# Performance Based Navigation:

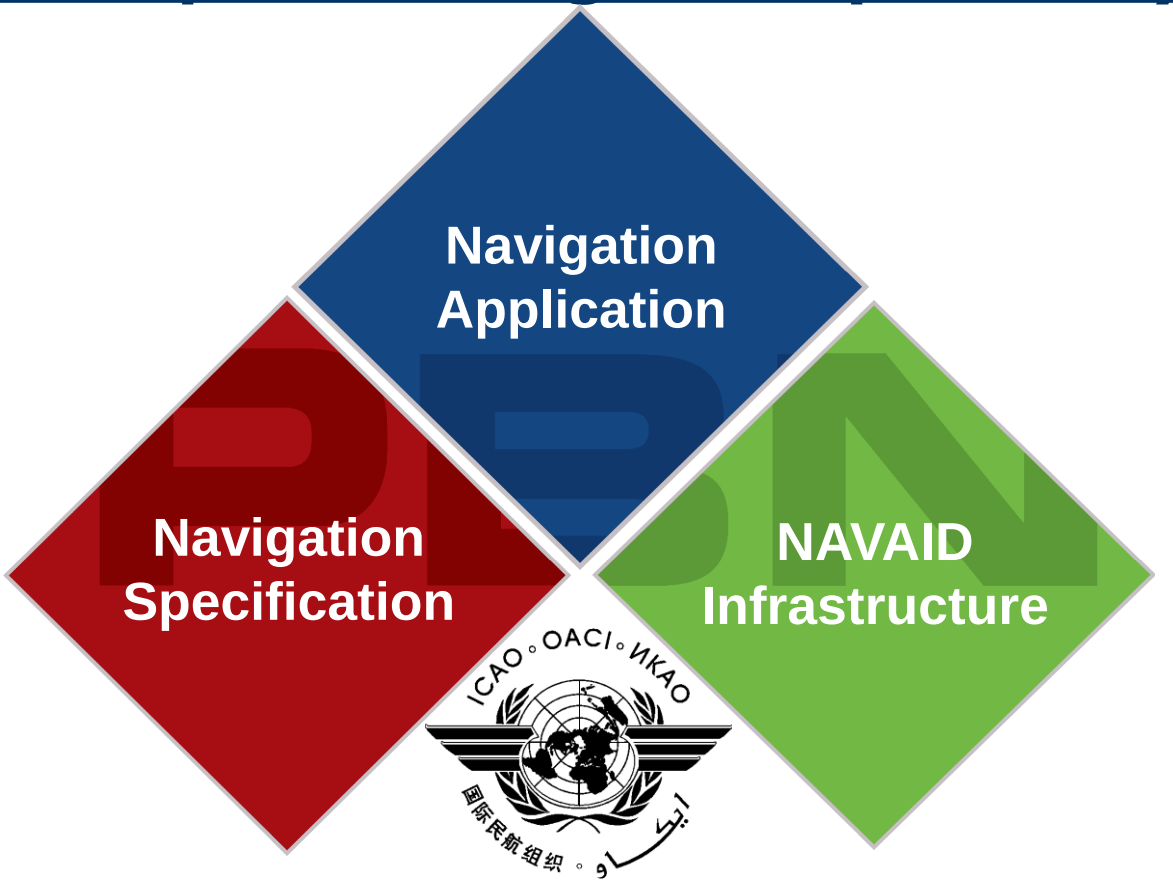
## Global view and importance of PBN to increase safety, capacity and efficiency within Europe

