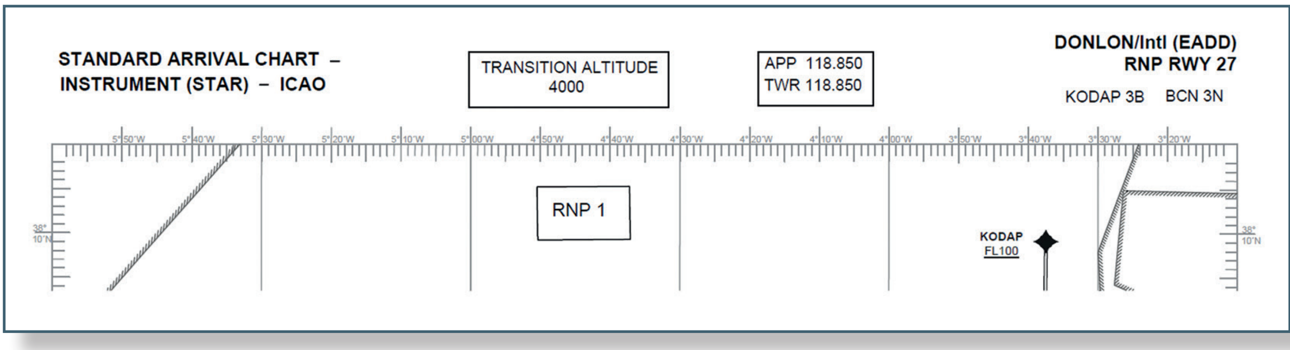
Navigation specification: ***RNAV 1***
Navigation sensor limitations: ***None*** (GNSS and DME/DME are available)
Functional requirement: ***None***



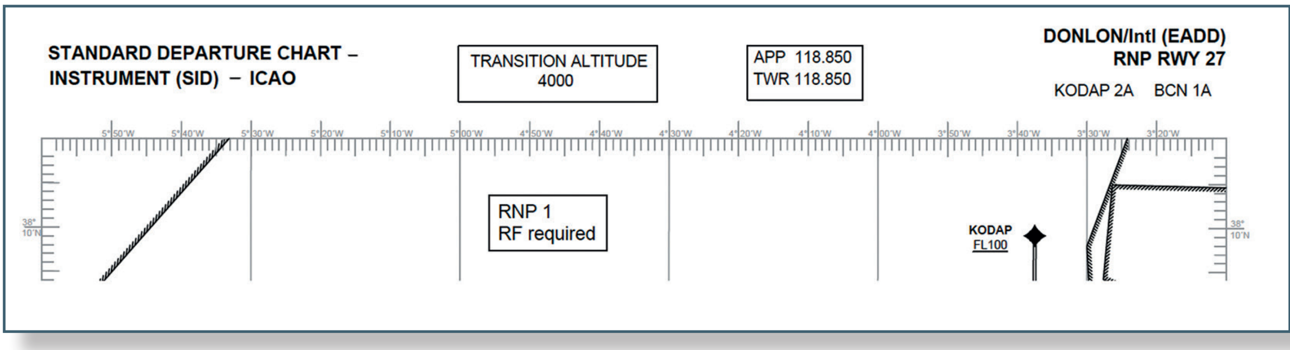
Navigation specification: ***RNAV 1***
Navigation sensor limitations: ***GNSS or DME/DME/IRU required****.*
Functional requirement: ***None***



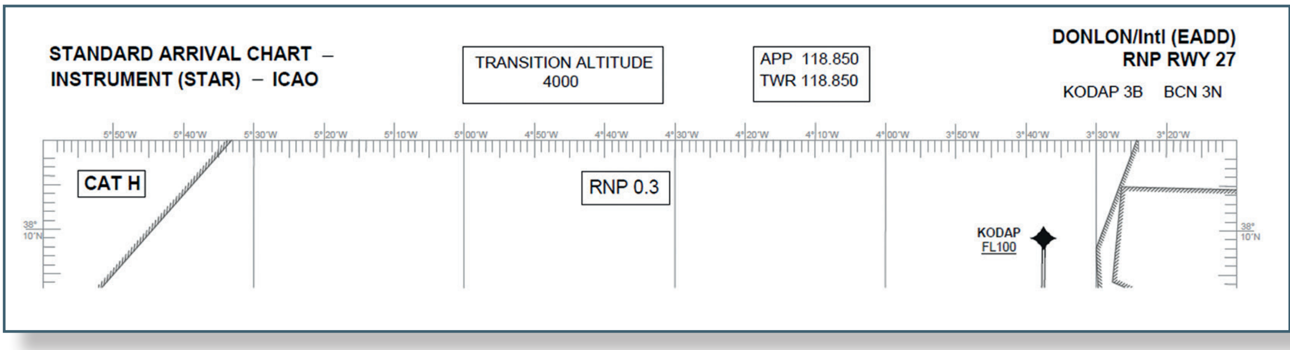
Navigation specification: ***RNP 1***
Navigation sensor limitations: ***None*** *(GNSS required)*
Functional requirement: **None**



Navigation specification: ***RNP 1***
Navigation sensor limitations: ***None*** *(GNSS required)*
Functional requirement: ***RF required***



Navigation specification: ***RNP 0.3*** *(CAT H)*
Navigation sensor limitations: ***None*** *(GNSS required)*
Functional requirement: **None**



Glossary

AIP	Aeronautical information publication
ANS	Air navigation services
ATM	Air traffic management
DME	Distance measuring equipment
GNSS	Global navigation satellite system
IRU	Inertial reference unit
PBN	Performance-based navigation
RF	Radius to fix
RNAV	Area navigation
RNP	Required navigation performance
SID	Standard instrument departure
STAR	Standard instrument arrival

Further Information

The EUROCONTROL Navigation Steering Group (NSG) coordinates the activities necessary for the implementation of PBN procedures in ECAC.

For more information, please contact the nav.user.support@eurocontrol.int or visit our website: https://www.eurocontrol.int/communications-navigation-and-surveillance

EUROCONTROL

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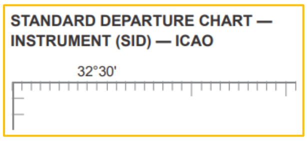
APPENDIX 6B

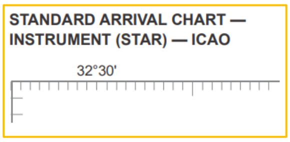
ICAO Charting Provisions

1. ICAO Provisions for Chart Titles:

References: ICAO Annex 4, Doc 8697 and Doc 8168 Vol. II

a. Chart shall be titled in accordance with Annex 4 specifications.
b. The chart title shall not include "ICAO" unless the chart conforms with all ICAO Standards mentioned in the Annex.
c. The title must be "Standard Departure Chart — Instrument (SID) — ICAO" for SID and "Standard Arrival Chart — Instrument (STAR) — ICAO" for STAR.
d. The chart title is placed at the top left corner of the chart in bold upper-case type.

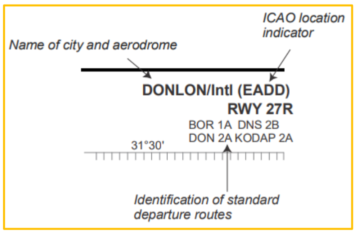


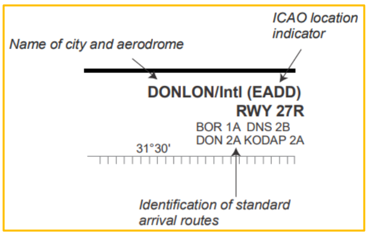


2. ICAO Provisions for Chart Identifications:

References: ICAO Annex 4, Doc 8697 and Doc 8168 Vol. II

a. The chart shall be identified in accordance with Annex 4 requirements and shall include the term RNAV or RNP, depending on the navigation specification.
b. The chart should include an identifier which is unique for that aerodrome and which may include reference to either a runway, fix or NAVAID.
c. The chart shall be identified by the name of the city or town or area which the aerodrome serves, the name of the aerodrome, and the identification of the SID or STAR.
d. The ICAO location indicator may also be included with the name of the aerodrome.
e. The chart identification is placed at the top right corner of the chart in bold upper-case type.





3. ICAO Provisions for PBN Requirement Boxes:

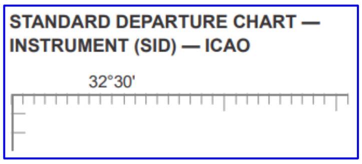
Reference: Doc 8168 Vol. II

a. The provision of PBN requirement boxes is missing in Annex 4 and Aeronautical Chart Manual and specification charts except for those in Doc 8168, Vol. II.
b. PBN items shall be published in a PBN requirements box.
c. The PBN requirements box shall include:
   - the identification of the navigation specification used in the procedure design, such as RNAV 5, RNAV 2, RNAV 1, A-RNP, RNP AR and RNP 1.
   - any navigation sensor limitations, such as GNSS required, DME/DME required.
   - any required functionalities that are described as options in the navigation specification, such as RF required.

<u>Guidance for Chart Harmonization:</u>

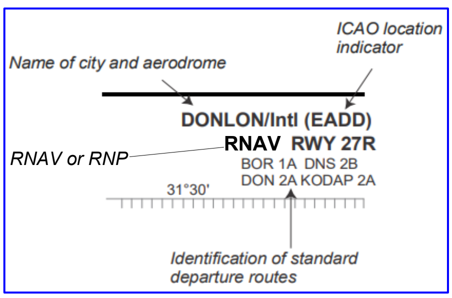
1. Standardizing Chart Titles:

a. Ensure all SID charts are titled as "Standard Departure Chart - Instrument (SID) - ICAO" and all STARs charts as "Standard Arrival Chart - Instrument (STAR) - ICAO".
b. The title should be placed at the top left corner of the chart in bold upper-case type.
c. Do not use ICAO in the chart title if the chart does not meet the Annex 4 charting criteria.
d. Do not use any other things, such as PBN, RNAV, RNP or DEP/ARR, in the chart titles.

Example: 

2. Consistent Chart Identification:

a. Identify charts by the name of the city or town, the aerodrome name, and the identification of the standard departure/arrival routes.
b. Include the ICAO location indicator with the name of the aerodrome.
c. The chart identification should be placed at the top right corner of the chart in bold upper-case type.
d. Use 'RNAV' or 'RNP' based on the navigation specification used in designing the SIDs or STARs. For example, use 'RNAV' for an RNAV1 SID or STAR, and use 'RNP' for an RNP1 SID or STAR, before the runway designation.

Example: 

3. Requirements for PBN Boxes:

a. Include PBN items in the PBN requirements box, preferably on the plan view of the chart, not obscuring the chart information. Do not use such information in any places other than PBN requirement box.
b. The PBN box should contain the navigation specification (e.g., RNAV 1, RNP 1 or A-RNP) that is used for the design of PBN SID or STAR.
c. Clearly specify any sensor limitations (e.g., GNSS required or DME/DME required) within the PBN box, as required.
d. Include any additional functional requirements (e.g., RF required) in the PBN requirement box, as applicable.

Example 1: With sensor limitations and functional requirement

Navigation Specification -------------------------> RNP 1
Sensor Limitations -------------> GNSS and DME/DME required
Functional Requirements ------------------> RF required

Example 2: No sensor limitations, but with a functional requirement for RF

A-RNP
RF required

Example 3: GNSS or DME/DME/IRU only allowed, with no functional requirements

RNAV 2
GNSS or DME/DME/IRU required

Example 4: GNSS only allowed, with no functional requirements

RNAV 1
GNSS required

Example 5: No sensor limitations and functional requirements

RNAV 5

APPENDIX 6C

NOTAM TEMPLATE FOR GNSS INTERFERENCE

Item Q – Qualifier: the following qualifiers shall be mentioned in item Q:

Qualifier FIR: This Item shall contain the ICAO location indicator of the FIR within which the flights may be impacted by the RFI. If more than one FIR of the same country is impacted, the ICAO nationality letters of that country (e.g. OE) should be followed by 'XX'.

Qualifier NOTAM CODE: the following NOTAM code qualifiers (second and third letter) shall be used as appropriate for GNSS RFI event notification in the case of:

TBD (additional NOTAM codes for GNSS interference events)

Qualifier TRAFFIC: the « IV » should be used as a traffic qualifier, indicating that both IFR and VFR traffic may be impacted by the RFI

Qualifier PURPOSE: the code NBO should be used to notify RFI events:

Qualifier SCOPE: Depending on the impacted area, one of the following codes should be used:

- A = if the event only impacts aerodrome(s) operations (used QGA)
- E = if the event only impacts en-route traffic (used QWA)
- AE = if the event impacts both Aerodrome and En-route traffic (used QWA)

Qualifier LOWER/UPPER: Depending on the jamming range and the traffic in the impacted area.

Qualifier GEOGRAPHICAL REFERENCE – Coordinates: this qualifier indicates the interference source coordinates. For NOTAM with 'Scope' 'A' the Aerodrome Reference Point (ARP) coordinates should be inserted. For NOTAM with 'Scope' 'AE' or 'E' the centre of a circle whose radius encompasses the whole area of interference should be inserted.

Qualifier 'GEOGRAPHICAL REFERENCE' – Radius*: The radius of the impacted area should be inserted in this field.

Item A – Location

All FIR location indicators affected by the information should be entered in Item A), each separated by a space. In the case of a single FIR, the Item A) entry must be identical to the 'FIR' qualifier entered in Item Q). When an aerodrome indicator is given in Item A), it must be an aerodrome/heliport situated in the FIR entered in Item Q).

Item B – Start of Activity

A ten-digit date-time group giving the year, month, day, hour and minutes, at which the NOTAM comes into force, should be mentioned in Item B).

Item C – End of Validity

A ten-digit date-time group giving the year, month, day, hour and minute, at which the NOTAM ceases to be in force and becomes invalid, should be mentioned in Item C). This date and time should be later than that given in Item B).

Item E – NOTAM Text

The following standard text should be used according to Q-code:

Jamming :

GNSS JAMMING OCCURRENCES HAVE BEEN REPORTED. GNSS MAY BE UNUSABLE WITHIN. CREWS TO REMAIN VIGILANT AND REPORT TO ATC

WITHIN: specify route / geographical area (coordinates / waypoints)

Spoofing :

GNSS SPOOFING OCCURRENCES HAVE BEEN REPORTED. GNSS MAY BE MISLEADING WITHIN ………. CREWS TO REMAIN VIGILANT AND REPORT TO ATC

WITHIN: specify route / geographical area (coordinates / waypoints)

GNSS INTERFERANCE

GNSS INTERFERENCES OCCURRENCES HAVE BEEN REPORTED. GNSS MAY BE UNUSABLE WITHIN …. CREWS TO REMAIN VIGILANT AND REPORT TO ATC.

WITHIN: specify route / geographical area (coordinates / waypoints)

Navigation Minimal Operating Networks

(NAV MON) Template

State Name

Table of Contents

TBA

Executive Summary

~~TBA~~

The shift from facility-referenced navigation to coordinate-based navigation enabled by performance-based navigation (PBN) provides significant benefits, in particular by supplying the flexibility required to design airspace and associated routes and procedures according to operational needs. The most suitable navigation infrastructure to support PBN is GNSS. Consequently, the role of conventional navigation aids is currently evolving towards that of a reversionary terrestrial infrastructure capable of maintaining safety and an adequate level of operations in case of unavailability of GNSS (for example due to outages). During this evolution, terrestrial aids may also enable PBN operations for users not yet equipped with GNSS.

Until a solution to ensure adequate GNSS resilience is available, it is essential that a terrestrial navigation infrastructure, suitably dimensioned to be capable of maintaining safety and continuity of aircraft operations, be provided.

In line with the ASBU elements NAVS-B0/4 element, this plan encompasses the definition of the Minimum Operating Network (MON) of legacy Navaids to sustain the system in case of PBN disruption or degraded operations and addresses the PBN contingency modes.

This plan, developed in partnership with the national authorities (ANSP, Operators and Airspace users), should be revisited with the introduction of new navigation capabilities and frequently updated and considered as a living document.

1. 2. Introduction

The implementation of Performance-Based Navigation (PBN) on a wide scale in all phases of flight is well under way and is itself a prerequisite for ground-based navigation aids (navaids) rationalization. This is because PBN procedures are enabled by GNSS as the primary navigation means. While some of the ground systems can also support PBN operations (e.g. DME), the role of the ground based navigation infrastructure will evolve towards providing a reversion capability for GNSS and supporting contingency operations in the case of GNSS becoming unusable. This offers the opportunity to rationalize some of the terrestrial infrastructure while retaining a Minimal Operational Network to maintain ATM operations using only ground-based Navaids.

This plan supports the evolution of PBN as the preferred means of navigation by sustaining and expanding the use of GNSS, providing a PBN-capable backup with the DME, and a minimum operational network of VORs to ensure aircraft can navigate safely during GNSS outages.

The GANP has the objective of a future harmonized global navigation capability based on area navigation (RNAV) and performance-based navigation (PBN) supported by the global navigation satellite system (GNSS)

The optimistic planning that was considered at the time of the Eleventh Air Navigation Conference for all aircraft to be equipped with GNSS capability and for other GNSS constellations to be available, together with dual frequency and multi-constellation avionics capability being carried by aircraft have not been realized

The shift from facility-referenced navigation to coordinate-based navigation enabled by performance-based navigation (PBN) provides significant benefits, in particular by supplying the flexibility required to design airspace and associated routes and procedures according to operational needs. The most suitable navigation infrastructure to support PBN is GNSS. Consequently, the role of conventional navigation aids is currently evolving towards that of a reversionary terrestrial infrastructure capable of maintaining safety and an adequate level of operations in case of unavailability of GNSS (for example due to outages). During this evolution, terrestrial aids may also enable PBN operations for users not yet equipped with GNSS.

