International Civil Aviation Organization

Performance Based Navigation

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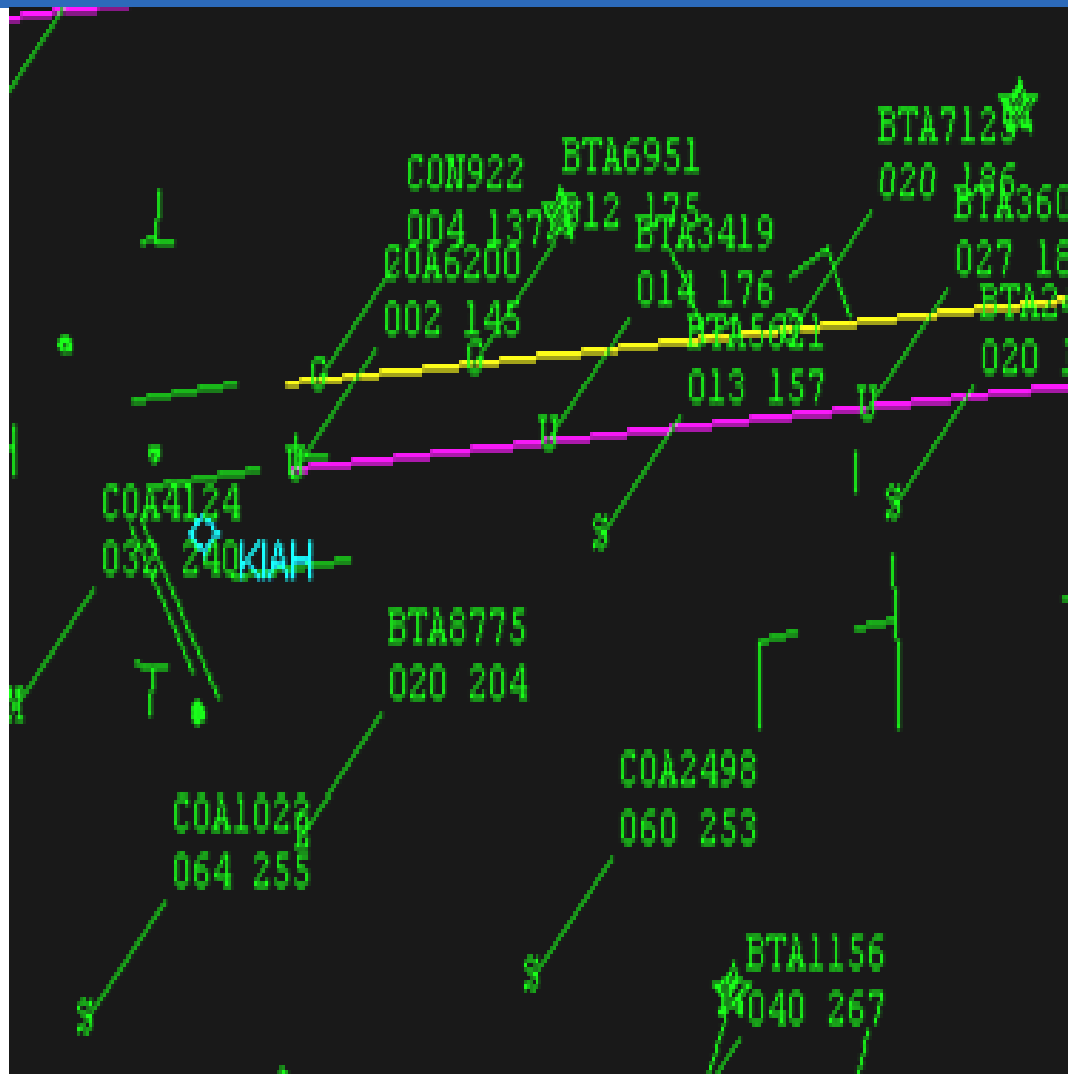
Seamless ATM Symposium