EASA Workshop on PBN Operations
Cologne, 14 and 15 January 2014

Sasho NESHEVSKI
Senior Expert - Regulation

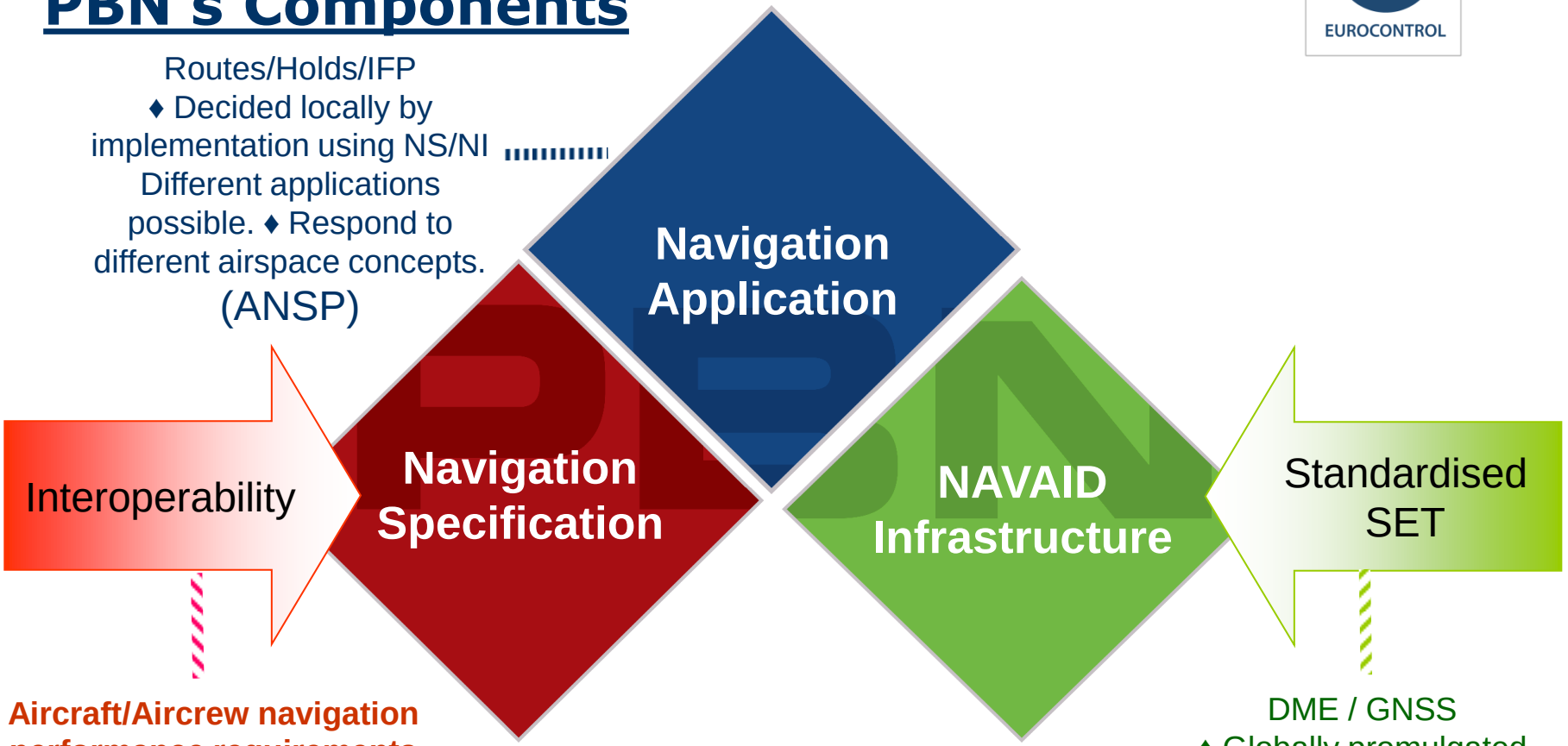
DSS/SES Unit, EUROCONTROL
sasho.neshevski@eurocontrol.int