It had initially been expected that the rationalization of the legacy navigation infrastructure would have been a consequence of a top-down process where the implementation of PBN and GNSS within volumes of airspace would result in navigation aids being made totally redundant so they could be simply be switched off

NAVS ASBU Elements:

Element ID	Title
NAVS-B0/1	Ground Based Augmentation System (GBAS)
NAVS-B0/2	Satellite Based Augmentation System (SBAS)
NAVS-B0/3	Aircraft Based Augmentation System (ABAS)
NAVS-B0/4	Navigation Minimal Operating Networks (Nav.MON)

NAVS-B1/1	Extended GBAS
NAVS-B2/1	Dual Frequency Multi Constellation (DF MC) GBAS
NAVS-B2/2	Dual Frequency Multi Constellation (DF MC) SBAS
NAVS-B2/3	Dual Frequency Multi Constellation (DF MC) ABAS

2. NAVS-B0/4 Navigation Minimal Operating Networks (Nav. MON):

The new element "Navigation Minimal Operating Networks" (NAVS B0/4) has been classified as priority 1 in the MID Region Air Navigation Strategy (MID Doc 002). The NAV MON element allows the rationalization of the ground based conventional infrastructure through the definition of minimal networks of ground navaids. Consultations and agreements from airspace users and aircraft operators including MIL are required to define this element. The MON should be revisited with the introduction of new navigation capabilities. The main purposes of the NAV MON Element (NAVS B0/4) are:

- To adjust conventional navaids networks through the increased deployment of satellite based navigation systems and procedures to ensure the necessary levels of resilience for navigation.
- To provide a minimum level of capabilities to accommodate State aircraft operations where there is a mismatch in terms of aircraft equipage.
- To make a more efficient use of the frequency spectrum

MIDANPIRG Conclusion related to NAV MON TBA and Link to MID AN Strategy

3. **3. Performance-based navigation impact on NAVAID infrastructure planning**
4. Infrastructure planning is complex, particularly with the increased integrated reliance on global navigation satellite system (GNSS) by communication, navigation and surveillance (CNS) and the increased pressure to decommission unnecessary terrestrial NAVAID infrastructure. Therefore, NAVAID infrastructure planners cannot look at the NAVAID infrastructure in isolation, but need to work closely with ATM system engineers, surveillance and communication infrastructure, operators and regulators when planning the infrastructure for both normal and contingency operations. The removal of conventional navigation aids and associated procedures constitutes an airspace change. In this respect, extensive consultation needs to take place with all impacted stakeholders.
5. PBN implementation will require infrastructure planners to consider:
6. a) the infrastructure requirements for normal operations;
7. b) the infrastructure required for contingency operations (a function of the objective of the contingency operations (such as safety only, required levels of service, compliance with regulatory requirements); and
8. c) how CNS supports both normal and contingency PBN operations (trade-offs between C-N-S can be made)
9. ICAO Twelfth Air Navigation Conference ANC 12 adopted the following Recommendations in this respect, published in ICAO Doc 10007:
10. *Recommendation 6/8* – Planning for mitigation of global navigation satellite system vulnerabilities That States: a) Assess the likelihood and effects of global navigation satellite system vulnerabilities in their airspace and apply, as necessary, recognized and available

~~mitigation methods; …. f) where it is determined that terrestrial aids are needed as part of a mitigation strategy, give priority to retention of distance measuring equipment (DME) in support of inertial navigation system (INS)/DME or DME/DME area navigation, and of instrument landing system at selected runways.~~

~~11. *Recommendation 6/10* – Rationalization of terrestrial navigation aids That, in planning for the implementation of performance-based navigation, States should:~~

~~12. a) assess the opportunity for realizing economic benefits by reducing the number of navigation aids through the implementation of performance-based navigation;~~

~~13. b) ensure that an adequate terrestrial navigation and air traffic management infrastructure remains available to mitigate the potential loss of global navigation satellite system service in their airspace; and~~

~~14. c) align performance-based navigation implementation plans with navigation aid replacement cycles, where feasible, to maximize cost savings by avoiding unnecessary infrastructure investment.~~

~~15.~~

~~16. The overview of the ICAO Global context given above shows that in general,~~

3. ICAO Strategy

T~~t~~he role of the ground-based Navaids will evolve towards providing a reversion for GNSS and supporting contingency operations in case of GNSS becoming unusable. This evolution offers the opportunity for the rationalization of some of the terrestrial infrastructure and retaining only a Minimum Operational Network (MON) which is designed to efficiently provide reversion service.

However, each Navaid can fulfil different operational roles irrespective of the availability of ATS Surveillance:

- During normal ATM operations, ground-based Navaids support

  – PBN applications as a primary positioning source;
  – PBN applications as a secondary positioning source to GNSS
  – Conventional procedures (e.g. either in an environment where there are no PBN procedures; or to accommodate non-PBN capable aircraft.)

- During ATM contingency operations, ground-based Navaids support

  – PBN applications as a back up positioning source due to GNSS outage;
  – Conventional procedures as a means of reversion during a GNSS outage;

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In order to plan the evolution of the navigation infrastructure in MID Region, it is important to have a thorough picture of the type of operations that can be supported by each type of terrestrial Navaid as per MID PBN Implementation Plan. This understanding will enable States to develop both an optimization and decommissioning plan of Navaids as well as a coordinated evolution to a reversionary terrestrial infrastructure. Table below identifies which ground-based Navaid support which PBN specification.

MID Navigation Specifications and (**R**equired or **O**ptional) Navaid Infrastructure

	GNSS	IRU	DME/DME	DME/DME/ IRU	VOR/DME
RNAV 10[1]	O	O			
RNAV 5[1]	O	O	O	O	O
RNAV 1[1]	O		O	O	
RNP 1	R		TBD[2]	TBD[2]	
RNP APCH	R				
RNP AR	R	O			

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Note 1: For this navigation specification without required navaid infrastructure at least one navaid is requested for the associated navigation application.

Note 2: the use of DME/DME for this navigation specification requires a specific State authorization.

Note 3: IRU may be integrated with the GNSS sensor to improve performance and continuity of the operation.

3.1 ICAO reversion strategy

Annex 10 Attachment H defines a global "Strategy for rationalization of conventional radio navigation aids and evolution toward supporting performance based navigation". The objective of Attachment H is to provide guidance to the States for both the rationalization and reversion of the terrestrial Navaid infrastructure. The recommendations included in this high-level strategy are based on the residual roles foreseen for each type of Navaid to support PBN operations and/or conventional procedures.

Furthermore, consideration of this strategy should be given when deciding investments into new facilities or on facility renewals. As this strategy is highly relevant to the objectives of this plan, key points of this strategy are included below, customized for the MID region.

Operational Considerations for terrestrial Navaids and reversion strategy

		Operational Roles	**Navigation Performance**	**Specific Limitations**	**Opportunities And Solutions (Residual roles – PBN/conventional)**
NDB	**PBN**	Exceptionally, can be used for extraction on the missed approach for RNP APCH. This operation is not encouraged.	None	N/A	Rationalize NDB and associated conventional procedures and if NDBs are used to define PBN ATS Routes they should be replaced by RNAV waypoints. Non—Precision Approaches based on NDB should be replaced by RNP APCH. Similarly, if NDBs are used as ILS locators associated with an RNAV procedure intercept, RNAV Waypoints should replace these.
	CONV	Can support en route operations and ATS Routes, SIDS/STARs and NPAs. This is not encouraged. NDB may be paired with a DME.	Can enable homing to a beacon. When co-located with a DME, ranging information is also available.	Ref Annex 10, Chapter3	
VOR	**PBN**	Can be used in the en-route phase of flight and arrival segment of an IFP. On the missed approach it can be used for extraction of an RNP APCH.	Can support a position estimation for RNAV 5. This enables operations in FRA and on RNAV 5 ATS Routes.	(*) Maximum range of conventional VOR typically 60 NM; Doppler VOR, typically 75 NM.	The opportunity arises to rationalize some VORs providing cost savings. Introduction of new VORs is not encouraged, but existing ones may be needed to support reversion operations; enhance situational; provide limited inertial updating if DME/DME not available; exceptionally to be used for NPAs if no other option is available; to support aircraft only able to navigate conventionally (this may include state aircraft) and support procedural separation. The use of VOR(/DME) to support RNAV 5 should be considered only in exceptional cases:
	CONV	Paired (or not) with a DME can support en route operations and SIDS/STARs and NPA	Can provide bearing information and enable homing to a beacon. When co-located with a DME,	Ref Annex 10, Chapter3	

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		and intercept to the ILS or missed approach.	range and bearing information is available.		• in areas where DME/DME coverage is not possible (e.g. islands environment) • in areas where DME/DME coverage is achievable only with high investment and operational cost (e.g. near the bottom of enroute airspace in terrain rich environment)
DME	**PBN**	Can be used in all phases of flight except final approach. On the missed approach it can be used for extraction.	Can support a position estimation for RNAV 5 and RNAV 1 operations. This enables operations in FRA, RNAV 5 ATS Routes and RNAV 1 SIDS/STARs.	Minimum range of 3NM and maximum range of 160 NM for RNAV 1; Below 40° above the horizon as viewed from the DME facility; geometric limitations between DME pairs of 30° to 150°;	DME/DME provides a fully redundant capability to GNSS for RNAV applications, and a suitable reversionary capability to RNAV 1 for RNP applications requiring a lateral accuracy performance of ±1 NM (95%), providing there is an adequate DME infrastructure. Many DMEs are co-located with VORs which creates certain limitations. When VORs are decommissioned, this can be an opportunity to optimise the DME network. In such instances, to save costs or to improve DME/DME performance, DME's can be re-located (ideally with other CNS assets) if a co-located VOR is withdrawn. To be operationally robust, efficient DME network design should fill gaps and provide DME/DME coverage as low as possible without requiring more investment unless needed for safety reasons. (Other solutions such as requiring on-board IRU, reliance on ATS surveillance and/or military TACANS may be viable alternatives). Cross-border use of DME facilities is encouraged supported by the necessary authorisations and/or agreements. Deployment of new DME stations should avoid that part of the
	CONV	Paired with a VOR, ILS or NDB, it can support conventional operations. Stand-alone it can enable the flying of DME arcs.	Can provide range when co-located with a VOR, NDB or ILS.	Ref Annex 10, Chapter3	

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					frequency spectrum close to the GNSS L5/E5 band (1164 – 1 215 MHz). CONCLUSION: The application of the above principles should enable uniformity of DME deployment across the MID region; It is recognized that in some areas, the provision of D/D navigation is not possible or practical, such as at very low altitudes, in terrain-constrained environments, or on small islands, remote areas and airspace over the water. Finally, it is possible that in some countries there could be an increase in the number of DMEs to support A-PNT. Note: Some FMS may exclude the use of ILS-associated DMEs. Consequently, it is not possible to ensure consistent D/D service is available to all D/D-equipped users based on ILS-associated DMEs. Therefore, those facilities should not be planned in the provision of such D/D service (regardless of whether they are published in the en-route section of the AIP), without an appropriate fleet assessment.

(*) If a State wished to use a VOR in excess of the typical ranges stated, then an implementation safety assessment based on a flight inspection demonstration may enable such non-standard use, subject to approval by the competent authority.

Due consideration should be given to evaluate the dependency of conventional ATS route network on Ground NAVAIDs particularly the Regional ATS Route network available at MID ANP Vol II table ATS – 1, coordination with ATM personnel (on national level) would support the evaluation.

3.2 Evolution Strategy

There is a need to consult aircraft operators and international organizations, and to ensure safety, efficiency and cost-effectiveness of the proposed infrastructure solutions. Based on the above, the global strategy is to:
a) Rationalize NDB and VOR and associated conventional procedures;
b) Align rationalization planning with equipment life cycles and PBN implementation planning;
c) Replace conventional approaches without vertical guidance with vertically guided approaches;
d) Where a terrestrial navigation reversion capability is required, evolve the existing DME infrastructure
towards providing a PBN infrastructure complementary to GNSS; and
e) Provide a residual capability based on VOR (or VOR/DME, if possible) to cater to airspace users not
equipped with suitable DME/DME avionics, where required.

Operational considerations

NDB-related considerations : NDBs serve no role in PBN operations except as a means for position cross-checking and general situational awareness. These minor roles should not lead to the requirement to retain NDB facilities.

Add MIDANPIRG Conclusion regarding decommissioning of NDB

VOR related considerations : The only PBN navigation specification enabled by VOR, provided a co-located DME is present, is RNAV 5. Provision of RNAV 5 based on VOR/DME is subject to significant limitations, since integrated multi-sensor navigation makes very little use of VOR/DME, in some cases limiting the range of use to 25 NM. Also, only very few aircraft operators have a certified RNAV 5 capability which is based only on VOR/DME. Consequently, the use of VOR/DME to provide PBN services is discouraged. The only exception to this could be to support RNAV 5 routes at or near the bottom of en-route airspace (above minimum sector altitude, MSA) where achieving DME/DME coverage is challenging. In principle, to enable cost savings, VOR facilities should be withdrawn in the context of an overall PBN plan. No new stand-alone VOR facilities (e.g. at new locations) should be implemented. However, VORs may be retained to serve the following residual operational purposes such as as a reversionary navigation capability.

The analysis concerning VOR's operational role should consider all the other potential residual roles described in ICAO Annex 10 Attachment H. The following minimum set of considerations is recommended.

En route & TMA

Identify where VOR (/DME) is needed to support:

- RNAV 5 operations in FRA or on ATS routes;
- Conventional ATS routes defined by VOR/DME which are required to be maintained;
- the operations of State aircraft or aircraft of lower capabilities on ATS Routes;

the provision of:

- Navigation, cross-checking and situational awareness (e.g. during contingency operations, in support of radar vectoring or to avoid airspace infringements) within an airspace volume.
- procedural separation within an airspace volume;

Approach and landing Identify where VOR(/DME) is required to support:

- Conventional instrument approach procedures that will be maintained or potentially redesigned. The analysis should consider the aerodromes which are designated as alternates for major aerodromes and/or for aerodromes where only RNP APCH procedures are foreseen;
- ILS IAP (LOC intercept and; avoid premature automatic flight control system arming for ILS intercept);
- Missed Approach Operations;

DME-related considerations : DME/DME fully supports PBN operations based on the RNAV 1, RNAV 2 and RNAV 5 navigation specifications. Consequently, DME/DME (for equipped aircraft) is the most suitable current terrestrial PBN capability. DME/DME provides a fully redundant capability to GNSS for RNAV applications, and a suitable reversionary capability for RNP applications requiring an accuracy performance of ±1 NM (95 per cent) laterally, where supported by an adequate DME infrastructure.

Consequently, the following to be considered when identifying the future operational roles of the DME network:

En route & TMA

Identify where DME/DME is needed to support:

- RNAV 5 operations in FRA or ATS routes, in ENR airspace volumes;
- RNAV 1 operations (SIDs/STARs) in terminal airspace volumes;
- RNP 1 reversion operations (actually RNAV 1, SIDs/STARs) terminal airspace volumes;

What type of operation requires DME or DME/DME and where is this coverage needed?

What is the required performance of the DME (DME/DME) signal-in-space?

- Conventional ATS Routes incl. SIDS/STARS in en route or terminal airspace volumes, where DMEs are co-located with VORs;

Approach and landing

Identify where DME is required, as a co-located facility, to support:

- The intercept, approach or missed approach of conventionaNol approach procedures.

~~Add para decommissioning plan including lifetime, spare parts,…etc~~

4. National Navigation Minimal Operating Networks

4.1 Main operations supported by VORs in the GNSS contingency concept

VOR ID	Location	Main operations supported in the GNSS contingency concept								
		IAP	TMA			EN-ROUTE				
		IAP - intercept - Final - Missed	Conventional SIDs/STARs	cross-checking and situational awareness	Conventional Holding	RNAV 5 and FRA	Conventional Routes and procedural separation	Situational Awareness & Reach Alternate A/D	RNAV Holding	Conventional Holding

~~4.1 Ground based Navigation Aids~~

Description to be ~~added~~

~~4.2 Space based operation~~

~~*Description to be added*~~

~~*Add para about coverage analysis tool*~~

~~Phase of flight (enroute, terminal, approach)~~	~~Area of operation~~	~~NAV Facility(ies)~~			
		~~Normal operation~~	~~Augmentation~~	~~Contingency operation~~	~~Facility ID~~
~~RNAV5~~	~~Enroute~~	~~GNSS~~	~~ABAS~~	~~VOR/DME~~	

4.2 Evolution of the ground infrastructure towards MON configuration

Type of NAV facility	Location	ID	Facility life cycle		Rationalization plan		relocation of existing facilities or installation of new facilities
			Start	End	Decommissioning	Replacement	

4.14.3 4.3 Future components of the National Navigation Minimal Operating Networks

Description to be added

Type of NAV facility	Location	ID	Range	Decommissioning Plan		
				Date	Replacing facility type	

Type of NAV facility	Location	ID	Phase of flight (enroute, terminal, approach)	Range	Purpose of operation	
					Normal operation	Contingency operation

INTERNATIONAL CIVIL AVIATION ORGANIZATION

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EUR RNP APCH GUIDANCE MATERIAL

- *Second Edition* –
(V.2.0)
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RECORD OF AMENDMENTS

Edition Number	Edition Date	Description	Pages Affected
1.0	December 2012	First Edition	All
2.0	January 2021	- Amendment prepared by EUROCONTROL NSG and approved by ICAO PBNC TF/3 ECTL NSG/30 - Endorsed by the EASPG through correspondence	All

TABLE OF CONTENTS

1. INTRODUCTION

1.1. ICAO is encouraging all States to implement RNP Approach procedures and requesting the publication of a PBN Implementation Plan through the ICAO Assembly Resolutions 36-23 and 37-11. A first version of this document was developed in 2012 in response to an increasing need for guidance on RNP Approach implementation that had been expressed in several forums.

1.2. In 2020, the landscape for RNP Approach implementation in Europe had evolved significantly and the need to update the document became evident. The second version of the Guidance Material accounts for instance for the declaration of the EGNOS LPV200 service in 2015, the publication of the PBN Implementing Regulation [1] and the availability of new EASA standards for PBN in 2019. It also benefits from lessons learned throughout the implementation of the many RNP Approach procedures already published on the EUR region.

1.3. This guidance is primarily intended for States in the ICAO European region who wish to implement RNP Approach operations. It describes the generic steps that an ANSP and/or Airport should undertake to introduce such operations together with the applicable standards and relevant documentation that is available. The guidance also addresses aircraft operators by including an overview of the available standards that can be used to obtain airworthiness certification and operational approval.

1.4. RNP AR Approach procedures and the use of PBN specifications different from RNP APCH for initial and intermediate segments are outside the scope of this document.

2. GLOSSARY OF MAIN TERMS

ABAS - Aircraft-based augmentation system. An augmentation system that augments and/or integrates the information obtained from GNSS elements with other information available on board the aircraft. [2]. RAIM is a form of ABAS which uses GNSS information exclusively.

APV – Approach Procedures with Vertical Guidance. See definition of Instrument approach procedure (IAP).

- **APV I –** Refers to a set of performance criteria for navigation systems that support RNP Approach down to LPV minima designed using the SBAS APV I procedures design criteria (see ICAO Annex 10 [2] Table 3.7.2.4-1 "Signal-in-space performance requirements"). In Europe, EGNOS provides an APV I Service level meeting these performance requirements.

- **APV Baro-VNAV –** RNP Approach down to LNAV/VNAV minima based on barometric vertical navigation.

- **SBAS APV –** RNP Approach down to LPV minima. ICAO now reserves this term for procedures designed according to APV I criteria (excluding those designed according to SBAS Cat I criteria).

Area Navigation. A method of navigation which permits aircraft operation on any desired flight path within the coverage of ground or space-based navigation aids or within the limits of the capability of self-contained aids, or a combination of these [4].

Area navigation system – There are two types of area navigation system: RNAV and RNP systems. Flying PBN applications requires such systems. An RNP system is required for an RNP APCH application.

Baro-VNAV – Barometric vertical navigation (Baro-VNAV) is a function of an area navigation system that presents computed vertical guidance to the pilot referenced to a specified vertical path angle (VPA), nominally 3°. The computer-resolved vertical guidance is based on barometric altitude and is specified as a VPA from reference datum height (RDH).

