



TWELFTH AIR NAVIGATION CONFERENCE

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Agenda Item 2: Aerodrome operations – improving airport performance

2.2: Performance-based navigation (PBN) – a practical way to improve airport performance with safety and efficiency

THE REPUBLIC OF KOREA'S PERFORMANCE-BASED NAVIGATION (PBN) IMPLEMENTATION STATUS AND FUTURE PLAN

(Presented by the Republic of Korea)

1. INTRODUCTION

1.1 The ICAO 36th Session of the Assembly urged its Member States to develop a national performance-based navigation (PBN) implementation plan by 2009 and to implement area navigation (RNAV) and required navigation performance (RNP) air traffic services (ATS) routes and procedures including approach procedures with vertical guidance (APV) (barometric vertical navigation (Baro-VNAV) and/or augmented global navigation satellite system (GNSS)) for all instrument runways by 2016 (Resolution A36-23), and this was confirmed by the ICAO 37th Session of the Assembly (Resolution A37-11).

1.2 ICAO continuously encourages the implementation of PBN for the improvement of efficiency and effectiveness of ATS routes, terminal airspace and aerodrome, and the PBN routes will be the foundation of 4D trajectory-based operations (TBO).

2. PBN IMPLEMENTATION PLAN OF THE REPUBLIC OF KOREA

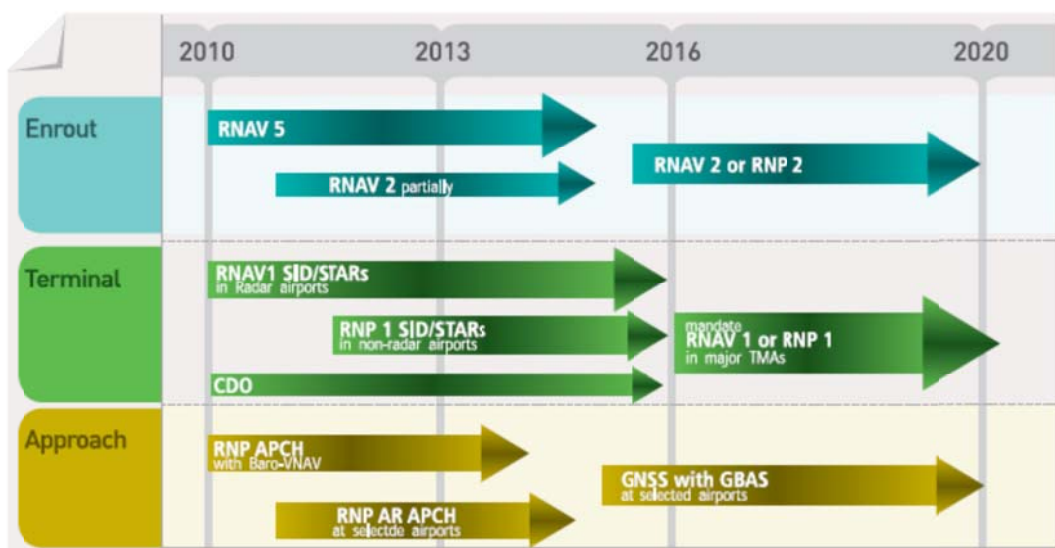
2.1 In line with the above, the Republic of Korea formed a PBN task force comprised of experts from regulators, air traffic service providers (ANSP), airport corporations, airlines and general aviation operators and developed a national PBN Implementation Plan in December 2009.

2.2 The PBN Implementation Plan of the Republic of Korea comprises three steps; short-term (2010 – 2012), medium-term (2013 – 2016) and long-term (2017 –). Main contents of each step are as follows.

2.2.1 *Short-term (2010 – 2012):* Conventional RNAV routes will be adjusted to meet ICAO's RNAV 5 or RNAV 2 specifications and unidirectional parallel routes using RNAV 2 specifications will be implemented. In terms of terminal areas, conventional RNAV SIDs/STARs will be switched over to RNAV 1 SIDs/STARs and new SIDs/STARs will have RNAV 1 specifications. In addition, the continuous descent operations (CDO) will be applied to all major airports and APV with Baro-VNAV introduced to all international airports and domestic airports with high traffic volume as back-up for ILS approaches or primary means for non-precision approaches.

2.2.2 *Medium-term (2013 – 2016):* RNAV 2 or RNP 2 specifications will be applied to new ATS routes. International PBN routes will be considered in coordination with neighbouring States. In addition, conditional routes through special use airspace (SUA) with PBN specifications will be implemented for the efficient use of airspace. In terms of terminal areas, all international airports and major domestic airports will have RNAV 1 SIDs/STARs and CDO will be applied to all airports. Also, APV with Baro-VNAV will be introduced to all airports in the Republic of Korea and GBAS landing system (GLS) will be tested for the selected airports.

