USE AND APPLICATION OF GNSS IN THE IMPLEMENTATION OF NAVIGATION BASED ON PERFORMANCE IN ECUADOR
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The guidelines for the transition to the use of the Global Navigation Satellite System GNSS in the CAR / SAM Regions were issued by ICAO at the Eleventh World Air Navigation Conference (AN Conf / 11), Montreal, Canada, in 2003, to introduce in an evolutionary way, the GNSS capacity in all flight phases.
ICAO Assembly - 36th session - 2007
Resolution A36-23- Global navigation goals based on performance.

- Urged States to implement ATS routes and RNAV and RNP approach procedures in accordance with the ICAO PBN concept in Doc. 9613
- The States and regional groups to complete a PBN implementation plan for the year 2009 in order to achieve the implementation of:
  - RNAV and RNP operations in routes and terminal areas; and
  - Approaches with vertical guidance (APV) until 2016
With this guidelines from ICAO, Ecuador begins a process of knowledge and training of GNSS documentation and in 2006 publishes through a SUPPLEMENT the first RNAV / GNSS / RNP procedures for the old Quito airport.
For this implementation, ICAO has been developing reference documentation on complementary and more advanced systems for air transport with the objective to implement Performance Based Navigation (PBN).
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TOOLS:

Doc. 8168 Vol. II
ICAO Criteria
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TOOLS:

Doc. 9613
ICAO PBN Manual
Contains:
- Concept
- Airspace concepts
- Implementation
- Guidance
- Planning and implementation
- Abbreviations
- definitions
Doc. 9931 CDO ICAO Manual
Contains:

- guidance material on the air space design
- instrumental flight procedures
- ATC facilitation
- flight techniques necessary to enable to continuous descent profiles
- background and implementation guidance for: air navigation service providers, aircraft operators, airports operators and aviation regulators.
Doc. 9993
Contains:

- guidance material on the air space design
- instrumental flight procedures
- ATC facilitation
- flight techniques necessary to enable to continuous climb profiles
- provides background and guidance for: air navigation service providers, aircraft operators/pilots, airports operators and aviation regulators.
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TOOLS:

Doc. 9992

provide step-by-step guidance on the application of performance-based navigation (PBN) in a development of an airspace concept

The manual can also be used by stakeholders involved in the implementation of PBN.
What is PBN?

Area navigation based on performance requirements that apply to aircraft performing operations on:

- a route of air traffic services (ATS)
- an instrument approach procedures
- a designated airspace.
PBN Concept

 Represents a change from sensor-based navigation to performance-based navigation

 Specifies the performance requirements of the RNAV/RNP system for the operation of the aircraft on:

 - an ATS route
 - an instrument approach procedure
 - a designated airspace.
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COMPONENTS OF THE PBN
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Ground aids for Navigation

- VOR; DME (NDB not included)

Satellite based-aids for GNSS Navigation

- GPS, GLONASS, Galileo
What is the performance required by the RNAV system?

What functionalities are necessary?

Which navigation sensors need to be integrated into the navigation system?

What are the requirements of the flight crew and the operator?
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RNAV: Area navigation
RNP: Required navigation performance

Conventional Navigation
Area Navigation (RNAV)
Required Navigation Performance
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**RLA/06/901**
Deals with all air navigation issues related to the implementation of the PBN.

**RLA/99/901**
Deals all safety issues (requirements, advisory circulars, and procedures) related to the implementation of PBN.
BENEFITS OF PBN

- Reduces the need to maintain routes and procedures based on a specific sensor and its associated costs.
- It avoids the need to develop operations based on a specific navaid.
- It allows the efficient use of air space (route location, efficient fuel consumption, noise reduction)
- Clarifies the way in which RNAV / RNP systems should be used; and
- Facilitates the operational approval process of operators, providing navigation specifications for global use.
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STEPS OF THE PBN IMPLEMENTATION

- **PLAN**
  - Activity 1: Agree on operational requirements
  - Activity 2: Create an airspace design team
  - Activity 3: Agree on objectives, scope and timeline
  - Activity 4: Analyse reference scenario
  - Activity 5: Select safety criteria, safety policy and performance criteria
  - Activity 6: Agree on CNS/ATM assumptions, enablers and constraints

- **DESIGN**
  - Activity 7: Design airspace routes and holds
  - Activity 8: Design initial procedure
  - Activity 9: Design airspace volumes and sectors
  - Activity 10: Confirm ICAO navigation specification

- **VALIDATE**
  - Activity 11: Validate airspace concept
  - Activity 12: Finalize procedure design
  - Activity 13: Validate procedure

- **IMPLEMENT**
  - Activity 14: Integrate ATC system
  - Activity 15: Develop awareness and training material
  - Activity 16: Implement
  - Activity 17: Conduct post-implementation review
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AIRSPACE DESIGN TEAM
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DESIGNS DEVELOPED FOR PBN IMPLANTATION
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“THE IMPLEMENTATION OF NAVIGATION BASED ON PERFORMANCE IS THE BEST WINDOW TO RAISE OPERATIONAL SAFETY LEVELS”

Thank you

bolivar.davalos@aviacioncivil.gob.ec
bolodavalos@hotmail.com