CDFA – CDFA is a flight operational technique for flying the final approach segment of an NPA as a continuous descent. The technique is consistent with stabilized approach procedures and has no level-off. A CDFA starts from an altitude/height at or above the FAF and proceeds to an altitude/height approximately 50 feet (15 meters) above the landing runway threshold or to a point where the flare manoeuvre should begin for the type of aircraft being flown. This definition is harmonized with the ICAO and the European Aviation Safety Agency (EASA).

CRC – Cyclic Redundancy Check

DA/H (Decision Altitude/Height) - A specified altitude or height in a 3D instrument approach operation at which a missed approach must be initiated if the required visual reference to continue the approach has not been established.

EGNOS – The European Geostationary Navigation Overlay Service. This is the European Satellite Based Augmentation System (SBAS).

EGNOS SoL – The EGNOS Safety of Life Service is the Service offered to aviation users as described in the EGNOS SoL Service Definition Document issued by the European Commission [16].

ESSP – The European Satellite Services Provider (ESSP) is the EGNOS operator. It holds an Air Navigation Service Provider certificate and is under EASA oversight.

Final approach segment (FAS) data block. The coding of procedures to LPV minima in the on-board navigation database includes a FAS Data Block. The FAS Data Block information is protected with high integrity using a cyclic redundancy check (CRC). GLS approaches based on GBAS also use a FAS data block which is slightly different.

GNSS – Global Navigation Satellite System. GNSS is a generic term for all satellite navigation systems including core constellations such as GPS, Galileo, Glonass and BeiDou augmented as necessary by ABAS, SBAS and GBAS to support the required navigation performance for the intended operation.

Instrument approach procedure (IAP). According ICAO Annex 6 [3]: A series of predetermined manoeuvres by reference to flight instruments with specified protection from obstacles from the initial approach fix, or where applicable, from the beginning of a defined arrival route to a point from which a landing can be completed and thereafter, if a landing is not completed, to a position at which holding or en-route obstacle clearance criteria apply. Instrument approach procedures are classified as follows:

- Non-precision approach (NPA) procedure. An instrument approach procedure designed for 2D instrument approach operations Type A.

  Note.— Non-precision approach procedures may be flown using a continuous descent final approach (CDFA) technique. CDFAs with advisory VNAV guidance calculated by on-board equipment are considered 3D instrument approach operations. CDFAs with manual calculation of the required rate of descent are considered 2D instrument approach operations. For more information on CDFAs, refer to PANS-OPS (Doc 8168), Volume I, Part II, Section 5.

- Approach procedure with vertical guidance (APV). A performance-based navigation (PBN) instrument approach procedure designed for 3D instrument approach operations Type A.

- Precision approach (PA) procedure. An instrument approach procedure based on navigation systems (ILS, MLS, GLS and SBAS CAT I) designed for 3D instrument approach operations Type A or B.

LNAV, LNAV/VNAV, LPV and LP distinguish the various minima lines on an RNP Approach chart. The minima line to be used depends on the aircraft capability.

LNAV – Lateral Navigation. The minima line on a chart for RNP approach without vertical guidance which does not require the use of SBAS.

LNAV/VNAV – the minima line on a chart for RNP Approach based on Baro-VNAV system performances that can be used by aircraft approved according to CS-ACNS [6] or equivalent. LNAV/VNAV minima can also be used by aircraft capable of RNP APCH to LPV minima if this is approved by the local regulatory authority.

LPV – Localiser Performance with Vertical Guidance: the minima-line on a chart for RNP Approach with vertical guidance based on SBAS performances that can be used by aircraft approved according to CS-ACNS (replacing AMC 20-28) or equivalent.

LPV 200 – the EGNOS SoL Service level declared by the EGNOS Service Provider in September 2015 which enables SBAS-based Category I precision approach (RNP Approach down to LPV minima as low as 200 ft) with a Vertical Alert Limit (VAL) equal to 35m. The LPV 200 service level is described in the SoL Service Definition Document.

LP – Localiser Performance: The minima line on a chart for RNP approach without vertical guidance which requires the use of SBAS. At some airports, it may not be possible to meet the requirements to publish an approach procedure to LPV minima. This may be due to: obstacles and terrain along the desired final approach path, airport infrastructure deficiencies, or the inability of SBAS to provide the desired availability of vertical guidance (i.e., an airport located on the fringe of the SBAS service area). When this occurs, a State may provide an RNP Approach to LP minima; an approach procedure with angular lateral guidance equivalent to a localizer approach, with lower minima than an RNP Approach to LNAV minima.

MDA/H (Minimum Descent Altitude/Height) - A specified altitude or height in a 2D instrument approach operation or circling approach operation below which descent must not be made without the required visual reference.

NPA – Non-Precision Approach. See definition of Instrument approach procedure (IAP).

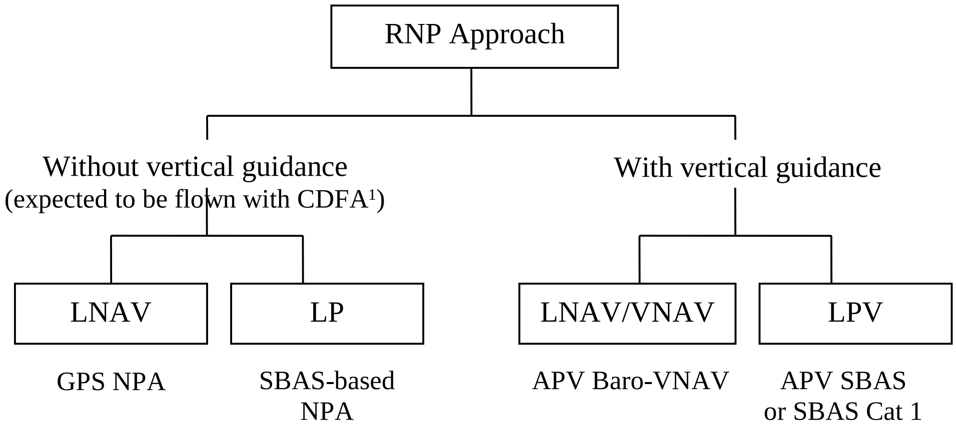
PA - Precision Approach. See definition of Instrument approach procedure (IAP)

PBN – Performance-Based Navigation. Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.

Note.— Performance requirements are expressed in navigation specifications (RNAV specification, RNP specification) in terms of accuracy, integrity, continuity and functionality needed for the proposed operation in the context of a particular airspace concept. Availability of GNSS SIS or some other NAVAID infrastructure is considered within the airspace concept in order to enable the navigation application. [4]".

RNP APCH – This is the name of the navigation specification in the ICAO PBN Manual [4] for the four approach types shown in Figure 1.

Figure 1: The four types of RNP Approach described in the ICAO PBN Manual [4]



RF – Stands for Radius to Fix. RF is an ARINC 424 path terminator which defines a precise curved path to be flown by RF-capable aircraft. The RF function is optional with the RNP APCH navigation specification. RF legs can be used outside of the final approach segment of an RNP Approach procedure and for the latter stages of a Missed Approach. This can be a useful procedure design tool in obstacle rich or constrained environments (e.g. better protection against obstacles, avoidance of noise sensitive areas).

RNP Approach –This is a generic name that refers to any kind of approach enabled by Global Navigation Satellite System (GNSS) and designed to be flown using the RNP system. RNP Approaches used to called “RNAV Approaches”. ICAO prescribed the transition to new chart titles “RNP” to ensure alignment with the name of the RNP APCH navigation specification [5].

RNP AR APCH – An approach which always requires specific aircraft qualification and operational approval. Such procedures are useful in particular environments rich in obstacles and dense terminal areas.

RNP – Required Navigation Performance. A requirement for on-board navigation performance monitoring and alerting, by means of a navigation system that supports area navigation operations by integrating information from one or more positioning sensors and provides flight crew with the means to define a desired flight path [6].

SBAS – Satellite-Based Augmentation System. This is a generic name for a system based on geostationary satellites and accompanying ground stations used for the augmentation of core constellation GNSS signals. The European SBAS is called EGNOS, the US version is called WAAS and there are also other SBASs in different regions of the World such as GAGAN in India and MSAS in Japan.

SBAS Cat I – RNP Approach down to LPV minima, designed according to SBAS Cat I procedure design criteria.

VNAV – Vertical Navigation. Refers to a method of navigation based on a computed vertical path [6].

3. APPLICABLE STANDARDS AND DOCUMENTATION

[1] COMMISSION IMPLEMENTING REGULATION (EU) 2018/1048 of 18 July 2018 laying down airspace usage requirements and operating procedures concerning performance-based navigation

[2] ICAO, Annex 10 to the Convention on International Civil Aviation, Aeronautical Telecommunications, Volume 1, Radio Navigation aids, Seventh Edition July 2018.

[3] ICAO Annex 6 to the Convention on International Civil Aviation, Operation of Aircraft, Part I – International Commercial Air Transport – Aeroplanes, Tenth Edition, July 2016

[4] ICAO Doc 9613, Performance Based Navigation (PBN) Manual, 4th Edition, 2013

[5] ICAO Circular 353: Transition Planning for Change to Instrument Flight Procedure Approach Chart Identification from RNAV to RNP, 2018

[6] EASA Certification Specifications and Acceptable Means of Compliance for Airborne Communications, Navigation and Surveillance, CS ACNS, Issue 2, 26 April 2019.

[7] ICAO Doc 9750, The Global Air Navigation Plan (GANP), Sixth Edition, 2019

[8] ICAO Doc 9992 Manual on the use of PBN in Airspace Design. First Edition, 2013

[9] Regulation (EU) 2018/1139, EASA Basic Regulation, 4th July 2018

[10] EUROCONTROL Airspace Concept Handbook for PBN implementation, Edition 3.0, 2013

[11] ICAO Annex 14 to the Convention on International Civil Aviation, Aerodromes, Volume 1, Aerodrome Design and Operations, Seventh Edition, July 2016

[12] ICAO Doc 8168, Procedures for Air Navigation Services, Aircraft Operations, (PANS OPS), Volume II, Construction of Visual and Instrument Flight Procedures, Sixth Edition, 2014.

[13] ICAO Doc 9365, Manual of All Weather Operations, Fourth Edition, 2017

[14] COMMISSION REGULATION (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council EASA, AIR OPS

[15] SES Regulation - Regulation (EC) No 550/2004, The Service Provision Regulation, as amended by Regulation (EC) 1070/2009 - Article 10.

[16] EGNOS Safety of Life (SoL) Service Definition Document (SDD), Issue 3.3, March 2019 – available on the EGNOS User Support website: https://egnos-user-support.essp-sas.eu)

[17] ICAO Doc 9849, GNSS Manual, Third Edition, 2017

[18] ICAO Doc 8071, Manual on Testing of Radio Navigation Aids, Volume II, Testing of Satellite-based Radio Navigation systems, Fifth Edition, 2007

[19] ICAO Doc 4444, Procedures for Air Navigation Services, Air Traffic Management, PANS ATM, Sixteenth Edition, 2016.

[20] Integrated Initial Flight Plan Processing System (IFPS) User Manual, Edition 23.0, Eurocontrol. 07/05/2019

[21] ICAO Doc 9906, Quality Assurance Manual for Flight Procedure Design, Volume 2 — Flight Procedure Designer Training (Development of a Flight Procedure Designer Training Programme), First Edition, 2009.

[22] COMMISSION IMPLEMENTING REGULATION (EU) 2020/469 of 14 February 2020 amending Regulation (EU) No 923/2012, Regulation (EU) No 139/2014 and

Regulation (EU) 2017/373 as regards requirements for air traffic management/air navigation services, design of airspace structures and data quality, runway safety and repealing Regulation (EC) No 73/2010

[23] ICAO Annex 19 to the Convention on International Civil Aviation, Safety Management, Second Edition, July 2016.

[24] ICAO Doc 9859, Safety Management Manual, Fourth Edition, 2018

[25] COMMISSION IMPLEMENTING REGULATION (EU) 2017/373 of 1 March 2017 laying down common requirements for providers of air traffic management/air navigation services and other air traffic management network functions and their oversight.

[26] ICAO Doc 9906, Quality Assurance Manual for Flight Procedure Design, Volume 5– Validation of Instrument Flight Procedures, First Edition, 2012

[27] ICAO Doc 9906, Quality Assurance Manual for Flight Procedure Design, Volume 1 – Flight Procedure Design Quality Assurance System, First Edition, 2009.

[28] ICAO Annex 4 to the Convention on International Civil Aviation, Aeronautical Charts, Eleventh Edition 2009.

[29] ICAO Annex 15 to the Convention on International Civil Aviation, Aeronautical Information Services, Sixteenth Edition, July 2018

[30] ICAO Doc 10066, Procedures for Air Navigation Services, Aeronautical Information Management, PANS AIM, First Edition, 2018

[31] ICAO Doc 8126 Aeronautical Information Services Manual, Sixth Edition, 2003

[32] RTCA DO 200B/EUROCAE ED-76A, Standards for Processing Aeronautical Data, 2015.

[33] COMMISSION REGULATION (EU) 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council.

4. PART A – INTRODUCTION TO RNP APPROACH OPERATIONS

4.1. Background Information

4.1.1. The widespread availability of high-performance area navigation systems on all types of aircraft and in particular the introduction of GNSS has made it possible to use area navigation in the approach phase of flight. Safety is improved by providing pilots with better situational awareness than on conventional Non-Precision Approaches (NPA), thereby reducing the risk of controlled flight into terrain (CFIT). Better access can also be provided to runways that are not equipped with precision approach and landing aids.

4.1.2. This guidance material is mainly intended for States in the ICAO European Region who wish to implement RNP Approach operations. It describes the steps that an ANSP and/or Airport should undertake to implement such operations and indicates the applicable standards and relevant documentation that is available. Finally, it provides guidance to air operators as to how to obtain approval for such operations.

4.1.3. Instrument Approach Procedures

Traditionally, there have been two types of Instrument Approach Procedure:

- Precision Approach (PA) using an instrument landing system (e.g. ILS, GLS, MLS, SBAS CAT I) which provides both lateral and vertical guidance on a geometrically defined continuous descent path along the final approach segment.

- Non-Precision Approach (NPA) using conventional navigation aids (e.g. NDB, VOR, DME) or GNSS providing only lateral guidance along the final approach segment.

4.1.4. Studies have shown that the risk of controlled flight into terrain (CFIT) on non-precision approaches could be significantly reduced. An improvement that gives pilots better situational awareness on NPA is to fly them using the RNAV or RNP capability of the aircraft. The area navigation system can be used for the approach phase of flight, provided RNP Approach procedures are designed and published. RNP Approaches are described by a series of waypoints, legs, altitude, glide path angles (GPA) and speed constraints published and stored in the navigation database.

4.1.5. GNSS-based RNP capabilities may be used to fly NPA procedures. These procedures are flown down to a Minimum Descent Altitude/Height (MDA/H), as with any conventional NPA procedure. The MDA/H is derived from the OCA/H indicated in the LNAV or LP minima line on the RNP instrument approach chart.

4.1.6. No modifications to the cockpit instruments (e.g. conventional Course Deviation Indicator – CDI, or electronic displays) are in principle necessary to use RNP Approach.

4.1.7. The level-off or “dive and drive” descent technique used along the conventional final approach segment in NPA procedures should be replaced by a stabilised vertical path. Operators are indeed encouraged[1] by Authorities to fly these procedures using the Continuous Descent Final Approach (CDFA) flying technique. This can be based on a manual calculation of the required rate of descent or it can make use of the VNAV guidance function available on many aircraft. The design of a NPA procedure is made according to a single set of design criteria in

[1] This is even mandatory for Commercial Air Transport (CAT) according EASA AIR OPS [14]

ICAO PANS-OPS and is not dependent on the flying technique. Charts include the nominal descent gradient. The minima are calculated in accordance with National Operating Regulations (based on EASA AIR OPS [14] in EASA States where values to be added to RVR minima are provided in case CDFA is not used). Whatever the flying technique (with or without CDFA) the aircraft must comply with MDA/H of the NPA.

4.1.8. RNP approaches with only lateral guidance are classed by ICAO as 2D approach operations Type A and therefore the lowest decision height to be used is 250ft.

4.2. Approaches with vertical guidance

4.2.1. In addition to lateral navigation capabilities, modern multi-sensor area navigation systems provide a VNAV function which allows a vertical path to be flown with a constant rate of descent based on the barometric altimeter, or on SBAS-augmented GPS position.

4.2.2. RNP Approaches using both lateral and vertical guidance are defined by ICAO in PANS OPS (Doc 8168) as Approach with Vertical Guidance (APV) or Precision Approach (PA). The vertical guidance is defined along the final segment only.

4.2.3. The RNP Approach procedures using barometric VNAV for vertical guidance are called APV Baro VNAV and are flown to a DA/H indicated in the LNAV/VNAV minima line on the chart. The lowest DH for APV Baro VNAV is 250ft. Aircraft equipped with SBAS and LPV-capable area navigation systems can also fly procedures designed for APV Baro VNAV if the State publishing the procedure permits it.

4.2.4. The RNP Approach procedures using SBAS for vertical guidance can be either SBAS APV or SBAS Cat I procedures depending on the criteria used for procedure design (APV I or Cat I criteria respectively). ICAO classifies these as 3D approach operations. They are flown to a DA/H derived from the OCA/H indicated in the LPV minima line on the chart. The lowest DH for SBAS APV is 250ft and for SBAS Cat I, 200ft.

4.3. Approaches and the PBN concept

4.3.1. ICAO's PBN concept was originally published in the ICAO PBN Manual [4] in 2007 replacing the previous RNP Concept and RNP Manual. The PBN Concept aims to streamline RNAV and RNP applications on a global basis by reducing the number of navigation specifications in use worldwide and thus enhancing safety, improving interoperability and reducing costs for operators. To these ends, the PBN Manual [4] includes a limited set of PBN specifications for worldwide use in different phases of flight.

4.3.2. The RNP APCH navigation specification available in the ICAO PBN Manual,[4] Volume II, Part C, Chapter 5 can support all segments of an RNP APCH operation, from the initial approach to the final phase of the missed approach. Alternatively, the Initial segment of an RNP APCH can be replaced by a Transition based on RNP 1, RNAV 1 or Advanced RNP. The missed approach can be based on other than PBN criteria or additional requirements requiring compliance to other Navigation specifications can be attached to the final segment of the RNP APCH missed approach the .

4.3.3. RNP Approach procedures used to be published on charts with the title RNAV (GNSS) RWY XX. That is one reason why they were referred to so far as RNAV or RNAV (GNSS) approaches. ICAO now prescribes these procedures are published on charts with the title

RNP [5] . This is to ensure alignment with the PBN Manual [4] which refers only to RNP APCH or RNP AR APCH applications for approach procedures. These approach charts can have several minima lines depending on the type of final segment defined within the RNP Approach. The table below provides cross reference between PANS-OPS and PBN terminology.