OVERVIEW

Performance Based Navigation

- Context
- Concept
- ICAO PBN Program
- Implementation
- Future targets



1 NAVIGATION IN CONTEXT

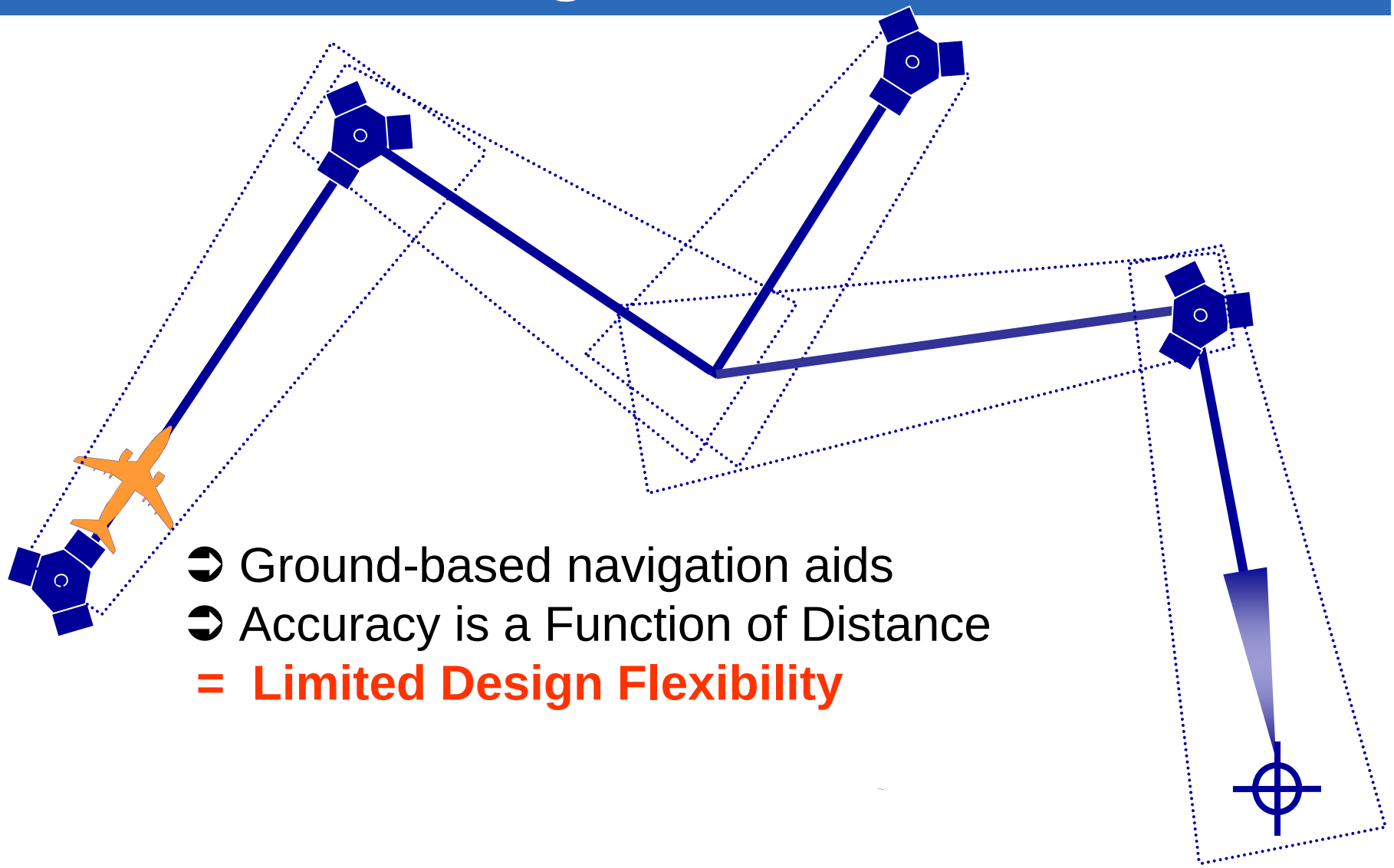
Aviation challenges

Growing:

- demand for solutions to airspace congestion
- fuel efficiency requirements
- environmental requirements
- demand for RNAV approaches (safety, accessibility)

Most can be met with current technology, but standardization and operational requirements have to be put into place

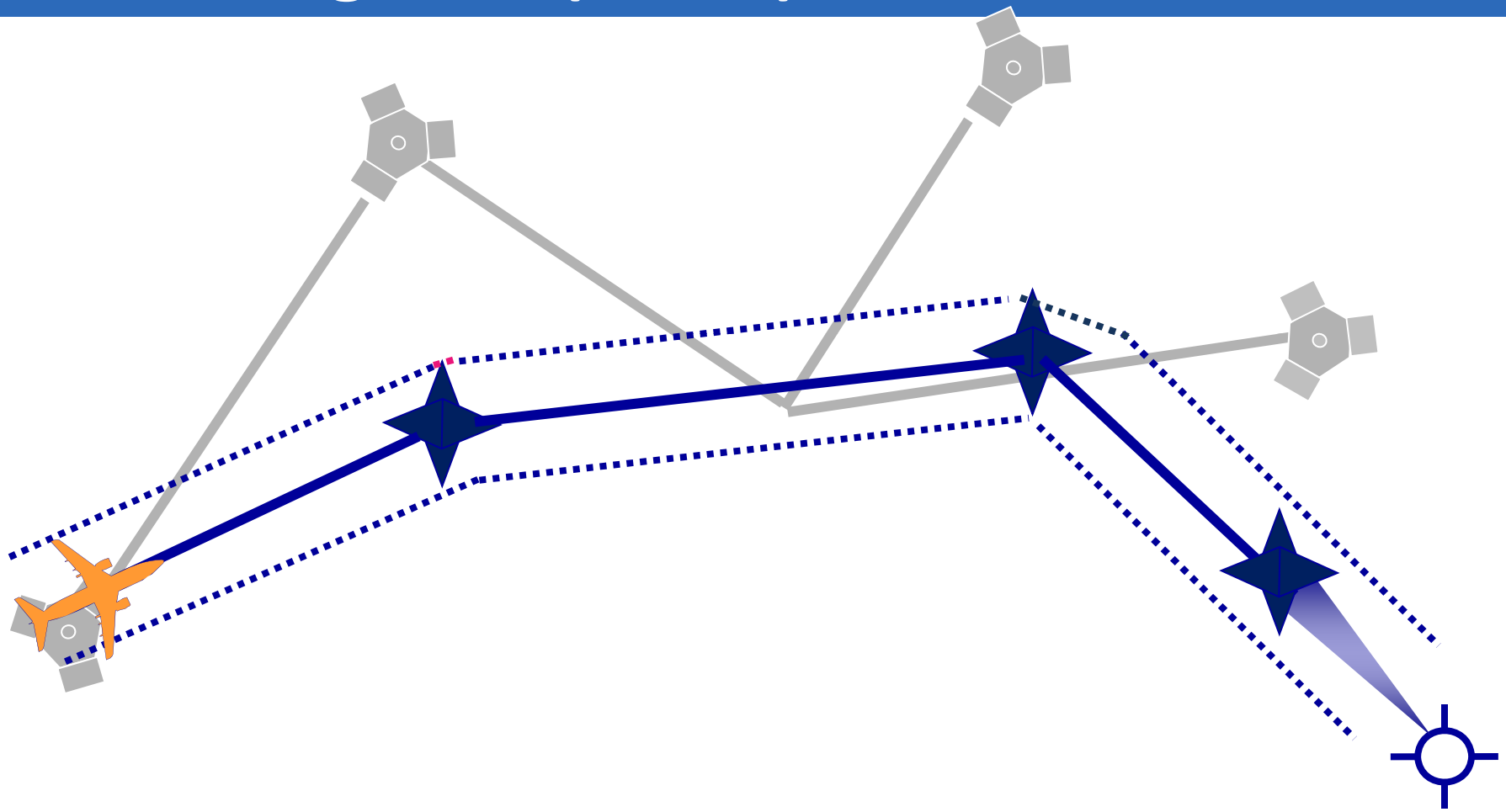
Conventional Navigation



- ➲ Ground-based navigation aids
- ➲ Accuracy is a Function of Distance

= Limited Design Flexibility

Area Navigation (RNAV)