# The PBN Concept: Enabling interoperability



# PBN's Components

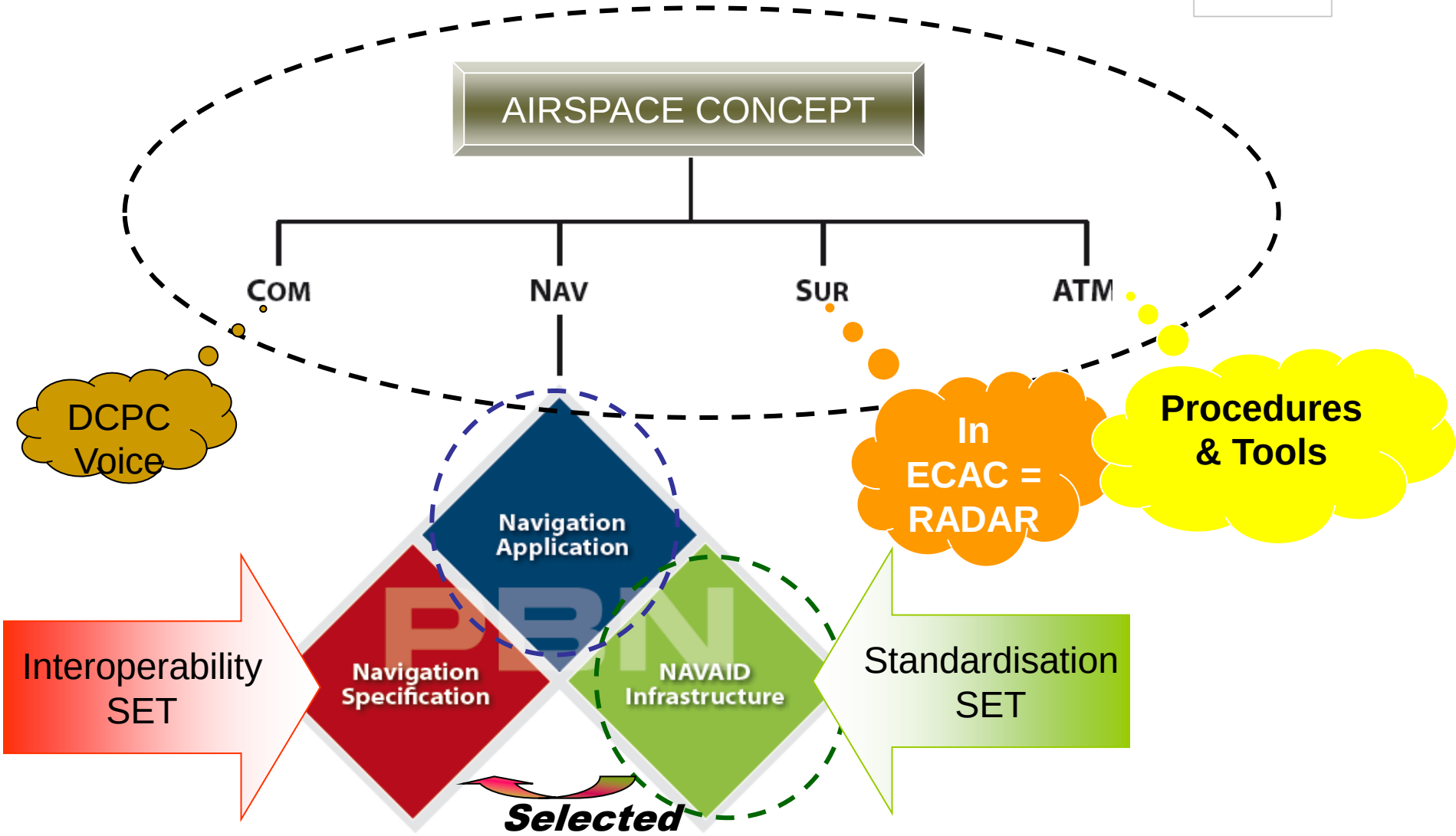
Routes/Holds/IFP
♦ Decided locally by implementation using NS/NI Different applications possible. ♦ Respond to different airspace concepts.
(ANSP)




**Aircraft/Aircrew navigation performance requirements**
♦ Fixed globally with acceptable means of compliance (in ICAO PBN Manual). ♦ Some options.
♦ 'Logic' is that state / regional certification should not be more demanding.
(OEM/Regulator)

DME / GNSS
♦ Globally promulgated performance standards (in ICAO Annex 10). ♦ Choice of Infra depends on NAV spec requirements *and* local infrastructure decisions.
(Service Provider & ANSP)