Table 1: RNP Approach terminology as per PBN Manual [4]

PANS-OPS Terminology	PBN Terminology	Chart Minima	Minimum Sensor
GPS NPA	RNP APCH	LNAV (MDA/H)	ABAS
APV Baro-VNAV	RNP APCH	LNAV/VNAV (DA/H)	ABAS + Baro-VNAV
SBAS NPA	RNP APCH	LP (MDA/H)	SBAS
SBAS APV	RNP APCH	LPV (DA/H)	SBAS
SBAS Cat I	RNP APCH	LPV (DA/H)	SBAS

4.3.4. An example of an RNP Approach chart containing the different minima lines is provided in Section 5.3.8 describing Activity 15 concerning procedure publication.

4.4. Provision of vertical guidance

4.4.1. The important distinction between the different types of RNP Approach operations is the provision of vertical guidance. RNP Approach to LNAV and LP minima include only lateral guidance and are flown to a MDA/H while RNP Approach procedures with vertical guidance are flown to a DA/H, which is usually lower than the NPA minima thus potentially increasing airport accessibility. In addition, the provision of vertical guidance improves pilot situational awareness, reduced Flight Technical Error (FTE) and lower flight crew workload if flown with either autopilot (AP) or flight director (FD), thus improving safety.

4.4.2. The procedure design criteria and the construction of a vertical profile are different for the different RNP Approach operations. RNP Approach to LNAV/VNAV minima accounts for vertical guidance in addition to lateral guidance (which is the same as for LNAV-only). The theoretical vertical descent profile is defined by a geometrical path with fixed flight path angle. The vertical path angle is computed between 50ft above the runway threshold and a final capture point which corresponds to the location of the FAF associated with the LNAV procedure. Vertical deviations are usually linear. Given that the vertical path is based on barometric inputs, it is very important that the correct local pressure setting (QNH) is entered into the area navigation system.

4.4.3. The final descent for APV Baro-VNAV is also influenced by temperature: With temperatures lower than ISA, the true altitude of an aircraft is lower than what the altimeter indicates; obstacle protection is therefore reduced. Temperatures greater than ISA have the opposite effect. They make the true altitude higher than the indicated altitude, leading to a steeper descent to the runway with a higher risk of an unstabilised approach. Some area navigation system provide temperature compensation to protect the aircraft from the temperature effect. Aircraft without temperature compensation will operate safely on this type of approach as long as the temperature stays within limits published on the chart. Extreme high temperature conditions rarely happen in Europe and high temperature limits are rarely published in our region. A low temperature will always be promulgated on an instrument chart. Assumptions made for the design of the procedure will set this low temperature limit. Note that the temperature correction of all altitudes published on a chart, including DA/MDA, is a requirement (except when under vectoring), regardless of the availability and use of a temperature compensation function on-board the aircraft.

4.4.4. RNP Approach to LPV minima is based on GNSS core constellation and SBAS. It assumes angular vertical guidance on the final approach segment defined in the Final Approach Segment Data Block (FAS DB). The vertical path angle is defined (not computed) and published in degrees (3° VPA is standard). Integrity of the FAS DB data is maintained through the use of a CRC.

5. PART B – GUIDANCE ON THE IMPLEMENTATION OF RNP APPROACH

5.1. General

5.1.1. Implementation of RNP Approach operations is a complex process covering a wide range of actors. In the following description the necessary activities are divided into two parts addressing the planning and implementation. These activities have been derived from the ICAO Manual on the use of Performance Based Navigation (PBN) in Airspace Design (ICAO doc 9992) methodology [8], adapted to RNP Approach implementation. Activities are presented here, as far as possible, in a chronological order. Annex 1 provides an illustration of the processes and their activities.

5.1.2. In the first part the objective is to gather information so that a decision can be taken on what type of RNP Approach should be implemented and where. The second part consists of the tasks needed to perform the actual implementation. General implementation considerations are provided here and States should feel free to adapt them to their specific situation.

5.2. Agreeing the operational requirement and building the implementation plan

5.2.1. General

5.2.1.1. The need to implement RNP Approach operations should be discussed and clarified. At this stage, the reasons for the deployment of RNP Approach are being considered.

5.2.1.2. The first part describes the activities required to take a decision on what type of RNP Approach should be implemented and at which locations. The output of this set of activities is a decision to implement RNP Approaches and a deployment strategy.

5.2.1.3. In case the implementation plan is developed at State level, the following activities will consist of selecting a pool of potential airports and selecting the preferred implementation locations. This activity must be performed in close co-operation with all the stakeholders such as Aircraft Operators, ANSPs, Regulators and Airport Operators in order to identify the most suitable airports/runway ends for RNP Approach implementation and the deployment sequence.

5.2.1.4. Alternatively, the implementation plan can be developed by an ANSP or at the level of an individual Airport. This would be mainly due to Aircraft Operator request. In this case, other stakeholders such as the Regulator need to be involved as soon as possible in the RNP Approach implementation process.

5.2.2. Activity 1: Assess the need for RNP Approach

5.2.2.1. Implementation of RNP Approach procedures may be triggered by a number of different factors, which can depend on the organisational and institutional arrangements. These inputs may include, though are not limited to, the following:

5.2.2.2. ICAO Assembly Resolutions and the Global Air Navigation Plan (GANP) [7]

5.2.2.2.1. The implementation of RNP Approach procedures with vertical guidance (APV) was primarily encouraged by ICAO Assembly Resolution 36-23 which urged the States to implement APV procedures to all instrument runway ends by 2016, either as primary or as backup approach procedures. RNP Approach to LNAV/VNAV and RNP Approach to LPV minima were the two options to fulfil the resolution. But the resolution A36-23 was updated at the 37th Assembly of ICAO, and resolution A37-11 (supersedes A36-23) now presents RNP Approach to LNAV minima as an acceptable alternative in places where APV implementation is not possible or does not make sense as no aircraft are suitably equipped. RNP Approach implementation is part of the resolution for ICAO PBN deployment, the main objective of which is to improve safety.

5.2.2.2.2. The executive part of the resolution A37-11 states:

[…]The Assembly:

1. Urges all States to implement RNAV and RNP air traffic services (ATS) routes and approach procedures in accordance with the ICAO PBN concept laid down in the Performance-based Navigation (PBN) Manual (Doc 9613);

2. Resolves that:

a) States complete a PBN implementation plan as a matter of urgency to achieve:

1) implementation of RNAV and RNP operations (where required) for en route and terminal areas according to established timelines and intermediate milestones; and

2) implementation of approach procedures with vertical guidance (APV) (Baro-VNAV and/or augmented GNSS), including LNAV only minima for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016 with intermediate milestones as follows: 30 per cent by 2010, 70 per cent by 2014; and

3) implementation of straight-in LNAV only procedures, as an exception to 2) above, for instrument runways at aerodromes where there is no local altimeter setting available and where there are no aircraft suitably equipped for APV operations with a maximum certificated take-off mass of 5 700 kg or more;

b) ICAO develop a coordinated action plan to assist States in the implementation of PBN and to ensure development and/or maintenance of globally harmonized SARPs, Procedures for Air Navigation Services (PANS) and guidance material including a global harmonized safety assessment methodology to keep pace with operational demands;

3. Urges that States include in their PBN implementation plan provisions for implementation of approach procedures with vertical guidance (APV) to all runway end serving aircraft with a maximum certificated take-off mass of 5 700 kg or more, according to established timelines and intermediate milestones;

4. Instructs the Council to provide a progress report on PBN implementation to the next ordinary session of the Assembly, as necessary;

5. Requests the Planning and Implementation Regional Groups (PIRGs) to include in their work programme the review of status of implementation of PBN by States according to the defined implementation plans and report annually to ICAO any deficiencies that may occur; and

6. Declares that this resolution supersedes Resolution A36-23. […]

5.2.2.2.3. Moreover, the Global Air Navigation Plan [7] has the objective of a future harmonised global navigation capability based on Performance Based Navigation (PBN) supported by the global navigation satellite system (GNSS). The GANP identifies PBN as the highest priority and outlines implementation issues involving PBN planning and implementation as part of the Aviation System Block Updates (ASBUs)

5.2.2.3. Strategic objectives (e.g. safety, accessibility)

5.2.2.3.1. RNP Approaches have the potential to provide better minima than conventional NPA. Consequently, better airport accessibility can be achieved at those airports without PA capability, as well as providing a back-up at airports where the precision approach aid is out of service.

5.2.2.3.2. Additionally, RNP Approach brings improved situational awareness for the pilots in both the horizontal and vertical domain (in the case of 3D operations), as well as the means to perform a better stabilised approach, both of which contribute to improve safety.

5.2.2.3.3. Those two issues are often identified as strategic objectives for airports in locations with challenging terrain and/or meteorology.

5.2.2.4. Aircraft operator requests

5.2.2.4.1. With the widespread availability of GNSS-based RNP and VNAV capability on many types of aircraft, operators may want to encourage RNP approaches to be published so that they can benefit from these on-board capabilities. The operators could be motivated by better airport accessibility and/or improved safety.

5.2.2.5. PBN implementation plans and airspace concept

5.2.2.5.1. States may have already identified the need for RNP approach implementation through the publication of a PBN implementation plan or through the development of a PBN compliant Airspace Concept. The PBN Manual [4] introduces the Airspace Concept as a formal way of setting strategic objectives to be satisfied by selected operations within an airspace. Airspace changes are triggered by operational requirements such as for example the addition of new runways, need to reduce aircraft noise over a residential area or improve airport accessibility. The Manual on the Use of PBN in Airspace Design [8] is the ICAO reference document on this matter.

5.2.2.6. ATM operational requirements

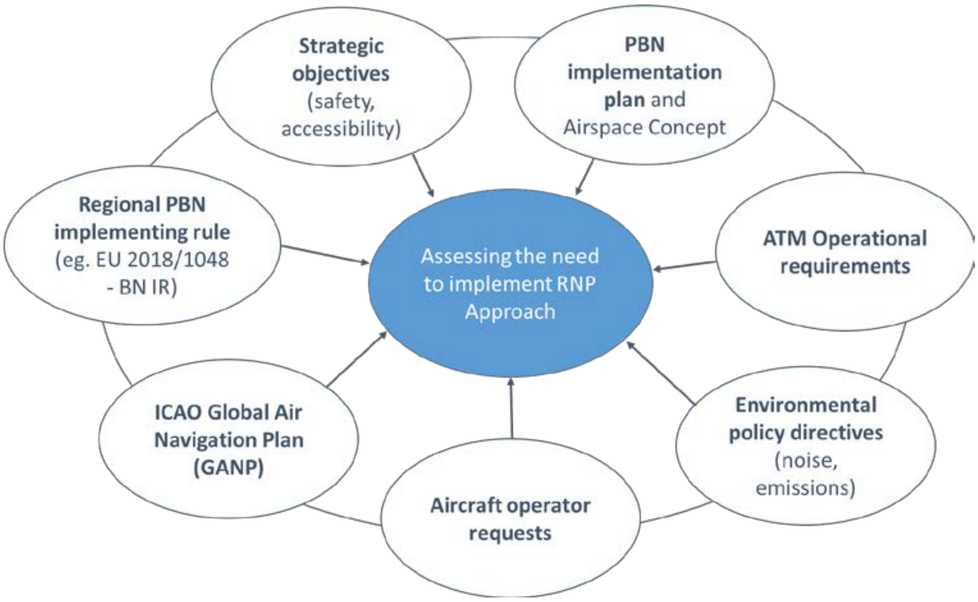
5.2.2.6.1. In Europe, the future ATM concept is described in the European ATM Master Plan and SESAR ATM Concept for 2020+. RNP Approach implementation is part of the near term Operational Improvement Steps, Enhancing Terminal Area, as identified by the European ATM Master Plan and Work Program. https://www.atmmasterplan.eu/ The key performance areas of RNP operations identified in the Master Plan are capacity, environmental sustainability, cost effectiveness, capacity and safety.

5.2.2.7. Environmental policy directives

5.2.2.7.1. Potential policy directives for noise and environment demanding changes to arrival and departure routes and the introduction of PBN terminal procedures may stimulate the need to implement RNP Approach operations.

5.2.2.7.2. Once the potential benefits are identified and agreed among all the stakeholders, there should be a high level consensus around the decision to implement RNP approach operations. At the same time, the actors need to comply with the applicable regulations in all areas of their activities. An additional reason to implement could be if it were required by a regional PBN regulation. This is the case in the European Union.

Figure 2: Assessing the need for RNP Approach implementation



5.2.2.8. The European Regulatory Framework

5.2.2.8.1. In July 2018, the European Commission adopted the PBN IR [1]. This regulation mandates the publication of RNP Approaches to LNAV, LNAV/VNAV and LPV minima at all instrument runway ends without precision approach capabilities by 3 December 2020 and at all instrument runway ends by 25 January 2024.

5.2.2.8.2. All aspects of RNP Approach implementation are covered by regulatory oversight. In the European Union area for instance, the EASA Basic Regulation [9] sets the regulatory framework.

5.2.2.8.3. In order to implement RNP Approach procedures all constituents in the area regulated by EASA, products, operations and services are under the responsibility of clearly identified organisations. This includes:

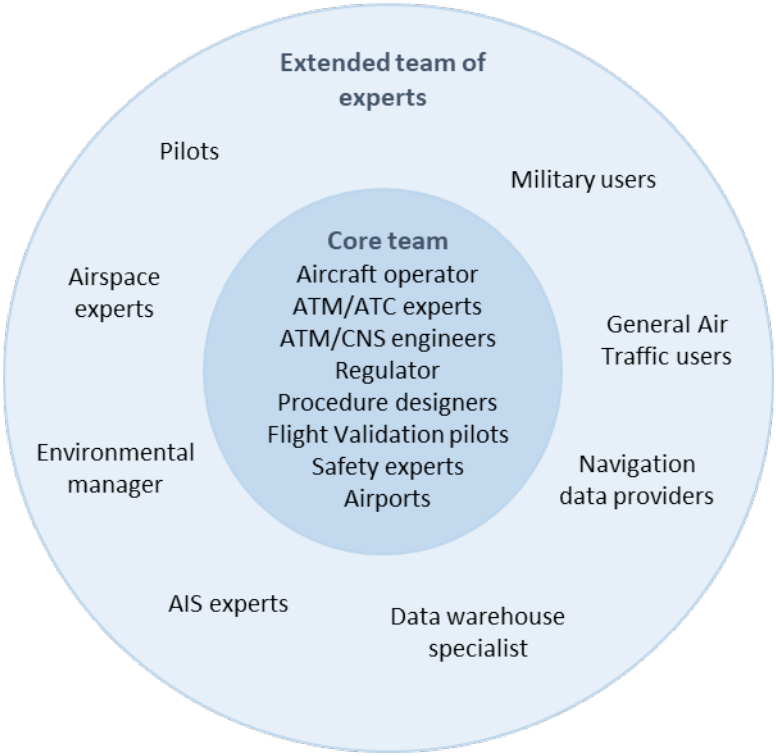
- Navigation Service Providers who provide radio-navigation signals.
- Aircraft and avionics design approval holders
- Aircraft operators
- Aerodrome operators
- Providers of Air Traffic Services
- Airspace/flight procedures designers
- AIS Service Providers
- Data suppliers

5.2.3. **Activity 2: Create the implementation project team**

5.2.3.1. A multi-disciplinary team is needed to ensure all necessary aspects of the implementation of RNP Approach procedures are recognised and adequately addressed, whether they are intended for a State, a set of airports or a single airport. The team composition may vary in different States, but principally, there should be a core team which can be extended on an “as needed” basis to include experts in particular domains as the implementation progresses. For example, it is recommended that the navigation data providers are consulted regarding the design of procedures when they rely on the use of new and not yet tested concepts within a state’s airspace. This should be done well in advance of publication and prior to any validation flight to ensure it can be coded correctly.

5.2.3.2. Depending on arrangements in different States, implementation of RNP Approach operations may be initiated by different stakeholders, namely Aviation Authorities, ANSPs, or Airport operators. Regardless of which stakeholder is the initiator, they will all need to co-operate to ensure a smooth implementation and subsequent operation. ANSPs, whether they provide a service for a country or a specific airport, are recognised to be the key actor who will drive the implementation of the change.

Figure 3: Establish a national RNP Approach implementation team



5.2.4. Activity 3: Agree project objectives, scope and timescale

5.2.4.1. Once the implementation team has been established, it needs to define the objectives, scope and resources required to build the implementation plan.

5.2.4.2. The timing for preparation of this plan may not be compatible with the objectives set in the PBN IR [1] of the European Commission, but the priority should be put on enabling the first implementation as soon as possible in order to gain the necessary experience.

5.2.4.3. If the RNP Approach implementation is made in the frame of an airspace concept development, a sample estimation of project timescale is available in Attachment 1 to the EUROCONTROL Airspace Concept Handbook for the implementation of PBN [10].

5.2.5. Activity 4: Survey of candidate airports

5.2.5.1. When implementation of RNP Approach is planned on a national basis, or for a group of airports, a survey of airports should be performed.

5.2.5.2. As a first step, one or two candidate airports can be identified to be the first implementation locations. This will allow the national team to exercise all the necessary activities and gather the lessons learned before implementation on a wider scale.

5.2.5.3. The new runway classification of ICAO makes it possible to implement RNP Approaches to non-instrument runway ends or aerodromes without ATS services. However, such implementation will require a case by case analysis. The first implementations should therefore take place at runways that already have an instrument approach procedure.

5.2.6. Activity 5: Assessment of Airport Capabilities

5.2.6.1. General

5.2.6.1.1. The capabilities of each of the airports chosen in the previous activity need to be assessed to determine whether RNP Approach operations can be implemented there, and if not, what modifications need to be made to enable the implementation.

5.2.6.1.2. The assessment should address the following domains:

5.2.6.2. Aerodrome infrastructure

5.2.6.2.1. An assessment of the aerodrome infrastructure should be performed in order to determine the type of runways on the airports of interest. The type of runway (instrument/ non-instrument, precision/non-precision as defined in [11]) will impact the minima that can be achieved.

5.2.6.2.2. According to ICAO PANS-OPS [12] the following principle applies:

- Non-precision instrument runways allow DH not lower than 250 ft.
- Precision instrument runways support approaches with DH lower than 250 ft.

5.2.6.2.3. Applicable aerodrome operating minima may be found in the ICAO All Weather Operations Manual [13] and in AMC&GM to Annex IV of EASA AIR OPS [14] for EASA countries.

5.2.6.3. Meteorological data

5.2.6.3.1. The project team may want to collect data on the meteorological conditions such as wind statistics, cloud ceiling and RVR per runway end. This data can be used as an input to estimating the benefits in terms of improved runway accessibility. Indeed, the potential for lower minima with RNP Approach allows a better runway use in case of bad weather. For more details about benefit assessment please refer to Activity 8.