RNAV (Pre-PBN) Shortfalls

- Only technology based
- No clear specification among States for implementation
- No clear guidance for:
  - aircraft requirements
  - operating procedures
  - training requirements
- No clear understanding for a match between onboard avionics and navaids

RNAV (Pre-PBN) Shortfalls

Developed *Required Navigation Performance* capability concept :

- To avoid selection between competing systems
- Only for en-route phase of flight (RNP-10 and RNP-4) for oceanic and remote applications
- No requirements for continental enroute and terminal applications

- This led to:
  - Proliferation of national standards
  - Variety of required navigation sensors
  - Differing air crew requirements

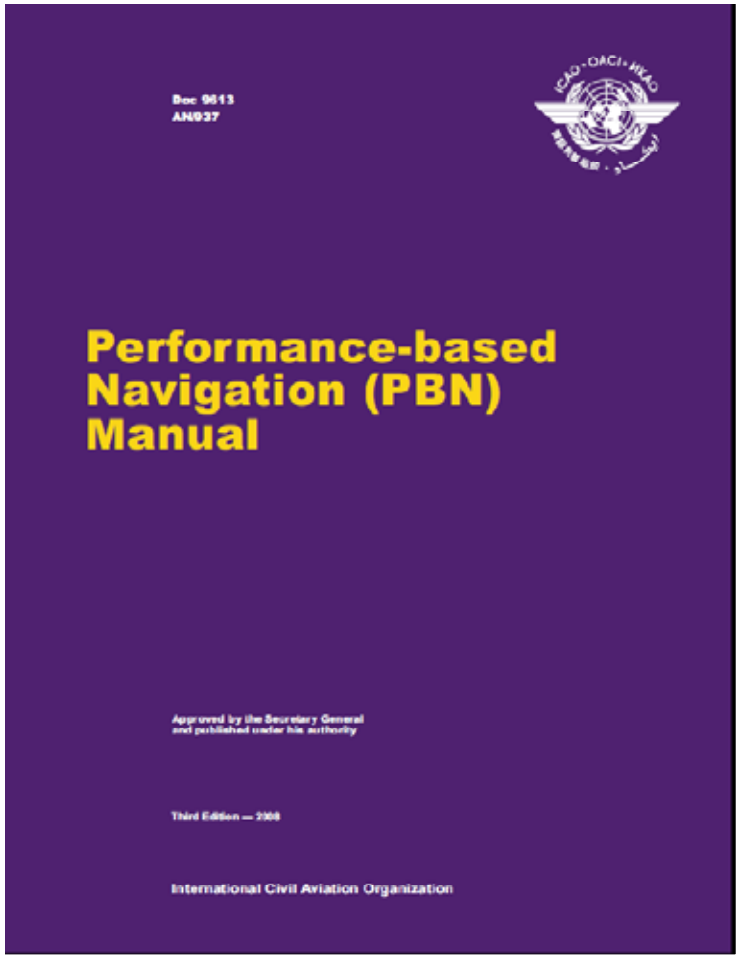
Lack of global harmonization

What needed to be done

- Distinction – operations that require performance monitoring and alerting and don't require
- Harmonization of RNAV and RNP operations
- New nav specs to meet operational requirements
- Clear implementation guidance needed to be available

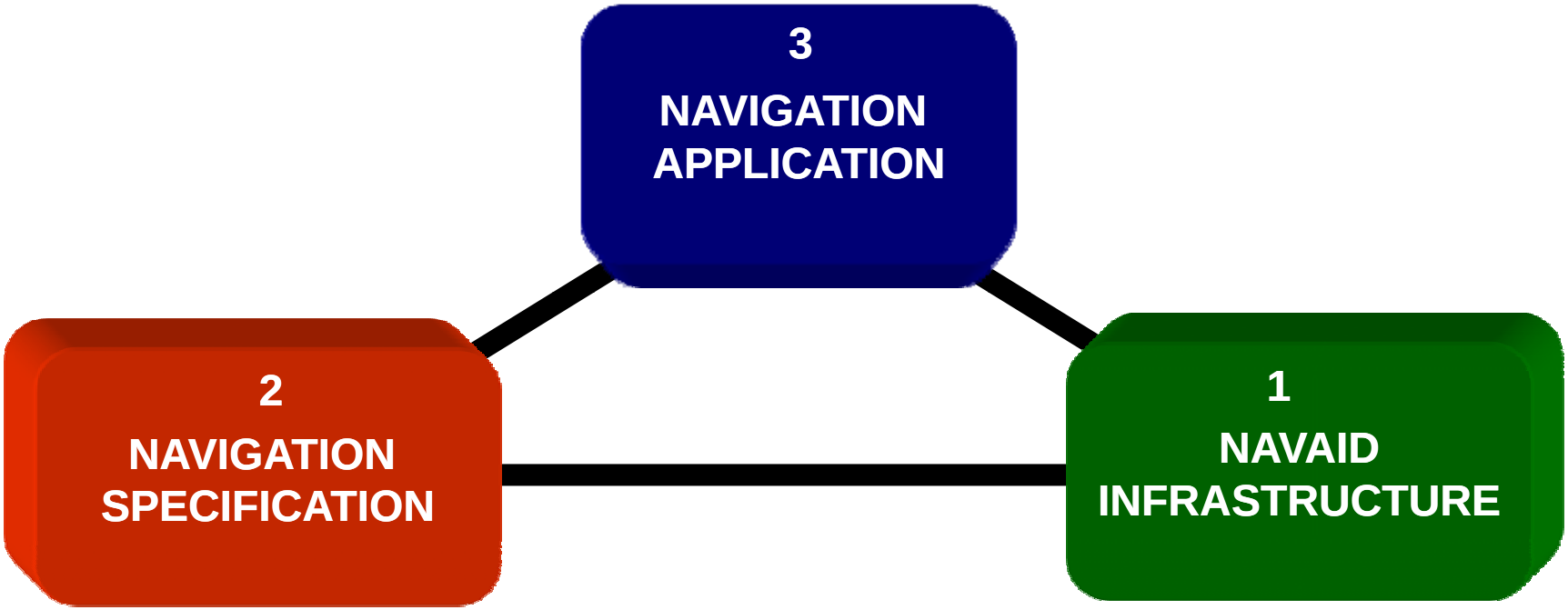
2. PBN CONCEPT

Performance Based Navigation



- *PBN Concept* replaced RNP Concept
- Publication of Doc 9613, PBN Manual

Components of PBN Concept



Components of PBN Concept - Infrastructure

- **Ground-based Navigation Aids (Navaids)**
  - **VOR; DME;** (Not NDB)
- **Space-based Navaids**
  - **GNSS**
    - **ABAS, GBAS and SBAS**