2.2.3 *Long-term (2017 –):* All RNAV 5 routes will be switched over to RNAV 2 or RNP 2 routes. Also, an RNAV 1 or RNP 1 capability mandate will be enforced for the congested terminal areas and the trial operation of GLS approach will begin in this period. In addition, ground NAVAIDs except for essential facilities for landing, ATS routes and airspace operations will be decommissioned gradually from 2021. As a result, conventional routes will be replaced with PBN routes.



3. PBN IMPLEMENTATION STATUS

3.1 In accordance with the PBN Implementation Plan, the Republic of Korea has been implementing PBN for ATS routes, SIDs/STARs and approach procedures. The Republic of Korea set the objectives of PBN implementation, in the short-term, as the enhancement of efficiency, effectiveness and safety through the reduction of airspace congestion and improvement of airspace capacity.

3.2 In line with this, the Republic of Korea decided to relieve traffic congestion on B576, the busiest ATS route within the Incheon Flight Information Region (FIR) using PBN. The first step was the

establishment of a new route to divide the traffic of B576. On this account, a new route Y65 was developed over the West Sea (Yellow Sea) using RNAV 5 specifications. This route connects between Jeju Island, the popular tourist destination of the Republic of Korea, and the north-eastern areas of China including Beijing. As a result, the flight distance between Jeju and the north-eastern areas of China was shortened compared to the use of B576, and the number of aircraft using this route was increased as the aircraft which used to operate on B576 began to operate on this route. Thus, the number of traffic using B576 was reduced and traffic congestion was somewhat released.

3.3 In addition, the Republic of Korea decided to establish parallel routes on either side of B576 to accommodate the increased air traffic through the improvement of airspace structure. However, there were many problems to be solved before the establishment of new parallel routes because B576 is surrounded by military airspace, i.e. military operations areas (MOA) and restricted areas. Considering the confrontational situations between the two Koreas within the Korean Peninsula, the adjustment of military airspace was one of the toughest issues between civil and military authorities, literally considered impossible. Moreover, this issue was on the table for more than ten years at the civil-military talks.

3.4 In this situation, the implementation of PBN has emerged as the best solution to compromise both sides needs. In other words, the civil aviation authority could establish parallel routes with a small amount of military airspace adjustment applying PBN en-route navigation specifications, while the military authority could maintain a majority of its airspace not significantly affecting its operation and training and gaining a good reputation for civil/military cooperation. As a result of this, the Republic of Korea is now operating unidirectional parallel routes, Y71 and Y72, reducing traffic congestion of B576 and improving safety, efficiency and capacity of airspace.

3.5 In terms of the PBN implementation in terminal areas, RNAV 1 SIDs/STARs have been implemented for Incheon and Gimpo International Airports, which deal with more than 70 per cent of air traffic volume within the Incheon FIR to improve terminal airspace efficiency. Especially, the point merge technique was applied to the STARs of Incheon International Airport. Even though this technique may increase the flight distance either in flight planning or in actual flight, this method could reduce the workload of pilots as well as air traffic controllers, increase situational awareness of pilots and apply CDO more easily before or after the sequencing leg. (Refer to the other working paper presented by Republic of Korea for the effect of point merge technique in conjunction with RNAV 1 STARs).

3.6 In relation to new STARs, the Republic of Korea introduced APV procedures with Baro-VNAV for all runways of both airports as back-up for ILS approaches. Also, all new STARs were connected to the ILS approaches of each runways.

3.7 To operate these PBN routes and procedures safely and efficiently, the Republic of Korea established PBN operational approval standards and published them. In addition, the Republic of Korea changed the flight plan processing system of each ATS unit to support a new flight plan format which is effective on 15 November 2012.

4. FUTURE PBN IMPLEMENTATION PLAN

4.1 Currently, the Republic of Korea is continuously developing PBN routes overlaying conventional VOR routes with either RNAV 2 or RNAV 5 specifications considering airspace conditions on the either side of current routes. Some of the new PBN routes will be used when the VORs conforming ATS routes are under unusable situations. In addition, the Republic of Korea is planning to establish

conditional routes through special use airspace (SUA) in cooperation with the military authority for the improvement of efficiency of airspace.

4.2 In terms of PBN implementation in terminal airspace, the Republic of Korea is developing RNAV 1 SIDs and STARs and APV with Baro-VNAV for two domestic airports and two international airports. Also, the Republic of Korea is studying the way to mandate the PBN capabilities for the congested terminal areas.

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