5.2.6.4. GNSS infrastructure

5.2.6.4.1. All RNP Approach operations rely on the use of GNSS and the appropriate authority needs to agree to the use of GNSS in their airspace. Today, the US GPS and the Russian Federation’s GLONASS are the GNSS core constellations standardized in ICAO Annex 10 [2]. ICAO recommends the authority approves the use of all GNSS elements available in their area.

5.2.6.4.2. RNP Approaches flown to LPV minima rely on the use of GPS augmented by SBAS such as the European Geostationary Navigation Overlay Service (EGNOS) in Europe, the US WAAS in the northern and western part of the European region or the Russian Federation's SDCM under development. EGNOS and WAAS augment GPS, but SDCM is planned to augment GPS and GLONASS.

5.2.6.4.3. Any Pan-European Service used by aircraft and ANSPs provided by an organisation established in the territory of the EU Member States, is subject to the SES Regulations. This applies to the EGNOS Service Provider. Article 41 of the EASA Basic regulation [9] requires that the ATM/ANS Provider holds a certificate. The provider has to demonstrate compliance with the implementing acts referred to in Article 43 adopted to ensure compliance with the essential requirements referred to in Article 40.

5.2.6.4.4. The EGNOS Safety of Life (SoL) APV I service level was declared on 2 March 2011 and the LPV 200 service level in 2015. The EGNOS SoL services are provided free of direct user charges.

5.2.6.4.5. RNP Approach procedures flown to LPV minima relying on EGNOS and make use of the EGNOS SoL service. According the Single European Sky [15] and EASA Basic Regulations [9] an ANSP implementing LPV is required to have an agreement with the EGNOS service provider. The EGNOS Working Agreement (EWA) is the interface between the ESSP and ANSPs implementing RNP Approaches to LPV minima. However, an EWA can be established with organizations other than ANSPs, such as Aerodrome or Aircraft Operator if required.

5.2.6.4.6. RNP Approach to LPV minima relying on EGNOS can be planned at any airport within the EGNOS APV I or LPV200 service area published in the EGNOS Service Definition Document (SDD) [16]. However, a specific assessment can be made with support from the ESSP to confirm that the EGNOS service available at the aerodrome concerned is suitable for intended operations.

5.2.6.4.7. According to ICAO recommendations, a legal recording mechanism should be put in place for any navigation system to be used in operations. This recommendation applies to GNSS. The archived data will be useful in the context of post-accident/incident investigations. ANSPs or States do not necessarily have to set up their own recording system; they can have agreements with other parties to provide them with the necessary data (e.g. IGS for GPS or ESSP for EGNOS).

5.2.6.4.8. Concerning the availability of real-time monitoring for GNSS systems, there are a number of specific features of RNP Approach which make operational status monitoring neither practical nor required for such operations. l[2]. ICAO plans to provide further guidance on this topic in the future.

5.2.6.4.9. Impracticability includes considerations on the variety of avionics designs, the difference between performance observed on the ground and performance experienced on-board approaching aircraft and the fact that with PBN there is no longer a direct link between the navigation infrastructure and the aircraft's ability to perform an operation. The PBN Manual [4] also highlights the fact that ATC will not be aware of the type of minima an aircraft will fly to except when only one minima is available on the approach chart (approach clearance is according to the chart identification - RNP

[2] However ICAO requires the provision of information on the operational status of essential radio navigation services on a timely basis consistent with the use of the service involved.

– and not to the specific minima). SBAS monitors might therefore not always help ATC in managing PBN approach operations..

5.2.6.4.10. According to the PBN Manual [4], the absence of service monitoring for PBN operations can be mitigated even if they are essential operations. Mitigations include the availability of pre-flight GNSS prediction services, the provision of GNSS NOTAM and real-time information to ATC provided by pilots.

5.2.6.4.11. A signal availability and spectrum check should be performed as part of the validation of the procedure at the intended location, but real time GNSS signal monitoring is not required. Real-time information, in particular integrity is provided on-board the aircraft.

5.2.6.4.12. More details on these subjects are available in ICAO annex 10 [2], the GNSS Manual [17], the PBN Manual [4] and the Manual on Testing of Radio Navigation Aids [18].

5.2.6.5. Other infrastructure

5.2.6.5.1. RNP Approach operations are based upon GNSS including the missed approach segment. Nevertheless, an RNP APCH may have a conventional missed approach if desired. Some conventional navigation aids (VOR, DME) may therefore be maintained. The use of NDB is discouraged and should be limited only to cases where the use of VOR and/or DME is not possible.

5.2.6.5.2. No specific communication and surveillance requirements are identified for RNP Approach implementation.

5.2.6.5.3. RNP Approaches can be implemented in environments both with and without ATS surveillance. The availability of a local ATS service is not necessarily required. This should be verified through the local safety assessment to be performed in the scope of Activity 12.

5.2.6.5.4. The availability of a local QNH is a requirement for the publication of RNP approach to LNAV/VNAV minima. Remote QNH is acceptable in the case of RNP Approach to LNAV minima and as long as this is accounted for in the procedure design. Remote QNH for RNP Approaches down to LPV minima is permitted.

5.2.6.5.5. PANS-OPS states that the temperature used as an input for temperature corrections shall be that of the altimeter setting source. A local QNH source is required for RNP Approach to LNAV/VNAV minima, therefore the availability of a local temperature measurement is also a requirement for the publication of such procedure.

5.2.6.6. Achievable minima estimation

5.2.6.6.1. This will be useful in future steps to determine the minima reduction enabled by RNP Approach, and consequently to estimate the airport accessibility gain provided by the implementation of the procedure (see Activity 8).

5.2.6.7. Integration of the new procedure into the terminal area

5.2.6.7.1. An initial airspace analysis should be made in order to assess the impact that implementation of RNP Approach would have on departure and arrival routes.

5.2.7. Activity 6: Survey of Traffic Characteristics and Aircraft Operators

5.2.7.1. Survey of traffic characteristics

5.2.7.1.1. Fleet capability is evolving with time: GNSS-based navigation capabilities are spreading and the publication of the PBN IR [1] is expected to speed up the rate of SBAS equipage. However, it cannot be assumed that airspace users are capable to perform all types of RNP Approach. Traditionally, Baro-VNAV procedures were the preferred option for commercial air transport operators whose aircraft tend to be equipped with APV barometric VNAV functions rather than with SBAS APV capability. On the contrary, regional operators, business aviation and general aviation where VNAV capability based on barometric altimetry is not widely available were the first user segments to equip for RNP Approach operations based on SBAS. The type of aircraft flying to and from an airport is therefore likely to remain an influencing factor in the implementation of one or another type of RNP Approach. Nevertheless it is recommended to implement an RNP Approach procedure with all three minima lines (LNAV, LNAV/VNAV and LPV) to best serve all types of users at an airport: the cost of designing and publishing all types of minima at the same time will be lower than the sum of costs for the design and publication of the different minima one after the other. The PBN IR [1] even makes it a requirement to publish all three minima lines.

5.2.7.1.2. In certain cases, the team must work with an estimation of a future traffic sample, for example, if the approaches are planned to be implemented at a new airport or where significant changes in the airspace concept are planned.

5.2.7.2. Survey of Aircraft Operators

5.2.7.2.1. The RNP Approach implementation process should be conducted in close co-operation with Aircraft Operators. It is very important to collect information regarding current and projected PBN capabilities of aircraft operating at the airport of interest, through a survey of Aircraft Operators. The survey should also include questions regarding the Aircraft Operators preferred approach operations.

5.2.7.2.2. Information should be collected regarding the following:

- aircraft equipment and navigation capabilities
- current experience with RNP Approach procedures
- operator requirements and preferences for RNP Approach procedures
- plans in terms of future equipage and operational approval

5.2.7.2.3. As several terminologies have proliferated around the use of RNAV, RNP and GNSS equipment and operations, it is suggested to use simple and straightforward questions to operators. If possible, provide an introduction section before the questions introducing RNP Approaches in order to avoid ambiguity.

5.2.7.2.4. Some sample questions may be:

- Please list the types of aircraft that are being operated.
- Do you have certified GPS receivers onboard the aircraft? If yes, please list for each type of aircraft the kind of the GPS receiver (e.g. TSO-C129a, TSO-C145(), TSO-146() or corresponding E-TSO) installed onboard.
- Which PBN operations have been approved?
- Does the aircraft have Baro-VNAV capability?
- Does the aircraft have SBAS capability?
- Does the aircraft have an airworthiness approval for the use of GPS and/or EGNOS in the approach phase of flight? If yes, for which type of operation (among different types of RNP Approach)?
- Does the operator have plans to equip with RNP Approach capability in the future?
- What would motivate the operator to equip with RNP Approach capability in the future?
- What type of RNP Approach operation is preferred by the operator?
- Would the potential removal of a conventional procedure cause any particular problem? If yes, which one?
- At which airports would the operator like to have RNP Approach published and to which minima (LNAV, LNAV/VNAV and/or LPV)? At which runway end(s) and why?

5.2.7.2.5. Information regarding the airworthiness approvals of the aircraft operators registered in the State should be available from the Civil Aviation Authorities. Additional sources of information to the survey can be used to evaluate the fleet capabilities, including the EUROCONTROL CNS dashboard which analyses the capabilities declared in the ICAO flight plans submitted by operators (https://www.eurocontrol.int/dashboard/communication-navigation-and-surveillance-dashboard). In some cases given a particular type of aircraft, an estimate can be made regarding its navigation capability.

5.2.7.2.6. The data collected through the survey and other sources of information should be compiled to provide meaningful information to the project team for choosing among candidate RNP Approach procedures to be implemented. Indeed fleet capability will have a direct impact on how the procedures will be used when they are published (see Activity 14).

5.2.8. Activity 7: Assess the impact on ATS and NOTAM services

5.2.8.1. An assessment should be made of the impact that RNP Approach implementation may have on the ATS and AIS services.

5.2.8.2. PANS ATM, ICAO Doc 4444 [19] covers the case of RNP Approach and provides, in its version applicable from November 2022, improved applicable phraseology for ATS to manage/deal with RNP Approach clearances. With existing standards, ATS will not be aware of the specific minima line the crew will use.

5.2.8.3. In most cases, an RNP Approach will be performed on pilot demand and the chart identification ‘RNP’ is to be used in the approach clearance (e.g. “Cleared RNP Approach runway 26”). The chart identification will include any suffix used in chart names (e.g. ‘Cleared RNP Zulu approach runway 26' for a procedure charted as 'RNP Z RWY 26').

5.2.8.4. PANS ATM provisions applicable from November 2022 better cover all cases, including those RNP Approaches with only an LPV line of minima and without an LNAV minima line entitled ‘RNP RWY 26 (LPV only)’. Indeed, chart identification details provided within brackets in such cases will not be pronounced.

5.2.8.5. Amendment 1 to the 5th Edition of Doc 4444 [19] in 2012 introduced the new ICAO flight plan provisions including indicators for operators to declare the aircraft’s PBN equipage in items 10 and 18 of the flight plan. ATM automated systems need to be upgraded to be able to extract this information from the FPL and it would need to be discussed if any such information needed to be displayed on ATS working positions. However, ATS do not require detailed information about the PBN equipment on-board an aircraft requesting or announcing its intention to carry out an RNP Approach because in that case, it is assumed to be capable. RNP Approach implementation can consequently be planned independently of the new flight plan provisions. EUROCONTROL makes available the IFPS User Manual [20] where PBN content of the flight plan is described in detail.

5.2.8.6. In order to support pre-flight planning, models of GPS and EGNOS allow the prediction of the impact of known and scheduled GNSS systems/subsystems outages. EUROCONTROL makes available a web-based service called AUGUR (http://augur.eurocontrol.int/) which provides GPS RAIM outage predictions to users.

5.2.8.7. GPS RAIM predicted unavailabilities may also be provided in the form of NOTAMs. EUROCONTROL proposes such a service as part of the catalogue of EAD services. The DFS is another provider of GPS RAIM NOTAM proposals.

5.2.8.8. EGNOS NOTAM proposals are provided by the EGNOS Service Provider to the AIS provider for validation and publication. The details of such a service are described and agreed in the scope of an EGNOS Working Agreement (EWA, as mentioned in section 5.2.6.4.6). Note that EGNOS availability to support operations to LNAV/VNAV and LPV minima is also available on the EGNOS User Support website (https://egnos-user-support.essp-sas.eu)

5.2.9. Activity 8: Identify expected benefits and costs for RNP Approach implementation

5.2.9.1. The outcome of a Cost and Benefits assessment can be one decision factor to implement RNP Approach. The following paragraphs discuss the different benefits and costs for such operations. Such aspects could be verified after implementation (e.g. under Activity 20 - post implementation review).

5.2.9.2. Benefits

5.2.9.2.1. The main benefit of implementing RNP Approach is to improve safety. RNP Approach operations reduce the risk of CFIT by providing better situational awareness to pilots leading to a stabilised approach. RNP Approach implementation can support the withdrawal of some conventional navigation aids thus saving costs for maintenance and flight calibration. This can lead to fewer building constraints on and around aerodromes and the possibility to develop and improve services.

5.2.9.2.2. The safety objective alone can be a sufficient argument to implement RNP Approach procedures, particularly in cases where most aircraft operators in a particular airspace already have PBN capabilities. Some States have already implemented RNP Approach procedures for this purpose and other States can benefit from this experience.

5.2.9.2.3. Nevertheless, if an ANSP or airport intends to perform a benefit assessment for implementing RNP Approach, the operational improvements that can be quantified are those associated with avoidance of delay and diversion that may result from the reduced operational minima. The RNP APCH may also support reversion operations when an ILS is out due to maintenance.

5.2.9.3. Costs

5.2.9.3.1. The costs to implement RNP Approaches should be estimated for all stakeholders such as ANSPs, Airports Operators and Aircraft Operators.

5.2.9.3.2. Costs for ANSPs and/or Airports Operators may emerge from the following:

- Procedure design and implementation costs which might include procedure designers' training, flight validation, chart preparation and AIP changes
- Safety assessment
- Runway upgrades as identified in Activity 5 – e.g. upgrade of runway lighting
- Operations' costs may include, but are not limited to, implementation of changes to airspace, design and publication of terminal procedures, update to operating procedures, etc.
- ATC training in PBN – the same cost as for training in conventional navigation

5.2.9.3.3. The implementation of RNP Approach procedures that are based on the use of GNSS do not require the installation of ground navigation aid infrastructure. Consequently, there is a potential for cost saving for ANSPs if a rationalisation of conventional navigation aids is made together with the deployment of the RNP Approaches.

5.2.9.3.4. The costs for aircraft operators will depend on the type of aircraft used (see information collected in Activity 6). This cost may include:

- Equipment acquisition and installation
- Airworthiness certification
- Operating procedures and documentation
- Flight Crew training
- Operational authorization

5.2.9.3.5. It is acknowledged that the widespread use of RNP Approach operations will happen in the future. On the one hand, experience has shown that operators must see clear benefits before deciding to acquire and install avionics. On the other hand, Airport Operators tend to delay the provision of new navigation services to when the fleet is ready for it. It is therefore most important that all actors coordinate and synchronise their investments to maximise return on investment.

5.2.10. **Activity 9: Choose which type of RNP Approach to implement**

5.2.10.1. At this stage of the process, outputs from earlier activities are available to the team in order to arbitrate between different scenarios for implementing RNP Approach operations.

5.2.10.2. The rationale behind all the decisions taken should be documented in an implementation plan.

5.2.10.3. The implementation plan should include at least the following elements:

- The rationale behind the particular RNP Approach implementation, the target strategic objectives and the expected benefits.
- The target airspace users (air transport, business, general aviation etc.).
- A deployment strategy which clearly indicates which RNP Approach (with minima LNAV, LP, LNAV/VNAV and/or LPV) will be implemented and for which runway end.
- Note that LNAV, LNAV/VNAV and LPV minima lines of RNP Approach can be published on a single chart. In some cases it might be necessary to publish different minima lines on separate charts. For example, when the missed approaches are different or step-down fixes are used. The application of the ICAO duplicate procedure identification concept i.e. usage of a single letter suffix may also be considered.
- It is recommended that, whenever possible, all three types of RNP Approach procedure be implemented at the same time for a particular runway.
- It is recommended that an RNAV Missed Approach Procedure is implemented in the design, or if a conventional Missed Approach is retained, a coding table is provided such that it may be flown with an RNP system.

5.3. RNP Approach implementation

5.3.1. General

5.3.1.1. This part consists of all activities required to deploy the RNP Approach implementation plan resulting from the previous activities.

5.3.2. Activity 10: Procedure design

5.3.2.1. Early identification of any issue related to procedure design expertise would allow time for training and procurement of such know-how that is indispensable during the implementation phase. Special consideration should be given when designing an LNAV procedure using step-down fixes (SDF). The use of the SDF is a valid design criteria permitting additional descent within a segment by identifying a point at which a controlling obstacle has been safely over-flown. However, due to the fact that RNP Approach procedures rely on navigation databases and Flight Management Systems (FMS), it has been recognized that there are some avionics limitations in handling coded SDFs within the final approach segment. For instance, if SDFs are coded, the distance to the next waypoint given to pilots during final approach is not the runway threshold or the missed approach point and the comparison between the distance/altitude table on the approach chart and the actual flight profile can't be made. It is therefore clear that some State regulators will not accept SDFs in the final segment are coded in the navigation database under any circumstances. In that case, the State regulator that does not accept SDF coding, should advise the navigation data provider through an official letter. It is highly recommended not to name SDFs, because un-named points are normally not coded, and to publish for each SDF both the procedure altitude to be maintained to the SDF (along the profile) and the minimum obstacle clearance altitude (MOCA) available up to the SDF (as a shaded block). These two values are very often different and publishing both is of helpful for pilots.

5.3.2.2. ICAO Doc 8168 [12] Volume II, Part III, and ICAO Annex 10 [2] include requirements for PBN training for procedure designers. However, it is recognised that the current ICAO material does not provide for the complete training needs of procedures designers. ICAO Doc 9906 Volume 2 [21] —provides additional guidance for the establishment of flight procedure designer training. Training is the starting point for any quality assurance programme. This volume provides guidance for the establishment of a training programme. In the European Union, the Commission Implementing Regulation (EU) 2020/469 [22] sets the requirements for Providers of Flight Procedure Design services (Annex XI - Part- FPD).

5.3.2.3. Procedure design will be performed accounting for the categories of aircraft operating on the airport (see outcomes of Activity 6).

5.3.2.4. The procedures design criteria regarding different RNP Approach operations can be found in ICAO Doc 8168 [12].

5.3.2.5. The criteria for RNP Approach procedures to LNAV minima (NPA) are provided in ICAO PANS OPS Volume II, Part III, Section 3, Chapter 3.

5.3.2.6. The criteria for RNP Approach with vertical guidance based on Baro VNAV (APV Baro-VNAV) design are described in ICAO PANS OPS Volume II, Part III, Section 3, Chapter 4.

5.3.2.7. The criteria for RNP Approach based on SBAS (SBAS NPA (LP), SBAS APV and SBAS Cat 1) criteria are provided in ICAO PANS OPS Volume II, Part III, Section 3, Chapter 5.