1

NAVAID INFRASTRUCTURE

Components of PBN Concept – Navigation Specification

International Navigation Specifications published in Volume II of PBN Manual

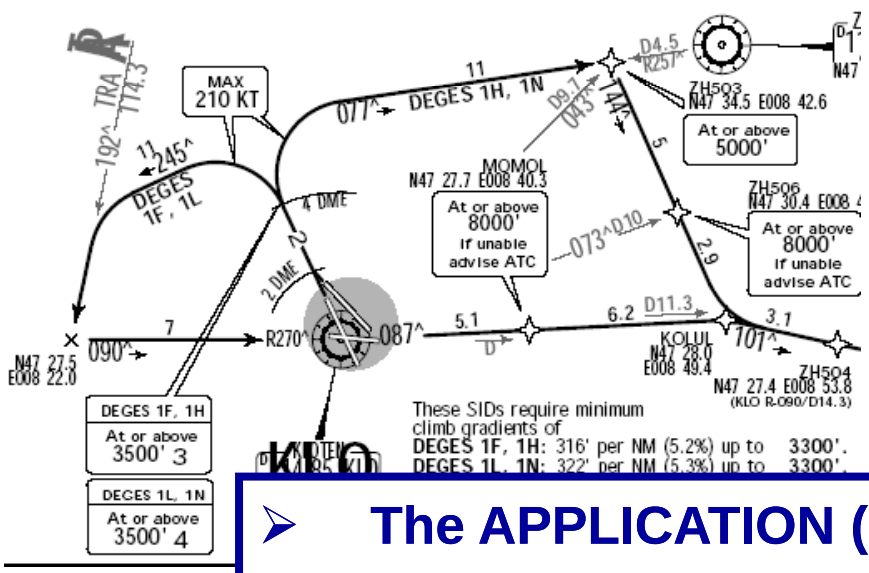
2
NAVIGATION SPECIFICATION

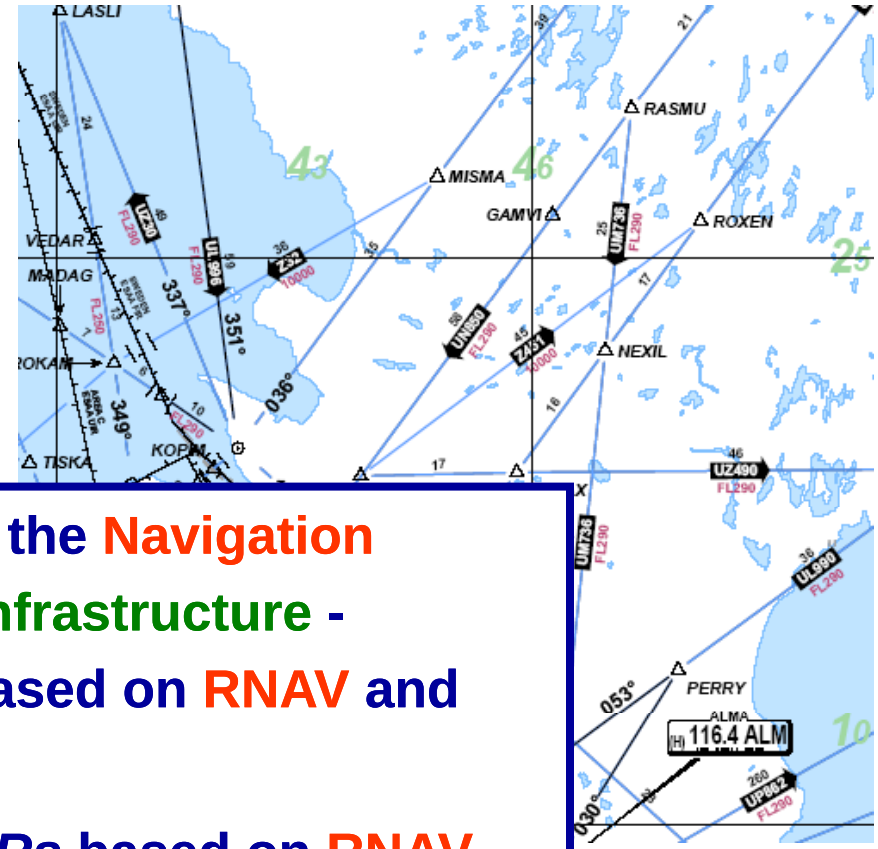
- **PERFORMANCE**
- **Functionalities**
- **Navigation Sensors**
- **Air crew requirements**

Previous RNP Concept

Document used by State as basis for developing Certification & Operational Approval