5.3.3. Activity 11: Verification of expected benefits

5.3.3.1. At this stage of the process, the actual minima enabled by RNP Approach procedure are known (Activity 10). It is consequently recommended to confirm that the benefits that were identified in Activity 8 are still valid.

5.3.4. Activity 12: Local Safety Assessment

5.3.4.1. The Local safety assessment should start as soon as possible because the analysis can have an impact on the design or on the charting of the procedure.

5.3.4.2. The ICAO references for risk assessment and mitigation include Annex 19 [23] and Doc 9859 [24]. According to ICAO, service providers shall have processes in place to identify and manage the safety risks that may arise from changes; and no operation should take place in a changed system or operational context until all safety risks are evaluated. In the European Union, Regulation (EU) No 2017/373 [25] applies and requires that risk assessment and mitigation activities are carried out before implementing any change in the ATM/ANS. Implementing RNP Approach is a change which requires such activities under oversight of the competent authority.

5.3.4.3. Finally, and in anticipation of implementation, a performance and safety monitoring system and procedures should be defined. This will include an occurrence reporting mechanism.

5.3.5. Gate: Final decision to implement

5.3.5.1. Once Activities 10, 11 and 12 are completed, the implementation plan developed earlier can be updated according to the latest conclusions.

5.3.5.2. Additionally, the following tasks can be performed:

- A notice on any potential airspace design change that can result from RNP Approach implementation.
- Notification of intent to operators by ANSP to implement RNP Approach.
- Notification of intent to operators of the removal of conventional procedures, if any conventional procedures are to be removed.
- A planned date for implementation should be announced.

5.3.5.3. A notification of each of the above tasks to the navigation data providers is highly recommended.

5.3.6. Activity 13: Procedure validation

5.3.6.1. Once designed, the procedure should undergo a validation process. The objective of procedure validation is to verify obstacles and navigation data and assess the fly ability of the procedure.

5.3.6.2. Validation will consist of ground validation and maybe also flight validation. Ground validation must always be undertaken. This consists of an independent instrument flight procedure design review and pre-flight validation. The review requires appropriate knowledge of flight validation issues and the involvement of a flight validation pilot is best practice. When ground validation can validate the accuracy and completeness of all obstacles and data considered in the procedure design and any other factors normally considered in the flight validation, then the flight validation requirement may be dispensed with. More details on this subject are available in ICAO Doc 9906 Volume 5 – Validation of Instrument Flight Procedures [26].

5.3.6.3. The process of quality assurance regarding the elements of procedure design, such as procedure design documentation, verification and validation methods, and guidelines on acquisition and processing of source data are described in ICAO Doc 9906 Volume 1 – Quality Assurance Manual for Flight Procedure Design, [27].

5.3.7. Activity 14: Preparing the entry into operations (ATC considerations)

5.3.7.1. Depending on the fleet mix, it is very likely that a certain number of aircraft operating at the airports where RNP Approach operations are to be introduced would not be capable of performing them or capable but not approved. Therefore, ATC must be capable of retaining a sufficiently high level of safety and performance of its service provision even in a mixed-mode environment where there is a mix of aircraft using conventional and area navigation.

5.3.7.2. RNP Approach procedures providing vertical guidance may be published either as backup for precision approaches or as sole approaches when there is no ILS/MLS/GLS. When they are published as a back-up to a precision approach procedure it is helpful to design the RNP Approach procedures as an overlay of the existing precision approach in order to assist ATC in managing the transition in case the navigation aid support the precision approach becomes unavailable. Once the RNP Approach becomes the main approach procedure used in operations, the procedure might be redesigned to optimise it and maximise the benefits.

5.3.7.3. When an RNP Approach procedure is published, it is possible that not all the three minima lines will be available on the chart. Aircraft equipped with Baro-VNAV capability only are not capable of flying LPV procedures however aircraft capable of RNP APCH to LPV minima have the potential to be approved for LNAV/VNAV procedures. Where possible, all runway ends should have an RNP Approach to LNAV minima and aircraft approved for either LNAV/VNAV or LPV may use it. It is common practice to publish all three minima lines on a single RNP approach chart.

5.3.7.4. If required, certain provisions should be implemented to enable the ATC to cope with mixed mode operations (conventional navigation versus area navigation where some aircraft are equipped to fly the RNP Approach and others are not). It may be necessary to provide navigation services to aircraft that are not capable and/or approved for RNP operations. Conventional procedures would therefore need to be retained. Conventional navigation aids may also be needed to support operators' contingency procedures in case of a GNSS outage.

5.3.7.5. In Europe and as defined in the PBN IR [1], the proportion of PBN non-capable aircraft is expected to reduce gradually so that providers of ATM/ANS can withdraw services using conventional procedures by 2030 (except for Cat II/III precision landing). A minimum network of conventional navigation aids will be retained for contingency situations.

5.3.8. Activity 15: AIS Requirements

5.3.8.1. Approach publication

5.3.8.1.1. For charting, general criteria apply as specified in ICAO PANS OPS Volume II. The title of the instrument approach chart shall be RNP RWY XX. The minima box could include OCA/H values for LNAV, LNAV/VNAV and LPV minima. An example of a chart that includes all three minima lines is provided in Figure 4.

5.3.8.1.2. If multiple RNP Approaches exist to the same runway, a suffix is added to each of the applicable approach identifiers, for example RNP Y RWY 27 and RNP Z RWY 27. Using a suffix is a common rule not specific to RNP Approach procedures. There is no harmonised use of suffices in Europe. The Z suffix often represents the preferential approach from an ATC perspective. But other suffices like 'N', 'S', 'W' or 'E' for approaches respectively from the North, South, West or East have also been observed. Suffix 'E' has also been used on approach charts with only an LPV minima ('E' refers to 'EGNOS' in that case), whereas suffix 'H' is sometimes used for Helicopter procedures.

5.3.8.1.3. To ensure that the procedures can be coded in ARINC 424 format, procedure designers have to be familiar with the path terminators used to code PBN procedures and their use. Understanding the functional capabilities of different area navigation systems for each path terminator is not a requirement. A close co-operation should exist between procedure designers, those involved in procedure validation and the navigation data providers that compile the coded data for the navigation database. Both procedure designers and data providers belong to the ANSP family as manifested in the EASA Regulatory framework (see [25] Part FPD[3] and Part DAT). All procedures must be based upon WGS-84 coordinates.

5.3.8.1.4. The State AIP should clearly indicate that the navigation application is RNP APCH. This should be indicated in the PBN Box of the approach chart, together with

[3] Previously known as Part ASD

optional on-board PBN functions which might be required (e.g. RF). The navigation data published in the State AIP for the procedures and supporting navigation aids must meet the charting requirements of Annex 4 [28], Chapter 11, paragraph 11.10.9; Annex 15 [29] and Doc 10066 [30] (as appropriate).

5.3.8.1.5. A coding table or a formal textual description should be published on the back of the chart providing the coordinates of all the waypoints (and fixes) used in the procedure. If it is not possible to put this information on the back of the chart a separate, properly referenced sheet can be used.

5.3.8.1.6. In the case of LPV, the data required to code the procedure includes an SBAS FAS Data Block, which contains an eight character hexadecimal representation of the calculated remainder bits called the CRC remainder. The CRC remainder is used to determine the integrity of the FAS data during transmission and storage and it is computed electronically using a FAS data block software tool. The content of the SBAS FAS Data Block should be published on the verso of the chart in order to ensure that the LPV portion of the procedure is correctly coded in the navigation database.

5.3.8.1.7. An SBAS FAS DB tool is made available on the EUROCONTROL web site (https://fasdb.eurocontrol.int/fasdb/). This tool allows the calculation of the CRC value for an SBAS FAS DB, generates an electronic version of the Data Block and converts electronic Data-Block into a textual form. Generally, FAS DB tools also generate a Data Block representation as a hexadecimal string. The textual description only, together with the CRC remainder value can be made available on the verso of the chart.

5.3.8.1.8. Project management should allow a reasonable amount of time for unexpected events, especially those related to procedure validation and coding.

5.3.8.1.9. Another detail concerning the publication of LPV procedures is that a unique SBAS channel number is needed for every published approach. Until 2019 and as agreed with ICAO and FAA, EUROCONTROL was the focal point in Europe for SBAS channel allocation. ICAO has now set up a global system of SBAS Channel assignments (https://www4.icao.int/SBAS/). Procedure designers are expected to request the channel number through National points of contacts. The SBAS channel number is a five digit number that must be globally unique and shall be in the range of 40,000 to 99,999. Channel number assignments are required for RNP Approach to LPV and LP minima and will be promulgated on the approach charts respectively. It should be noted that either an LP or an LPV minima is expected to be published to a single runway end, not both.

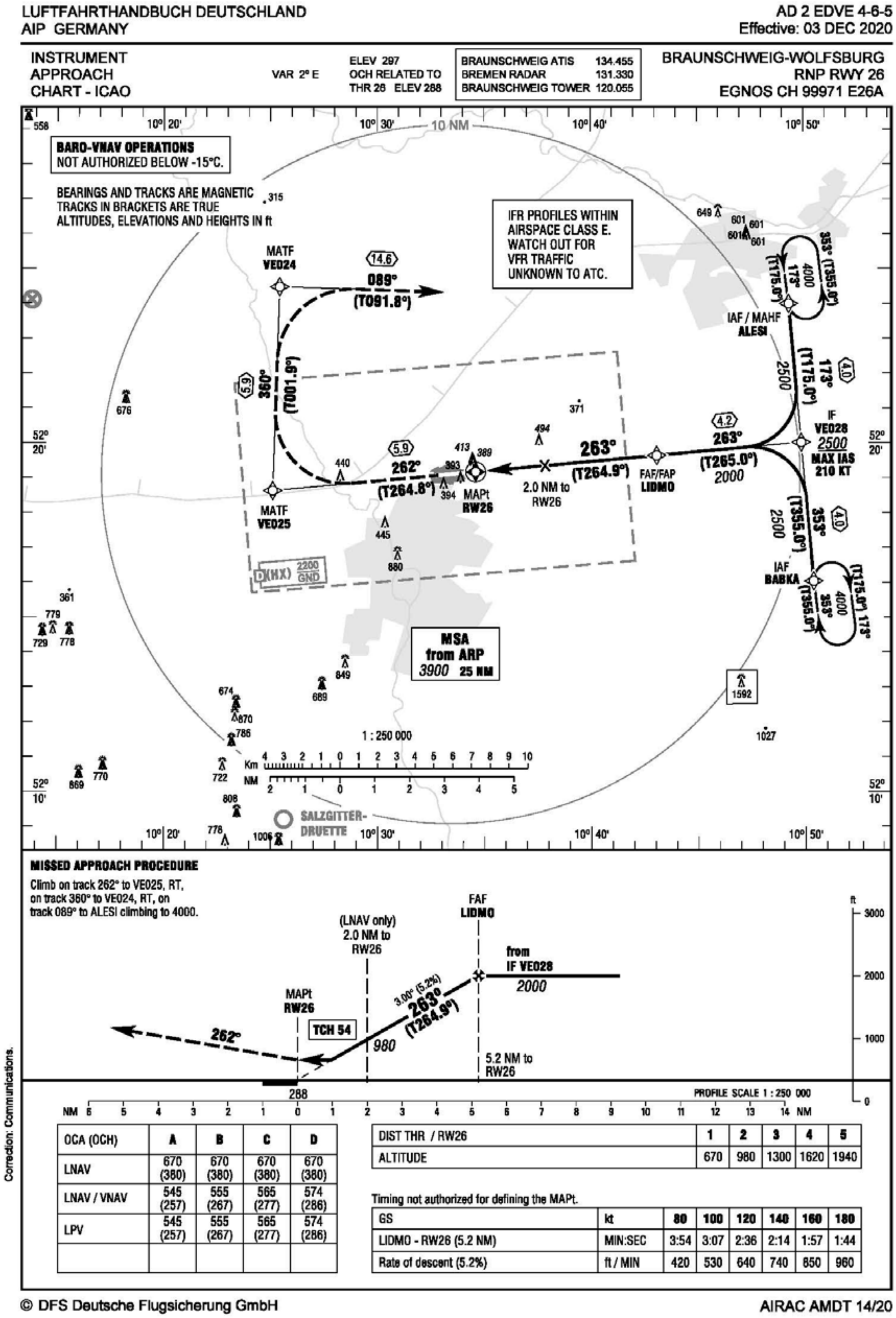
5.3.8.1.10. The information regarding the establishment of new RNP Approach procedures will need to be provided in accordance with the AIRAC publication system. It is recommended that new RNP Approach procedures are considered by States AIS as ‘major changes’ in respect of circumstances listed in Appendix 4, Part 3 of ICAO Annex 15 [29] (guidance on what constitutes a ‘major change’ is included in Doc. 8126

'AIS Manual' [31]). Therefore, it is recommended that new RNP Approach information is distributed by the AIS unit at least 56 days in advance of the planned effective date.

5.3.8.2. AIC and AIP publication

5.3.8.2.1. States are recommended to use AIC and AIP to provide information to users regarding GNSS, including SBAS. PANS AIM is in the process of being updated and it is expected that GNSS-related elements providing the navigation service are published in the State AIP General (GEN 3.4) and En-Route (ENR 4.3) sections. Even if the same aid (GNSS core constellations and/or SBAS) is used for both en-route and aerodrome purposes, a description will not be needed in AIP AD 2 and/or (if appropriate) AD 3 sections, as these sections will be dedicated to local systems.

Figure 4 Example RNP Approach Chart including all three minima lines



5.3.9. Activity 16: Navigation Database

5.3.9.1. The navigation database should be obtained from a supplier that complies with RTCA 200B/EUROCAE ED-76A 'Standards for Processing Aeronautical Data [32] (EUROCAE ED-76/RTCA DO-200A may also be acceptable). Such compliance shall be overseen by the appropriate regulatory authority. In States applying EASA rules, the Commission Implementing Regulation (EU) 2017/373 [25] applies since 1st January 2019. It sets the requirements for the certification of organisations processing aeronautical data for use on aircraft (DAT providers).

5.3.9.2. Virtually all aeronautical databases are loaded according to the specifications in the Aeronautical Radio, Incorporated (ARINC) 424 standard 'Navigation System Data Base'. While the ARINC 424 specification covers a large percentage of the aeronautical requirements, it is impossible to write a specification that wraps up every combination of factors used to design and fly instrument procedures.

5.3.9.3. Many of the differences between charts and databases are because there can be no standard implemented to have the information in both places depicted in exactly the same way. It is recognized that the basic design for most aeronautical information contained in instrument procedures i.e. conventional ones has been created for the analogue world. The art of entering data into an aeronautical database i.e. translation of the textual & graphical description of a procedure with the help of Path and Terminator (P/T) codes is one that balances the intent of the original procedure designer and the requirements of Flight Management Systems(FMS). With the implementation of PBN applications, a high degree of standardization and harmonization of chart and database information has been reached due to the following reasons:

- RNP Approach procedure standard shape 'Y' or 'T';
- Mostly straight segments (TF leg);
- Curved segments (RF legs) – optional outside of the final approach and initial missed approach segments;
- Small sub-set of Path Terminators compatible for PBN procedure coding;
- ICAO requirement for formal or tabular procedure description on chart verso which significantly reduced the misinterpretation of procedures by coders;

5.3.9.4. However, there are many different types of avionics equipment utilizing the same baseline navigation database. The same database information may be presented differently on certain types of airborne equipment even being manufactured by the same FMS vendor. In addition, some equipment may be limited to specific types of navigation database information, omitting other database information.

5.3.9.5. Since 1995, navigation data provider experts have been working with all avionics vendors to achieve as much standardization of PBN procedures as possible. In certain cases, alternative coding (such as path terminators, speed and altitude restrictions) may be used to enable specific area navigation systems to better follow the intended track.

5.3.9.6. Within an ARINC 424 output file for an RNP Approach to LPV minima, the SBAS FAS DB data is carried in a dedicated type of record called the Path Point (PP) file. The PP Primary record description contains all FAS data fields (twenty-one fields including the CRC remainder field) as required for the data wrap for CRC calculations. The specific order and coding of the twenty-one fields should be followed rigorously when computing the CRC to ensure avionics compatibility. When ‘un-wrapping ‘the FAS Data Block, the navigation data provider and avionics must compare the resulting CRC remainder i.e. representing the integrity field with the value provided by the procedure designer. If the values do not match, the FAS Data Block cannot be validated and extracted from database.

5.3.9.7. Additionally, the Path Point record has been further extended following industry requirements with a continuation record. The PP Continuation record containing fields such as LTP and FPAP orthometric heights, FPAP ellipsoid height and SBAS channel number. Therefore, States are also required to provide these parameters to the data provider in addition to the FAS DB.

5.3.9.8. In conclusion, RNP Approach procedures authorized for SBAS navigation demand a complex work-process for generation and extraction of the complete set of records by the navigation database supplier.

5.3.9.9. From a data quality and integrity level stand point, some elements of the SBAS FAS DB are classified as critical data requiring the highest possible resolution for latitude/longitude & elevation (hundredth of sec and 1 foot respectively). Therefore, attention should be paid throughout the entire chain of involved actors i.e. procedure designer – AIS expert – navigation data specialist – avionics representative in order that the highly demanding navigation database requirements for RNP Approach should be closely coordinated in a collaborative process.

5.3.10. **Activity 17: Training Requirements**

5.3.10.1. Training for ATC

5.3.10.1.1. Air traffic controllers, who provide control services at airports where RNP Approaches have been implemented, should have completed training that covers the items listed below.

5.3.10.1.2. Core training

How area navigation systems work:

- include functional capabilities and limitations;
- accuracy, integrity, availability and continuity including on-board performance monitoring and alerting;
- GPS receiver, RAIM, FDE, and integrity alerts;
- waypoint fly-by versus flyover concept (and different turn performances);

Flight plan requirements;

ATC procedures;

- ATC contingency procedures;
- separation minima;
- mixed equipage environment;
- transition between different operating environments; and
- phraseology.

5.3.10.1.3. Training specific to RNP Approach

a) Related control procedures:
- radar vectoring techniques (where appropriate);

b) RNP Approach and related procedures:
- including T and Y approaches; and
- approach minima;
- RF legs

c) impact of requesting a change to routing during a procedure.

Some items of the training are general. Local considerations may be added as a result of the local safety assessment.

5.3.10.2. Training for Flight Crew

Commission Regulation (EU) 2016/539 amended Regulation (EU) No 1178/2011 [33] as regards pilot training, testing and periodic checking for performance-based navigation (Part-FCL). This eliminated the specific operational approval for most PBN operations, including for RNP Approach, for CAT, SPA, NCC and NCO operators. AMC and GM to Part FCL contain theoretical knowledge and flight instruction elements on PBN and RNP Approach

5.3.11. Activity 18: Final Review before implementation

5.3.11.1. Once the above steps are performed, a final verification should be made so that the deployment can proceed.

5.3.11.2. The following list is proposed as a check list for this final review:

- Demonstrate how the targets set for the implementation of the RNP Approach procedures are to be met.
- The risk assessment and mitigation for the change must be accepted by the competent authority.
- The validation of the procedures must have demonstrated that the procedures can be successfully implemented.
- The impact on training and the level of fleet equipage on implementation date must be considered and if needed, a new target date for implementation should be agreed.
- In case a GO decision has been made, a commitment to implement and the agreed target date for the publication of the procedures should be announced.

5.3.12. Activity 19: Introduction into service

5.3.12.1. At this stage, predefined safety and performance monitoring tools and procedures need to be put in place, including an occurrence reporting mechanism.

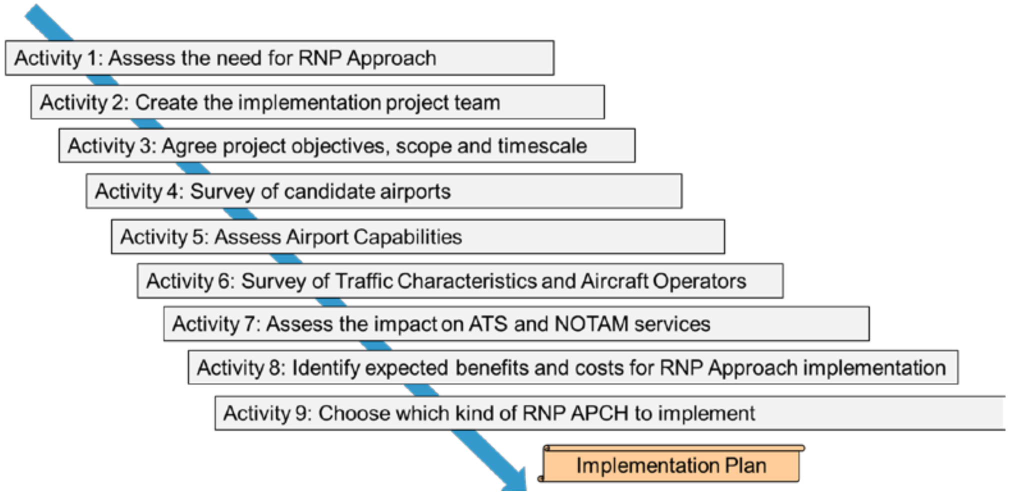
5.3.13. **Activity 20: Post-implementation activities**

5.3.13.1. Once the RNP Approach operations are introduced, their performance should be monitored. For this purpose, data on success and failure rates of RNP Approaches should be collected. This will allow for instance the verification of any expected safety improvements. A Post Implementation Review (PIR) should be undertaken after a suitable period of operational experience, typically one year.

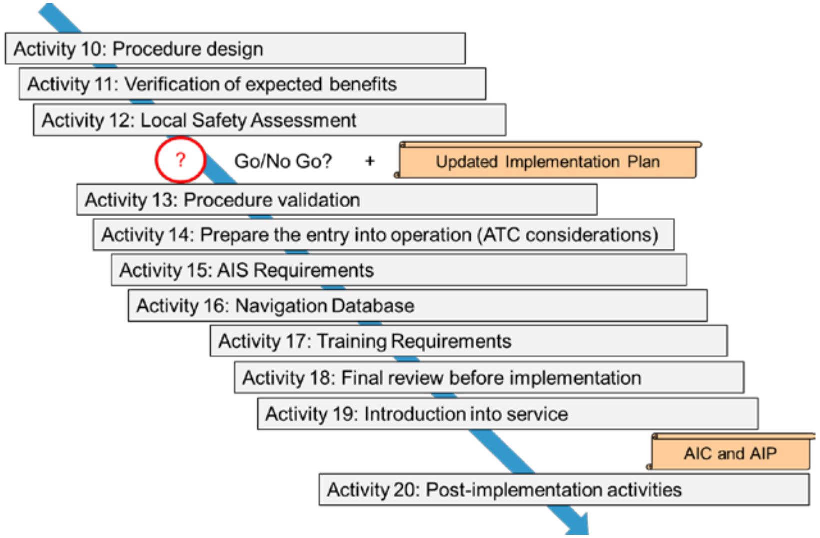
5.3.13.2. If unacceptable events occur during initial operations, the procedures should be removed and the operational concept should be reviewed in order to put in place the appropriate mitigations.

ANNEX 1: RNP APPROACH IMPLEMENTATION ACTIVITIES

Agreeing the operational requirements and building the implementation plan



RNP Approach implementation



APPENDIX 6F

MID REGION PBN IMPLEMENTATION STATUS

Updated on 01st December 2024

Legend	(red)	Not implemented
	(yellow)	Not feasible
	(orange)	Not applicable
	(green)	Implemented

Bahrain

Airport	RWY ends	APTA B0/1		APTA B0/2		APTA B0/4	APTA B0/5	APTA B0/7
		LNAV	LNAV/ VNAV	RNAV SID	RNAV STAR	CDO	CCO	PB-AOM
OBBI	12R	Implemented	Implemented	Not implemented	Not implemented	Implemented	Implemented	Implemented
	12L	Implemented	Implemented	Not implemented	Implemented	Implemented	Implemented	
	30R	Implemented	Implemented	Not implemented	Implemented	Implemented	Implemented	
	30L	Implemented	Implemented	Not implemented	Not implemented	Implemented	Implemented	
Implementation Status APTA THREAD/ELEMENTS PRIORITY 1 85%		100%		25%		100%	100%	100%

Egypt

Airport	RWY ends	APTA B0/1		APTA B0/2		APTA B0/4	APTA B0/5	APTA B0/7
		LNAV	LNAV/ VNAV	RNAV SID	RNAV STAR	CDO	CCO	PB-AOM
HECA	05L							
	05C							
	05R							
	23L							
	23C							
	23R							
HESH	04R							
	04L							
	22R							
	22L							
HEGN	16R							
	16L							
	34R							
	34L							
HELX	02							
	20							
HESN	17							
	35							
HEMA	15							
	33							
HEBA	14R							
	14L							
	32R							
	32L							
Implementation Status APTA THREAD/ELEMENTS PRIORITY 1 84%		100%		52%		Not applicable		100%

Iran

Airport	RWY ends	APTA B0/1		APTA B0/2		APTA B0/4	APTA B0/5	APTA B0/7
		LNAV	LNAV/ VNAV	RNAV SID	RNAV STAR	CDO	CCO	PB-AOM
OIKB	03R							
	21L							
OIFM	08L							
	26R							
	08R							
	26L							
OIMM	13L							
	31R							
	13R							
	31L							
OISS	29L							
	29R							
OITT	12L							
	30R							
OIEE	11L							
	29R							
OIII	11R							
	29L							
	11L							
	29R							
OIYY	13							
	31							
OIZH	17R							
	35L							
Implementation Status APTA THREAD/ELEMENTS PRIORITY 1 **25%**		12.5%		12.5%		0%	0%	100%

Iraq

Airport	RWY ends	APTA B0/1		APTA B0/2		APTA B0/4	APTA B0/5	APTA B0/7
		LNAV	LNAV/ VNAV	RNAV SID	RNAV STAR	CDO	CCO	PB-AOM
ORNI	28							
	10							
ORBI	15R							
	33L							
	15L							
	33R							
ORMM	32							
	14							
ORER	18							
	36							
ORSU	31							
	13							
Implementation Status APTA THREAD/ELEMENTS PRIORITY 1 **61%**		50%		33%		Not applicable		100%

Jordan

Airport	RWY ends	APTA B0/1		APTA B0/2		APTA B0/4	APTA B0/5	APTA B0/7
		LNAV	LNAV/ VNAV	RNAV SID	RNAV STAR	CDO	CCO	PB-AOM
OJAM	06							
	24							
OJAI	08R							
	26L							
	08L							
	26R							
OJAQ	01							
	19							
Implementation Status APTA THREAD/ELEMENTS PRIORITY 1 60%		100%		100%		0%	0%	100%

Kuwait

Airport	RWY ends	APTA B0/1		APTA B0/2		APTA B0/4	APTA B0/5	APTA B0/7
		LNAV	LNAV/ VNAV	RNAV SID	RNAV STAR	CDO	CCO	PB-AOM
OKBK	15R							
	33L							
	15L							
	33R							
Implementation Status APTA THREAD/ELEMENTS PRIORITY 1 100%		100%		100%		Not Applicable		100%

Lebanon

Airport	RWY ends	APTA B0/1		APTA B0/2		APTA B0/4	APTA B0/5	APTA B0/7
		LNAV	LNAV/ VNAV	RNAV SID	RNAV STAR	CDO	CCO	PB-AOM
OLBA	03							
	21							
	16							
	17							
Implementation Status APTA THREAD/ELEMENTS PRIORITY 1 50%		100%		50%		0%	0%	100%

Libya

Airport	RWY ends	APTA B0/1		APTA B0/2		APTA B0/4	APTA B0/5	APTA B0/7
		LNAV	LNAV/ VNAV	RNAV SID	RNAV STAR	CDO	CCO	PB-AOM
HLLB	15L							
	33R							
	15R							
	33L							
HLLS	13							
	31							
HLLT	09							
	27							
Implementation Status APTA THREAD/ELEMENTS PRIORITY 1 33.3%		0%		0%		Not Applicable		100%

Oman

Airport	RWY ends	APTA B0/1		APTA B0/2		APTA B0/4	APTA B0/5	APTA B0/7
		LNAV	LNAV/ VNAV	RNAV SID	RNAV STAR	CDO	CCO	PB-AOM
OOMS	08L							
	26R							
	08LR							
	26RL							
OOSA	07							
	25							
Implementation Status APTA THREAD/ELEMENTS PRIORITY 1 60%		100%		100%		0%	0%	100%

Qatar

Airport	RWY ends	APTA B0/1		APTA B0/2		APTA B0/4	APTA B0/5	APTA B0/7
		LNAV	LNAV/ VNAV	RNAV SID	RNAV STAR	CDO	CCO	PB-AOM
OTBD	15							
	33							
OTHH	16L							
	34R							
	16R							
	34L							
Implementation Status APTA THREAD/ELEMENTS PRIORITY 1 **100%**		100%		100%		100%	100%	100%

Saudi Arabia

Airport	RWY ends	APTA B0/1		APTA B0/2		APTA B0/4	APTA B0/5	APTA B0/7
		LNAV	LNAV/ VNAV	RNAV SID	RNAV STAR	CDO	CCO	PB-AOM
OEDF	16L							
	34R							
	16R							
	34L							
OEJN	16R							
	34L							
	16C							
	34C							
	16L							
	34R							
OEMA	17							
	35							
	18							
	36							
OERK	15L							
	33R							
	15R							
	33L							
Implementation Status APTA THREAD/ELEMENTS PRIORITY 1 **100%**		100%		100%		100%	100%	100%

Sudan

Airport	RWY ends	APTA B0/1		APTA B0/2		APTA B0/4	APTA B0/5	APTA B0/7
		LNAV	LNAV/ VNAV	RNAV SID	RNAV STAR	CDO	CCO	PB-AOM
HSOB	01							
	19							
HSSK	18							
	36							
HSNN	04							
	22							
HSPN	16							
	34							
Implementation Status APTA THREAD/ELEMENTS PRIORITY 1 30%		100%		50%		0%	0%	0%

Syria

Airport	RWY ends	APTA B0/1		APTA B0/2		APTA B0/4	APTA B0/5	APTA B0/7
		LNAV	LNAV/ VNAV	RNAV SID	RNAV STAR	CDO	CCO	PB-AOM
OSAP	09							
	27							
OSDI	05L							
	23R							
	05R							
	23L							
OSLK	17							
	35							
Implementation Status APTA THREAD/ELEMENTS PRIORITY 1 4%		12.5%		0%		Not Applicable		0%

UAE

Airport	RWY ends	APTA B0/1		APTA B0/2		APTA B0/4	APTA B0/5	APTA B0/7
		LNAV	LNAV/ VNAV	RNAV SID	RNAV STAR	CDO	CCO	PB-AOM
OMAA	13 R							
	31 L							
	13 L							
	31 R							
OMAD	13							
	31							
OMAL	01							
	19							
OMDW	12							
	30							
	13							
	31							
OMDB	12L							
	30R							
	12R							
	30L							
OMFJ	11							
	29							
OMRK	16							
	34							
OMSJ	12							
	30							
Implementation Status APTA THREAD/ELEMENTS PRIORITY 1 100%		100%		100%		100%	100%	100%

Yemen

Airport	RWY ends	APTA B0/1		APTA B0/2		APTA B0/4	APTA B0/5	APTA B0/7
		LNAV	LNAV/ VNAV	RNAV SID	RNAV STAR	CDO	CCO	PB-AOM
OYAA	08							
	26							
OYHD	03							
	21							
OYRN	06							
	24							
OYSN	18							
	36							
OYTZ	01							
	19							
Implementation Status APTA THREAD/ELEMENTS PRIORITY 1 58.3%		50%		25%		Not Applicable		100%

APPENDIX 6G

APTA : Improve arrival and departure operations

TABLE -APTA 3-1

EXPLANATION OF THE TABLE

Column	
1	Name of the State / International Aerodromes' Location Indicator
2	Runway Designator
3, 4, 5	Conventional Approaches (ILS / VOR or NDB)
6, 7, 8, 9	Elements of APTA B0/1 PBN Approaches with basic capabilities (Status of PBN Plan and implementation of LNAV, LNAV/VNAV), where:
	Y – Yes, implemented
	N – No, not implemented
10	PBN Runway: where any type of PBN approach is implemented
12, 15	Elements of APTA B0/2 PBN SID and STAR procedures (with basic capabilities)
	Y – Yes, implemented
	N – No, not implemented
11, 13	Elements of APTA B0/5 CCO basic (Status of implementation of CCO) per runway end and per aerodrome, where:
	Y – Yes, implemented
	N – No, not implemented
14, 16	Elements of APTA B0/4 CDO basic (Status of implementation of CDO) per runway end and per aerodrome, where:

	Y – Yes, implemented
	N – No, not implemented
17	Elements of APTA B0/7 Performance based aerodrome operating minima – Advanced aircraft (Compliance with the requirements for PB AOM) per State, where:
	FC – Fully compliant
	NC – Not compliant
18	Remarks

Int'l AD (Ref. MID ANP) (1)	RWY (2)	Conventional Approaches (3)			APTA (6)				CCO (11)				CDO (14)				PB AOM (17)	Remarks (18)
		Precision (4)		VOR or NDB (5)	PBN PLAN (7)	LNAV (8)	LNAV / VNAV (9)	PBN RWY (10)	RNAV SID (12)		CCO (13)		RNAV STAR (15)		CDO (16)			
		xLS	CAT		Update date				RWY	AD	RWY	AD	RWY	AD	RWY	AD		
BAHRAIN																		
OBBI	12L	ILS	II	VORDME		Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	
	12R			VORDME		Y	Y	Y	N	N	N	N	N	N	N	N		
	30L			VORDME		Y	Y	Y	N	N	N	N	N	N	N	N		
	30R	ILS	II	VORDME		Y	Y	Y	N	N	Y	N	Y	N	Y	N		
Total	4	2		4	Y	4	4	4	0	0	2	1	2	1	2	1	-	

%		50		100	Y	100	100	100	0	0	50	100	50	100	50	100	100	
EGYPT																		
HEBA	14					Y	N	Y	N	Y	N	N	N	N	N	N		
	32	ILS	I			Y	N	Y	Y	N	N	N	N	N	N	N		
HESN	17			VORDME		Y	Y	Y	Y	Y	N	N	Y	Y	N	N		
	35	ILS	I	VORDME		Y	Y	Y	Y	N	N	N	Y	N	N	N		
HECA	05L	ILS	I	VORDME		Y	N	Y	N	N	N	N	N	N	N	N		
	05C	ILS	II	VORDME		Y	N	Y	N	N	N	N	N	N	N	N		
	05R	ILS	II			Y	N	Y	N	N	N	N	N	N	N	N		
	23L	ILS	II	VORDME		Y	N	Y	N	N	N	N	N	N	N	N		
	23C	ILS	II	VORDME		Y	N	Y	N	N	N	N	N	N	N	N		
	23R	ILS	I	VORDME		Y	N	Y	N	N	N	N	N	N	N	N	Y	
HEGN	16L			VORDME		Y	Y	Y	N	Y	N	N	N	Y	N	N		
	16R			VORDME		Y	Y	Y	N	N	N	N	N	N	N	N		
	34L			VORDME		Y	Y	Y	Y	N	N	N	Y	N	N	N		
	34R	ILS	I	VORDME		Y	Y	Y	Y	N	N	N	Y	N	N	N		
HELX	2	ILS	I	VORDME		Y	Y	Y	Y	Y	N	N	Y	Y	N	N		
	20	ILS	I	VORDME		Y	Y	Y	Y	N	N	N	Y	N	N	N		
HEMA	15			VORDME		Y	N	Y	Y	Y	N	N	Y	Y	N	N		
	33			VORDME		Y	N	Y	Y	N	N	N	Y	N	N	N		
HESH	04L	ILS	I	VORDME		Y	Y	Y	Y	Y	N	N	Y	Y	N	N		

	04R			VORDME		Y	Y	Y	Y	N	N	N	Y	N	N	N		
	22L					Y	Y	Y	Y	N	N	N	Y	N	N	N		
	22R					Y	Y	Y	Y	N	N	N	Y	N	N	N		
Total	22	12		17	Y	22	12	22	13	6	0	0	12	5	0	0	-	
%		55		77	Y	100	55	100	59	86	0	0	55	71	0	0	100	
I.R. IRAN																		
OIKB	03L					N	N	N	N	N	N	N	N	N	N	N		
	03R			VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N		
	21L	ILS	I	VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N		
	21R					N	N	N	N	N	N	N	N	N	N	N		
OIFM	08L			VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N	Y	
	08R			VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N		
	26L			VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N		
	26R	ILS	I	VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N		
OIMM	13L			VORDME		N	N	N	N	N	N	N	N	N	N	N		
	13R			VORDME		N	N	N	N	N	N	N	N	N	N	N		

	31L			VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N	
	31R	ILS	I	VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N	
OISS	11L					N	N	N	N	N	N	N	N	N	N	N	
	11R					N	N	N	N	N	N	N	N	N	N	N	
	29L	ILS	I	VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N	
	29R			VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N	
OITT	12L			VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N	
	12R			VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N	
	30L	ILS	I	VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N	
	30R	ILS	I	VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N	
OIIE	11L	ILS	I	VORDME		Y	Y	Y	N	N	N	N	Y	Y	N	N	
	11R			VORDME		N	N	N	N	N	N	N	Y	N	N	N	
	29L					N	N	N	N	N	N	N	Y	N	N	N	
	29R	ILS	II	VORDME		Y	Y	Y	N	N	N	N	Y	Y	N	N	
OIII	11L			VORDME		N	N	N	N	N	N	N	N	N	N	N	