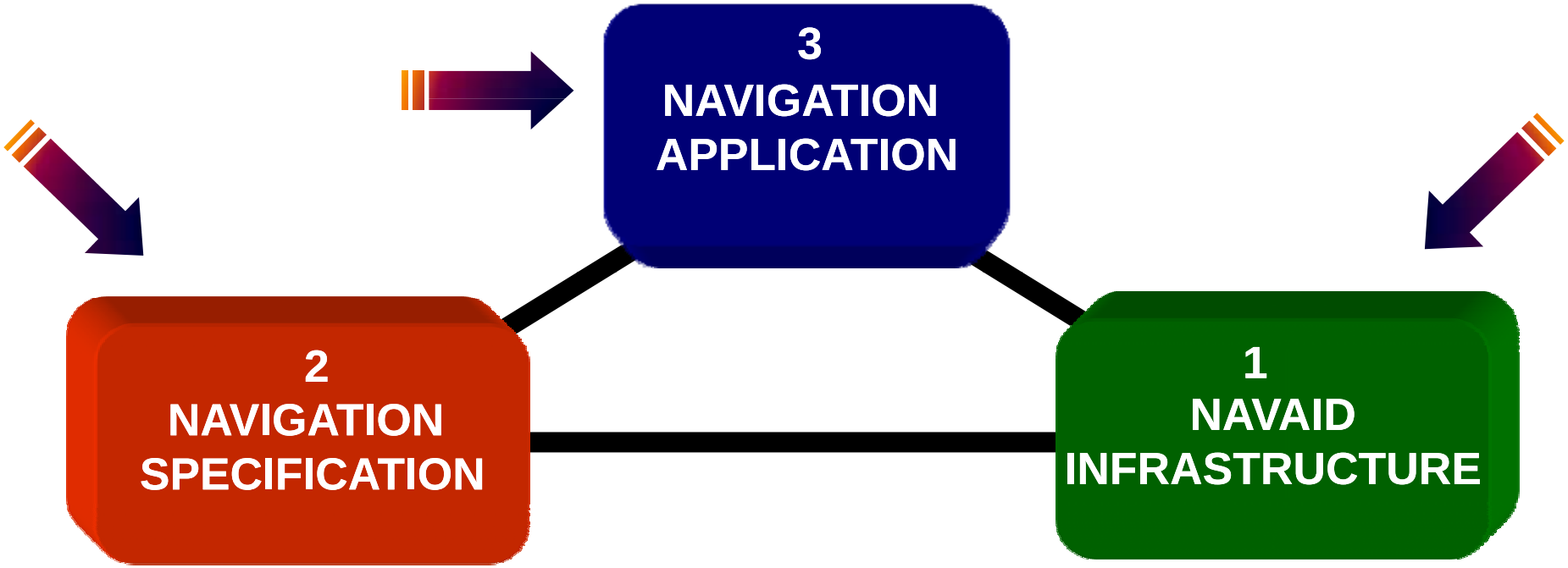
Components of PBN Concept – Navigation Application



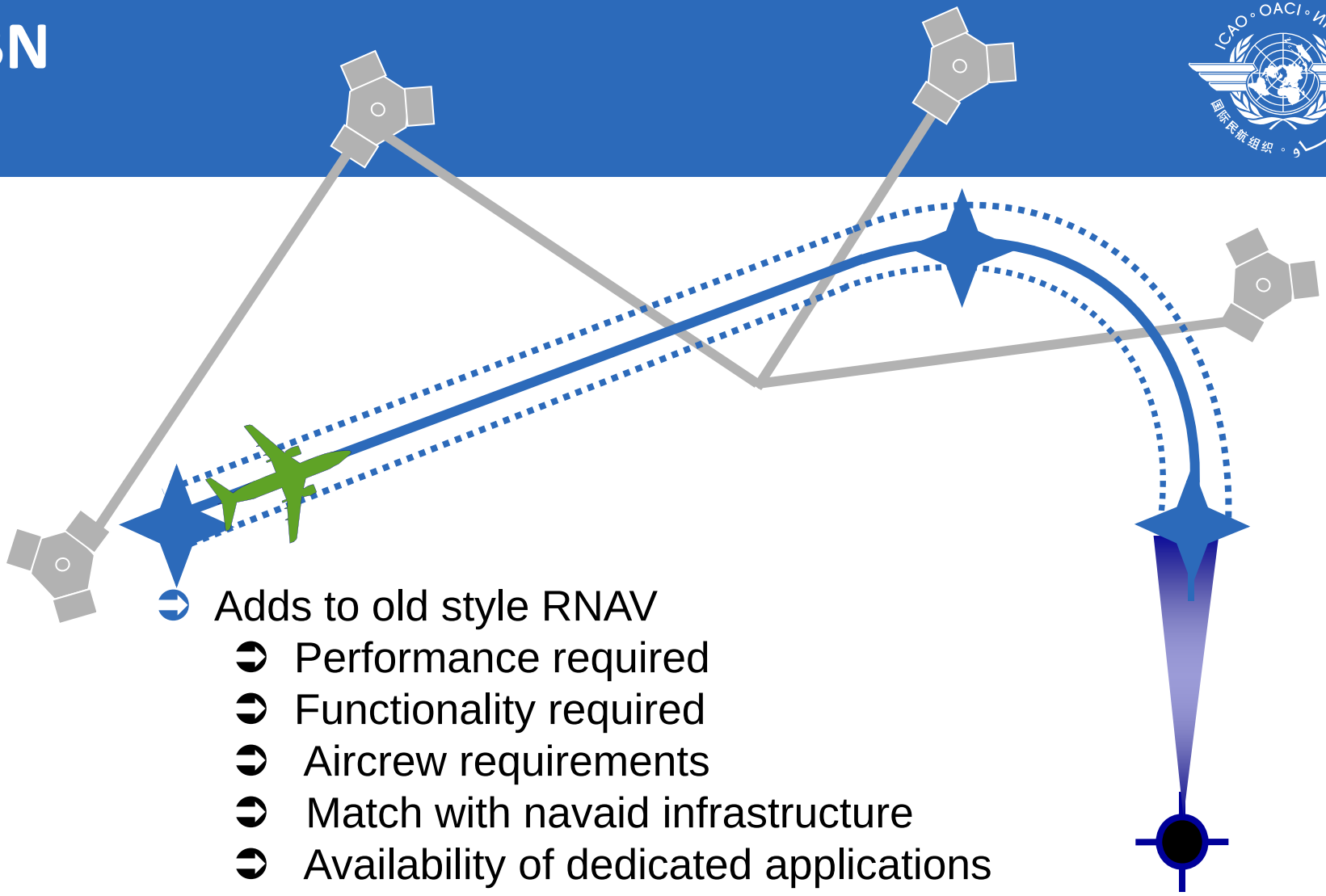


- **The APPLICATION (use of) the Navigation Specification and Navaid Infrastructure -**
  - **<u>For example:</u> *Routes* based on RNAV and RNP Specifications**
  - **<u>For example:</u> *SIDs/STARs* based on RNAV and RNP Specifications;**

Components of PBN Concept



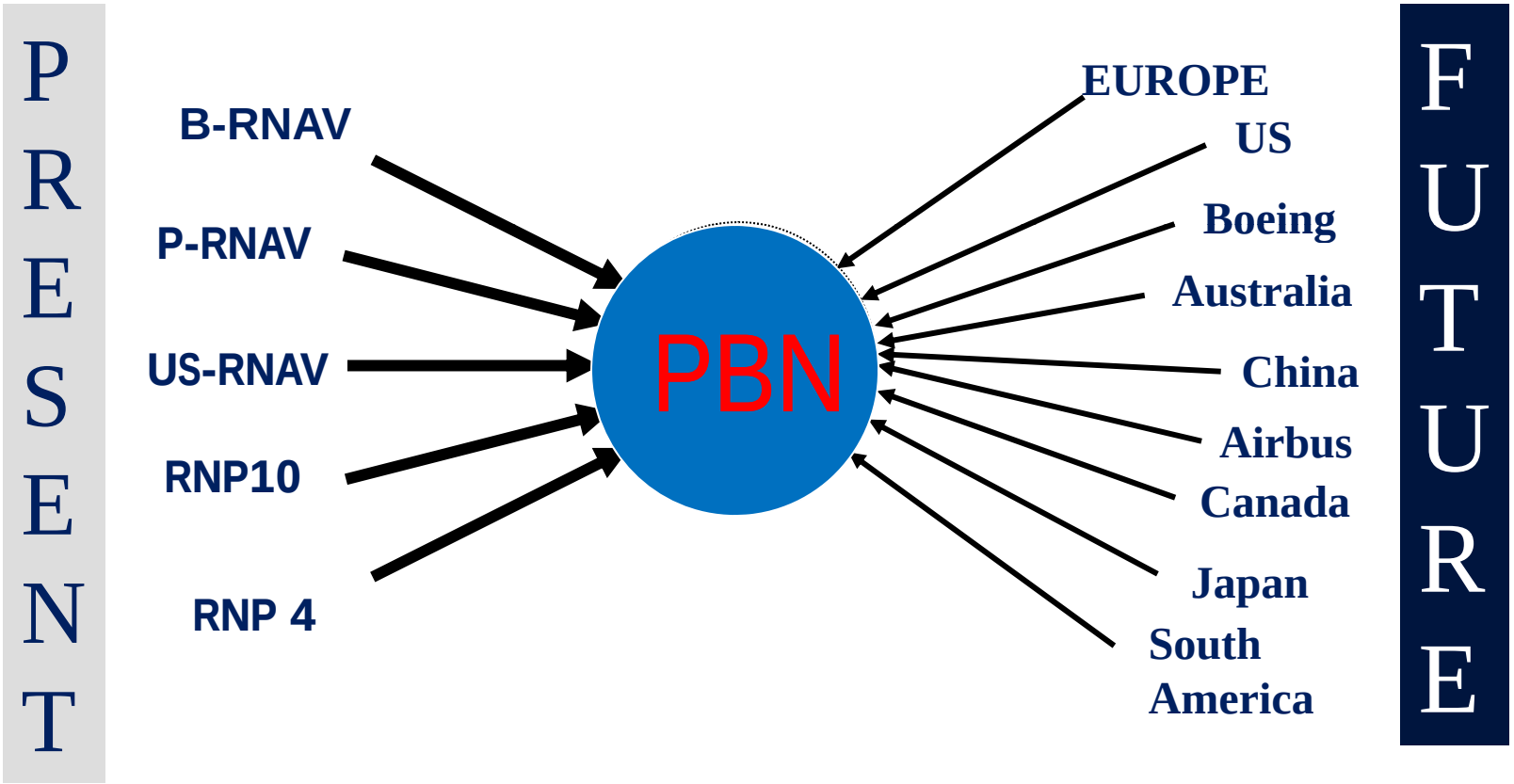
PBN



- Adds to old style RNAV
  - Performance required
  - Functionality required
  - Aircrew requirements
  - Match with navaid infrastructure
  - Availability of dedicated applications