	11R			VORDME		N	N	N	N	N	N	N	N	N	N	N		
	29L	ILS	I	VORDME		Y	Y	Y	N	N	N	N	N	N	N	N		
	29R			VORDME		N	N	N	N	N	N	N	N	N	N	N		
OIZH	17R					Y	Y	Y	N	N	N	N	Y	Y	N	N		
	17L					N	N	N	N	N	N	N	N	N	N	N		
	35L	ILS	I	VORDME		Y	Y	Y	N	N	N	N	Y	N	N	N		
	35R					N	N	N	N	N	N	N	N	N	N	N		
OIYY	13			VORDME		Y	N	Y	N	N	N	N	N	N	N	N		
	31	ILS	I	VORDME		Y	Y	Y	N	N	N	N	N	N	N	N		
Total	34	11		26	Y	7	6	7	0	0	0	0	6	3	0	0	-	
%		32		76	Y	21	18	21	0	0	0	0	18	9	0	0	100	
IRAQ																		
ORBI	15L	ILS	I	VORDME		N	N	N	N	N	N	N	N	N	N	N		
	15R					Y	N	Y	N	N	N	N	N	N	N	N		
	33L					Y	N	Y	N	N	N	N	N	N	N	N		
	33R	ILS	I	VORDME		N	N	N	N	N	N	N	N	N	N	N	N	
ORMM	14			VORDME		N	N	N	N	N	N	N	N	N	N	N		
	32	ILS	I	VORDME		N	N	N	N	N	N	N	N	N	N	N		
ORER	18	ILS	II			Y	N	Y	N	N	N	N	N	N	N	N		
	36	ILS	I			Y	N	Y	N	N	N	N	N	N	N	N		

ORSU	13	ILS	I	VOR		Y	N	Y	N	N	N	N	N	N	N	N		
	31	ILS	I	VOR		Y	N	Y	N	N	N	N	N	N	N	N		
ORNI	10	ILS	I	VOR		Y	Y	Y	Y	Y	N	N	Y	Y	N	N		
	28	ILS	I	VOR		Y	Y	Y	Y	N	N	N	Y	N	N	N		
ORBM	15					N	N	N	N	N	N	N	N	N	N	N		
	33					N	N	N	N	N	N	N	N	N	N	N		
Total	14	9		8	N	8	2	8	2	1	0	0	2	1	0	0	-	
%		64		57		57	14	57	14	17	0	0	14	16.67	0	0	0	
JORDAN																		
OJAI	08L	ILS	I	NDB		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	08R			NDB		Y	Y	Y	Y	N	N	N	Y	N	N	N		
	26L	ILS	II	VOR		Y	Y	Y	Y	N	N	N	Y	N	N	N		
	26R	ILS	I	VORDME		Y	Y	Y	Y	N	N	N	Y	N	N	N		
OJAQ	1	ILS	I			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	19	ILS	I			Y	N/A	Y	Y	N	N	N	Y	N	N	N		LNAV/VNAV not feasible
Total	6	5		4	Y	6	6	6	6	2	2	2	6	2	2	2	-	
%		83		67		100	100	100	100	100	33	100	100	100	33	100	100	
KUWAIT																		
OKBK	15L	ILS	II	VORDME		Y	Y	Y	Y	Y	N	N	Y	Y	N	N	N	
	15R	ILS	II	VORDME		Y	Y	Y	Y	N	N	N	Y	N	N	N		

	33L	ILS	II	VORDME		Y	Y	Y	Y	N	N	N	Y	N	N	N		
	33R	ILS	II	VORDME		Y	Y	Y	Y	N	N	N	Y	N	N	N		
Total	4	4		4	Y	4	4	4	4	1	0	0	4	1	0	0	-	
%		100		100		100	100	100	100	100	0	0	100	100	0	0	0	
LEBANON																		
OLBA	3	ILS	I	VORDME		Y	N	Y	N	N	Y	Y	Y	Y	Y	Y		
	16	ILS	I	VORDME		Y	N	Y	N	N	Y	N	Y	N	Y	N		
	17	ILS	I	VORDME / NDB		Y	N	Y	N	N	Y	N	Y	N	Y	N		
	21					Y	N	Y	N	N	Y	N	Y	N	Y	N	Y	
	34	N/A		N/A		N	N	N	N	N	Y	N	N	N	N	N		Not used for landing
	35	N/A		N/A		N	N	N	N	N	Y	N	N	N	N	N		Not used for landing
Total	4	5		5	N	4	0	4	0	0	6	1	4	1	4	1	-	
%		125		125		100	0	100	0	0	150	100	100	100	100	100	100	
LIBYA																		
HLLB	15R			VORDME		N	N	N	N	N	N	N	N	N	N	N		
	15L			VORDME		N	N	N	N	N	N	N	N	N	N	N		
	33R			VORDME		N	N	N	N	N	N	N	N	N	N	N	Y	
	33L	ILS	I	VORDME		N	N	N	N	N	N	N	N	N	N	N		
HLLS	13	ILS	I	VORDME		N	N	N	N	N	N	N	N	N	N	N		

	31			VORDME		N	N	N	N	N	N	N	N	N	N	N		
HLLT	9			VORDME		N	N	N	N	N	N	N	N	N	N	N		
	27	ILS	I	VORDME		N	N	N	N	N	N	N	N	N	N	N		
Total	8	3		8	N	0	0	0	0	0	0	0	0	0	0	0	-	
%		38		100		0	0	0	0	0	0	0	0	0	0	0	100	
OMAN																		
OOMS	08L	ILS	I	VORDME		Y	Y	Y	Y	Y	N	N	Y	Y	N	N	Y	
	26R	ILS	I	VORDME		Y	Y	Y	Y	N	N	N	Y	N	N	N		
OOSA	7	ILS	I	VORDME		Y	Y	Y	Y	Y	N	N	Y	Y	N	N		
	25	ILS	I	VORDME		Y	Y	Y	Y	N	N	N	Y	N	N	N		
Total	4	4		4	Y	4	4	4	4	2	0	0	4	2	0	0	-	
%		100		100		100	100	100	100	100	0	0	100	100	0	0	100	
QATAR																		
OTBD	15	ILS	I	VORDME		Y	N/A	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	LNAV/VNAV not feasible
	33	ILS	II/III	VORDME/NDB		Y	Y	Y	Y	N	Y	N	Y	N	Y	N		CCO/CDO tactically achieved
OTHH	16L	ILS	I/II/III	VORDME		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		CCO/CDO tactically achieved

	16R	ILS	I/II/III	VORDME		Y	Y	Y	Y	N	Y	N	Y	N	Y	N		CCO/CDO tactically achieved
	34L	ILS	I/II/III	VORDME		Y	Y	Y	Y	N	Y	N	Y	N	Y	N		CCO/CDO tactically achieved
	34R	ILS	I/II/III	VORDME		Y	Y	Y	Y	N	Y	N	Y	N	Y	N		CCO/CDO tactically achieved
Total	6	6		6	Y	6	6	6	6	2	6	2	6	2	6	2	-	
%		100		100		100	100	100	100	100	100	100	100	100	100	100	100	
SAUDI ARABIA																		
OEDF	16L	ILS	I	-		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	16R	ILS	I	VORDME		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	34L	ILS	I	VORDME		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	34R	ILS	I	VORDME		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
OEJN	16L	ILS	I			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	16C	ILS	I			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	16R	ILS	I	VORDME		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	34L	ILS	I	VORDME		NP	NP	N	Y	Y	Y	Y	Y	Y	Y	Y		(NP): Not Published due to operationally unacceptable

																		OCA
	34C	ILS	I	VORDME		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	34R	ILS	I			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
OEMA	17	ILS	I	VORDME		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	18			VORDME		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	35	ILS	I	VORDME		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	36	ILS	I	VORDME		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
OERK	15L	ILS	I	VORDME		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	15R	ILS	I	VORDME		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	33L	ILS	I			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	33R	ILS	I	VORDME		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Total	18	17		13	Y	18	18	18	18	18	18	18	18	18	18	18		
%		94		72	Jan 2023	100	100	100	100	100	100	100	100	100	100	100	100	
SUDAN																		
HSNN	4					Y	N	Y	Y	Y	N	N	Y	Y	N	N		
	22					Y	N	Y	Y	N	N	N	Y	N	N	N		
HSOB	1					Y	N	Y	Y	Y	N	N	Y	Y	N	N	N	
	19					Y	N	Y	Y	N	N	N	Y	N	N	N		
HSSS	18	ILS	I	VORDME		Y	N	Y	Y	Y	N	N	Y	Y	N	N		
	36	ILS	I	VORDME		Y	N	Y	Y	N	N	N	Y	N	N	N		

HSPN	17			VORDME / NDB		Y	N	Y	Y	Y	N	N	Y	Y	N	N		
	35	ILS	I	VORDME / NDB		Y	N	Y	Y	N	N	N	Y	N	N	N		
Total	8	4		4	Y	8	0	8	8	4	0	0	8	4	0	0	-	
%		50		50		100	0	100	100	100	0	0	100	100	0	0	0	
SYRIA																		
OSAP	9			VORDME		N	N	N	N	N	N	N	N	N	N	N		
	27	ILS	II	VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N		
OSLK	17	ILS	I	VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N		
	35					N	N	N	N	N	N	N	N	N	N	N	N	
OSDI	05L			VOR		N	N	N	N	N	N	N	N	N	N	N		
	05R	ILS	II	VORDME / NDB		N	N	N	N	N	N	N	N	N	N	N		
	23L			VORDME / NDB DME		N	N	N	N	N	N	N	N	N	N	N		
	23R	ILS	II	VORDME		Y	Y	Y	N	N	N	N	N	N	N	N		
Total	8	4		7		1	1	1	0	0	0	0	0	0	0	0	-	
%		50		88		13	13	13	0	0	0	0	0	0	0	0	0	
UNITED ARAB EMIRATES																		
OMAA	13L	ILS	II			AR	AR	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RNP AR

	13R	ILS	I	VOR		AR	AR	Y	Y	N	Y	N	Y	N	Y	N	RNP AR
	31L	ILS	II/III	VOR		AR	AR	Y	Y	N	Y	N	Y	N	Y	N	RNP AR
	31R	ILS	II			AR	AR	Y	Y	N	Y	N	Y	N	Y	N	RNP AR
OMAD	13			VORDME		Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	31	ILS	I	VORDME		Y	N	Y	Y	N	Y	N	Y	N	Y	N	
OMAL	1	ILS	I	VOR		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	19			VOR		Y	Y	Y	Y	N	Y	N	Y	N	Y	N	
OMDB	12L	ILS	I/II/III			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	12R	ILS	I/II/III			Y	Y	Y	Y	N	Y	N	Y	N	Y	N	
	30L	ILS	I/II/III			Y	Y	Y	Y	N	Y	N	Y	N	Y	N	
	30R	ILS	I/II/III			Y	Y	Y	Y	N	Y	N	Y	N	Y	N	
OMDW	12	ILS	II/III			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	30	ILS	II/III			Y	Y	Y	Y	N	Y	N	Y	N	Y	N	
OMFJ	11					N/A	N/A	N/A	Y	Y	Y	Y	N	Y	N	Y	Not used for landing
	29	ILS	I	VOR		Y	Y	Y	Y	N	Y	N	Y	N	Y	N	
OMRK	16			VOR		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	34	ILS	I	VOR		Y	Y	Y	Y	N	Y	N	Y	N	Y	N	
OMSJ	12	ILS	I			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RNP AR

	30	ILS	II			Y	Y	Y	Y	N	Y	N	Y	N	Y	N		RNP AR
Total	20	16		9	Y	20	18	20	20	8	20	8	19	8	19	8	-	
%		80		45		100	90	100	100	100	100	100	95	100	95	100	100	
YEMEN																		
OYAA	8	ILS	I	VORDME		N	N	N	N	N	N	N	N	N	N	N	Y	
	26			VORDME		N	N	N	N	N	N	N	N	N	N	N		
OYHD	3			VOR		N	N	N	N	N	N	N	N	Y	N	N		
	21			VOR / NDB		Y	N	Y	N	N	N	N	Y	N	N	N		
OYRN	6					N	N	N	N	N	N	N	N	N	N	N		
	24			VORDME		N	N	N	N	N	N	N	N	N	N	N		
OYSN	18	ILS	I	VORDME/NDB		Y	Y	Y	Y	Y	N		Y	Y	N	N		
	36			VOR		Y	Y	Y	Y	N	N	N	Y	N	N	N		
OYTZ	1					N	N	N	N	N	N	N	N	N	N	N		
	19					N	N	N	N	N	N	N	N	N	N	N		
Total	10	2		7		3	2	3	2	1	0	0	3	2	0	0	-	58
%		20		70		30	20	30	20	20	0	0	30	40	0	0	100	
Results					Plans	LNAV	LNAV/VNAV	PBN RWYs		SID		CCO		STAR		CDO		

Total	168	104		126	13	106	83	115	79	30	49	14	94	35	51	17	10 PBN APV + 101 ILS (111/166)
Percentage (%)		63		76	87	64	50	69	48	45	30	24	57	52	31	24	67% RWY Ends with Vertical guidance
58	Aerodromes																
Note. 6 RNP AR Approach were implemented in UAE (OMAA and OMSJ)																	

APPENDIX 7A

PERFORMANCE BASED NAVIGATION SUB-GROUP (PBN SG)

1. Terms of Reference

1.1 The terms of reference of the PBN Sub-Group are:

a) ensure that the implementation of PBN in the MID Region is coherent and compatible with developments in adjacent regions, and is in line with the Global Air Navigation Plan (GANP), the Aviation System Block Upgrades (ASBU) framework and the MID Region Air Navigation Strategy;

b) monitor the status of implementation of the MID Region PBN-related ASBU threads/elements included in the MID Region Air Navigation Strategy as well as other required PBN supporting infrastructure, identify the associated difficulties and deficiencies and provide progress reports, as required;

c) keep under review the MID Region PBN performance objectives/priorities, develop action plans to achieve the agreed performance targets and propose changes to the MID Region PBN plans/priorities, as appropriate;

d) seek to achieve common understanding and support from all stakeholders involved in or affected by the PBN and GNSS developments/activities in the MID Region;

e) provide a platform for harmonization of developments and deployments of PBN concentrating on PBN for approach and terminal areas;

f) monitor and review the latest developments in the area of PBN and procedure design, provide expert inputs for PBN-related issues; and propose solutions for meeting ATM operational requirements;

g) monitor and review the latest GNSS developments and activities;

h) provide regular progress reports to MIDANPIRG concerning its work programme; and

i) review periodically its Terms of Reference and propose amendments, as necessary.

1.2 In order to meet the Terms of Reference, the PBN Sub-Group shall:

a) provide necessary assistance and guidance to States to ensure harmonization and interoperability in line with the GANP, the MID ANP and ASBU framework;

b) provide necessary inputs to the MID Region Air Navigation Strategy through the monitoring of the agreed Key Performance Indicators related to PBN;

c) identify and review those specific deficiencies and problems that constitute major obstacles to the provision of efficient PBN implementations, and recommend necessary remedial actions;

d) Address PBN implementation aspects of States in the MID Region, including States National PBN Implementation Plans, Share and exchange best PBN Implementation practices between States within the Region

e) review and support the MID Flight Procedure Programme activities, as required, including coordination of capacity building activities related to training and qualification of the procedure design personnel and all other personnel involved in PBN implementation;

f) monitor the progress of studies, projects, trials and demonstrations by the MID Region States, and other ICAO Regions in PBN and GNSS;

g) Review and update MID PBN Regional Plan (MID Doc 007), as needed

h) Address and promote operational improvements and benefits accrued from PBN implementation, through review of the existing global and regional guidance materials; and provide further guidance, as needed; and

i) Coordinate with relevant MIDANPIRG and RASG-MID Subsidiary bodies issues with common interests.

2. Composition

2.1 The Sub-Group is composed of:

a) MIDANPIRG Member States;

b) concerned International and Regional Organizations as observers; and

c) other representatives from provider States and Industry may be invited on ad hoc basis, as observers, when required.

3. WORKING ARRANGEMENTS

3.1 The Chairperson, in close co-operation with the Secretary, shall make all necessary arrangements for the most efficient working of the Subgroup. The Subgroup shall at all times conduct its activities in the most efficient manner possible with a minimum of formality and paper work (paperless meetings). Permanent contact shall be maintained between the Chairperson, Secretary and Members of the Subgroup to advance the work. Best advantage should be taken of modern communications facilities, particularly video-conferencing (Virtual Meetings) and e-mails.

3.2 Face-to-face meetings will be conducted when it is necessary to do so.

ATTACHMENT A

ICAO MID

الهيئة العامة للطيران المدني
CIVIL AVIATION AUTHORITY
QATAR قطر

ICAO - PBN SG/9 Meeting

(Doha, Qatar, 9 – 11 December 2024)

List of Participants

	Country	Name	
1	Egypt	Abdelaziz Mahmoud A. Abouelmal	
2		Amr Ibrahim Abdellatif	
3	IRAN	Kaveh Parto	
4		Mehdi Pahlavani	
5		Hamid Naghavi	
6	IRAQ	Mudher Thamer Hasan	
7		Ali Safaa Mohammed Salih	
8		Mohammed Jabbar	
9	Jordan	Sameer Mohamad Rajab Abkhadra	
10		Mohammad Jamil Jamal Mohammed Abusalah	
11	Libya	Tariq Faraj Kashkar	
12		Abdulhamid Khalifa	
13		Mohamed Abubakr A. Targhi	
14	Oman	Rashid Al-Kasbi	
15		Sulaiman Al Salmi	
16		Suwarn Raj Upadhyay	
17	Qatar	Pamela Erice	
18		Peliyagoda Christo	
19		Tilak Priyankara N M	
20		Pubudu Sandaruwan	
21		Roumel Mercado	
22		Johan Venter	
23		Hanan Haddad	
24		Allan Douglas	
25		Darren Boucker	
26		Dmytro Pikel	
27		David Shaw	
28		Yousuf Al-Mohannadi	
29		Fatima Hamad Al Marri	
30		Nasser Al-Khalaf	
31		Mohd Al-Asmakh	
32		Mohammad Naiem Sheikh	
33		Noof Al-Sheebi	
34		Gonca Demiroz	
35	Saudi Arabia	Muhammad D. Aljuhani	
36		Talal Ayidh Zaed Alharthy	
37		Anas Ibrahim Fallatah	
38		Mustafa Ali Meshaal Alhakami	
39		Ehab Raslan M. Abdelgalil	
40	Sudan	Yasir Mohammed Abdalla	
41		Nagi Mohamed Abdalla M. Ahmed	
42	UAE	Saqr Almarashda	
43	ADL	Sumit Khinvasara	
44	Eurocontrol	NASSER Hamdi	
45	IATA	Jehad Faqir	
46	ICAO MID	Radhouan Aissaoui	
47	PVS AERO	Pieter-Bas Oortman	
48	Netherlands	Steffen Gros	
49	Qatar Airways	Mouna Bouassida Bouricha	
50	ICAO HQ	Ian Knowwles	
51	USA (FAA)	Mohammad Kushan	