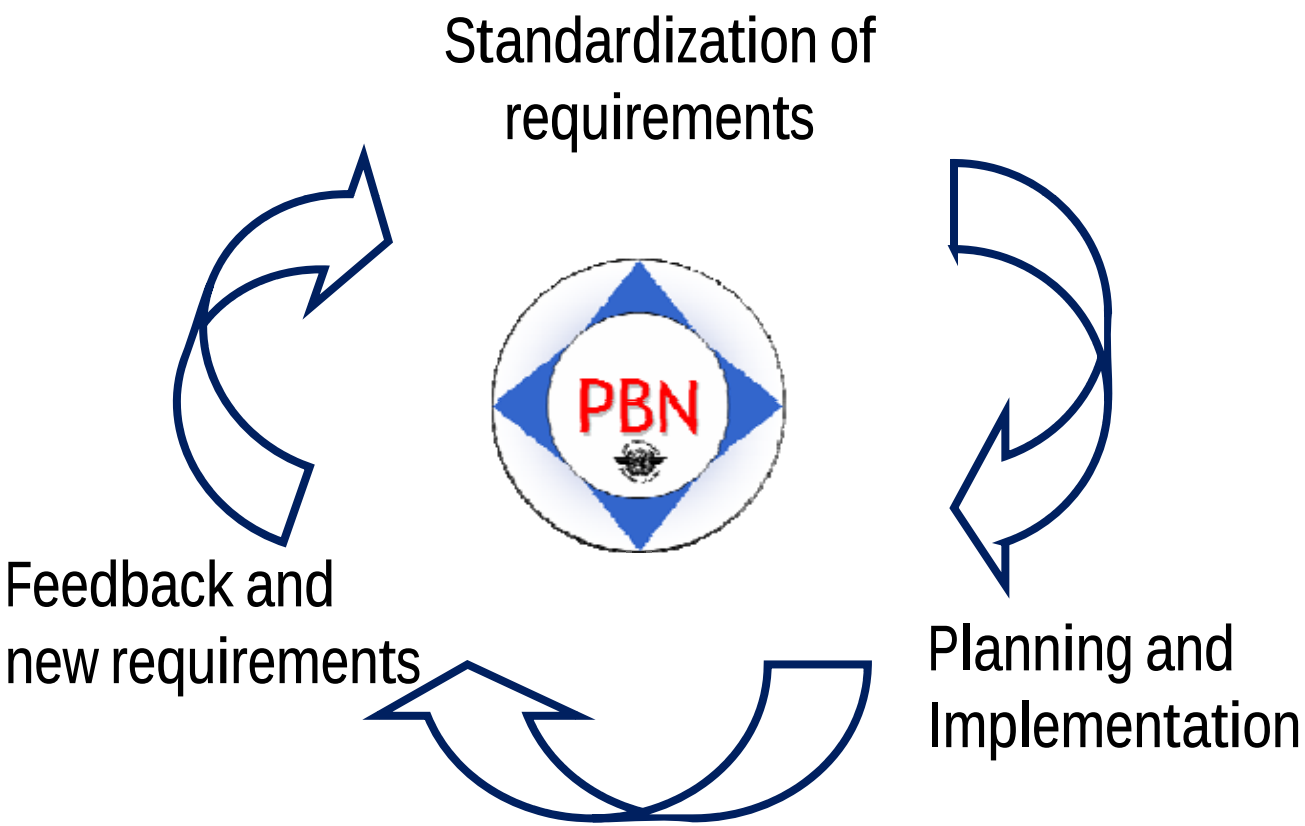
= Optimized Use of Airspace

PBN convergence



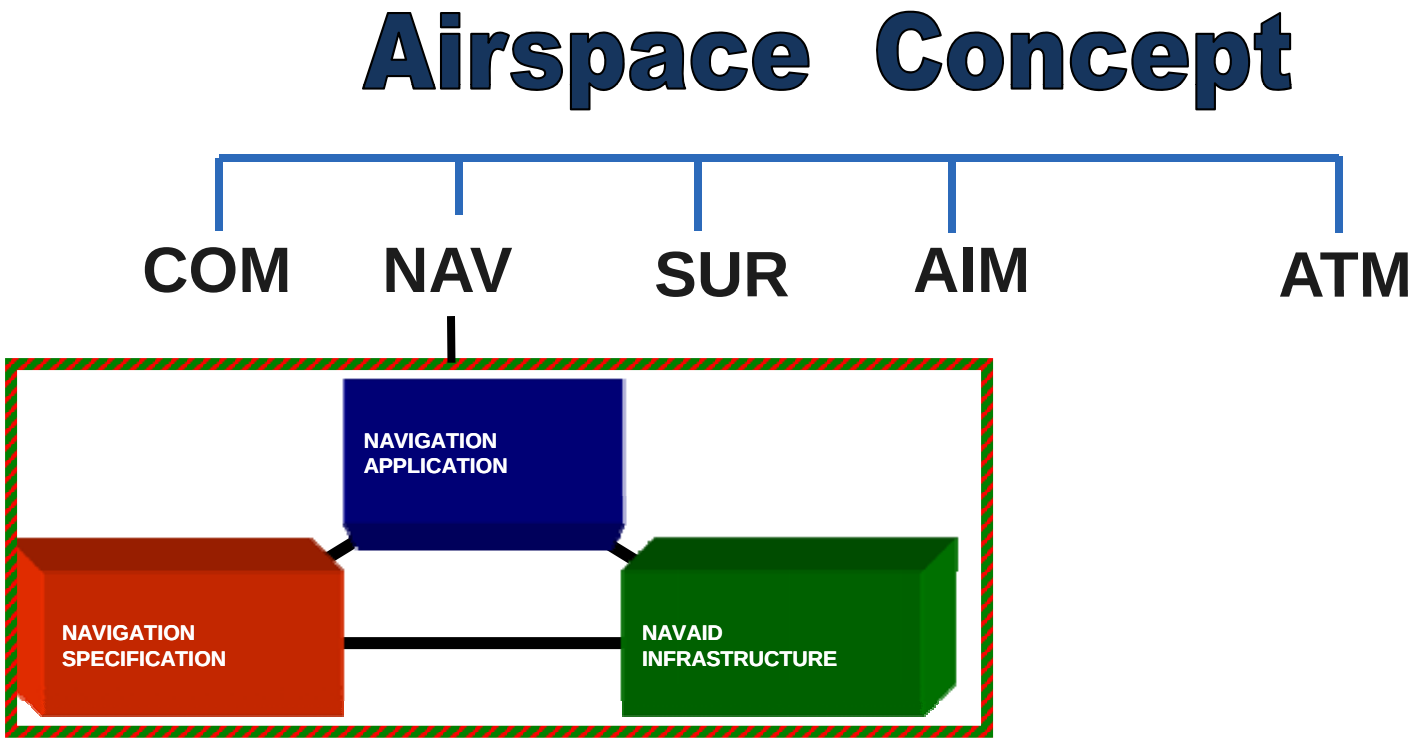
ICAO PBN Programme

An integrated approach



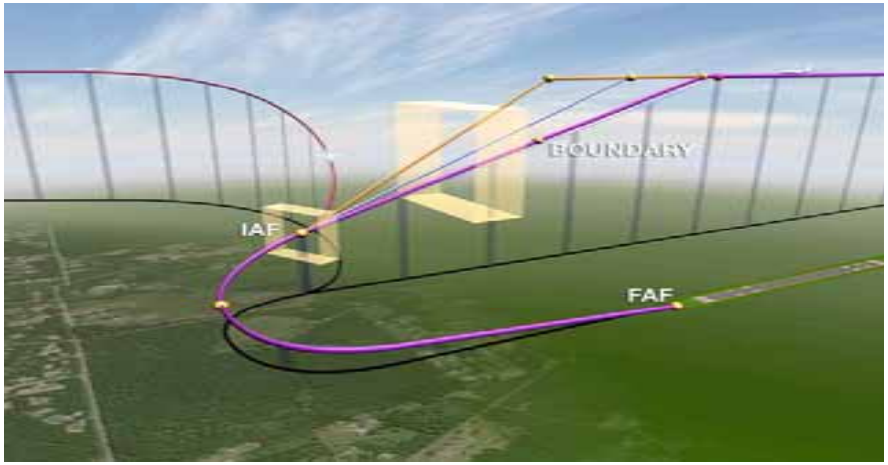
Context of PBN

ICAO GLOBAL ATM OPERATIONAL CONCEPT



Optimizing Airspace Operations Today

- Need: Expedite benefits-driven PBN implementation
- Plans for this triennium:
  - Joint ICAO/Industry Go-Teams
  - Airspace Design Workshops
  - Ops Approval Workshops
  - Continuous Descent/Climb Operations Workshops



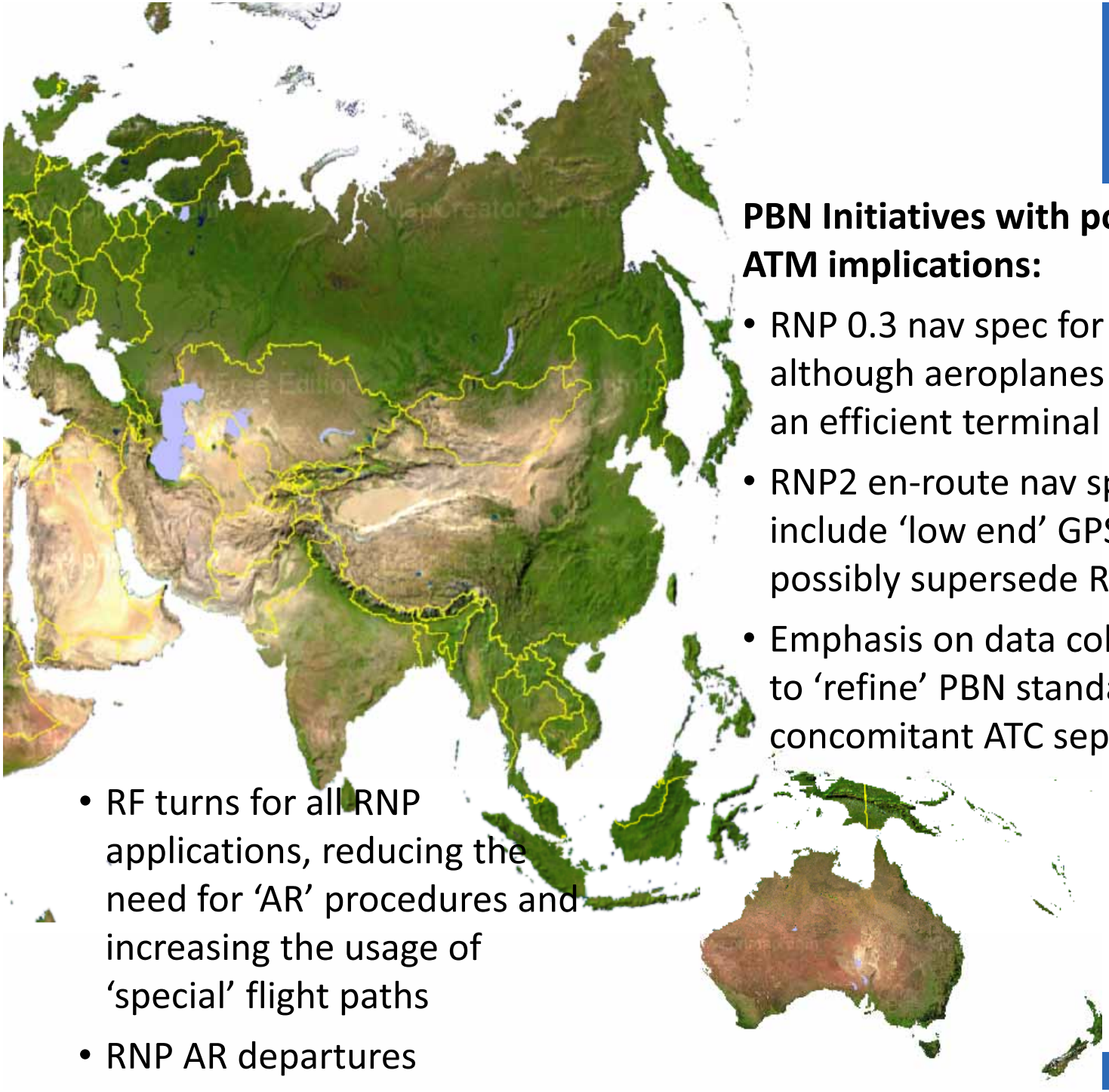
Initiative
Asia Pacific
Flight Procedure Program
(FPP)

Expedite PBN implementation through our partnership with States in the region

Pool of resources from the region

Build a minimum common level of IFP expertise across the region

Create win – win situation for States as well as industry



PBN Initiatives with possible Seamless ATM implications:

- RNP 0.3 nav spec for rotary operations although aeroplanes were not excluded - an efficient terminal application?
- RNP2 en-route nav spec which may include 'low end' GPS IFR aircraft and possibly supersede RNAV5/RNP4?
- Emphasis on data collection and analysis to 'refine' PBN standards and the concomitant ATC separation standards

- RF turns for all RNP applications, reducing the need for 'AR' procedures and increasing the usage of 'special' flight paths
- RNP AR departures

Future Goals

- **Contained in A37-11, September 2010**
- **States complete a PBN implementation plan**

Future

Courses:

- OPS approval
- Airspace design
- CDO/CCO design

GO-TEAMs:

-Assist in direct implementation

Hands-on guidance:

OPS approval

Airspace design

THANK YOU

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