# PBN in context



# Interoperable Navigation Specifications

Navigation Specification

Interoperability *inside*

**ICAO Navigation Specifications**

**PUBLISHED IN PBN MANUAL**

**Used by State as basis for developing Certification & Operational Approval**

## RNAV

**Designation**
**RNAV 10**
For Oceanic and Remote Continental Applications

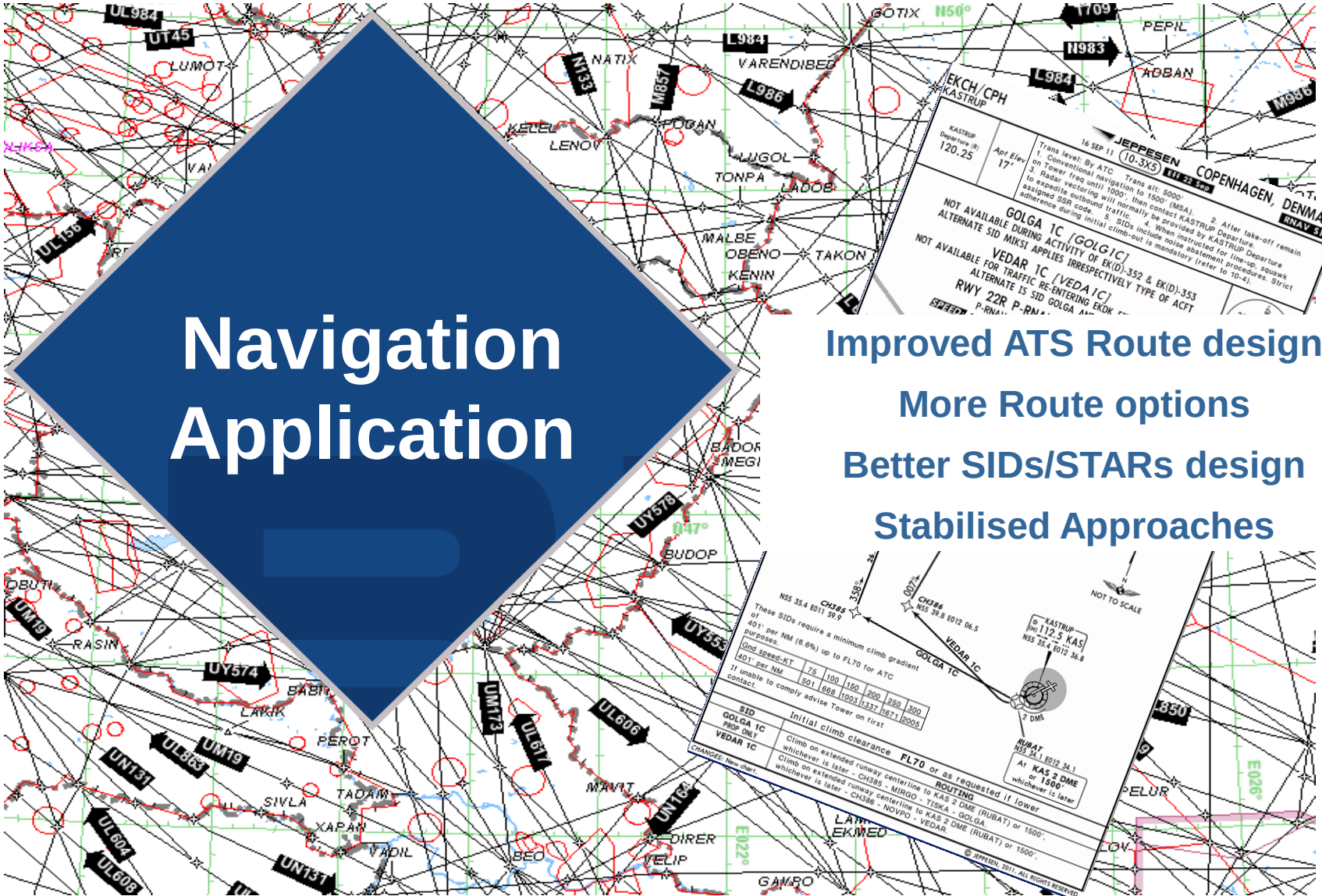
**Designation**
**RNAV 5**
**RNAV 2**
**RNAV 1**
For En-Route & Terminal Applications

## RNP

**Designation**
**RNP 4**
For Oceanic and Remote Continental Applications

**Designation**
**RNP 2**
**RNP 1**
**Advanced RNP**
**RNP 0.3**
**RNP APCH**
**RNP AR APCH**
For various phases of flight

# Using PBN

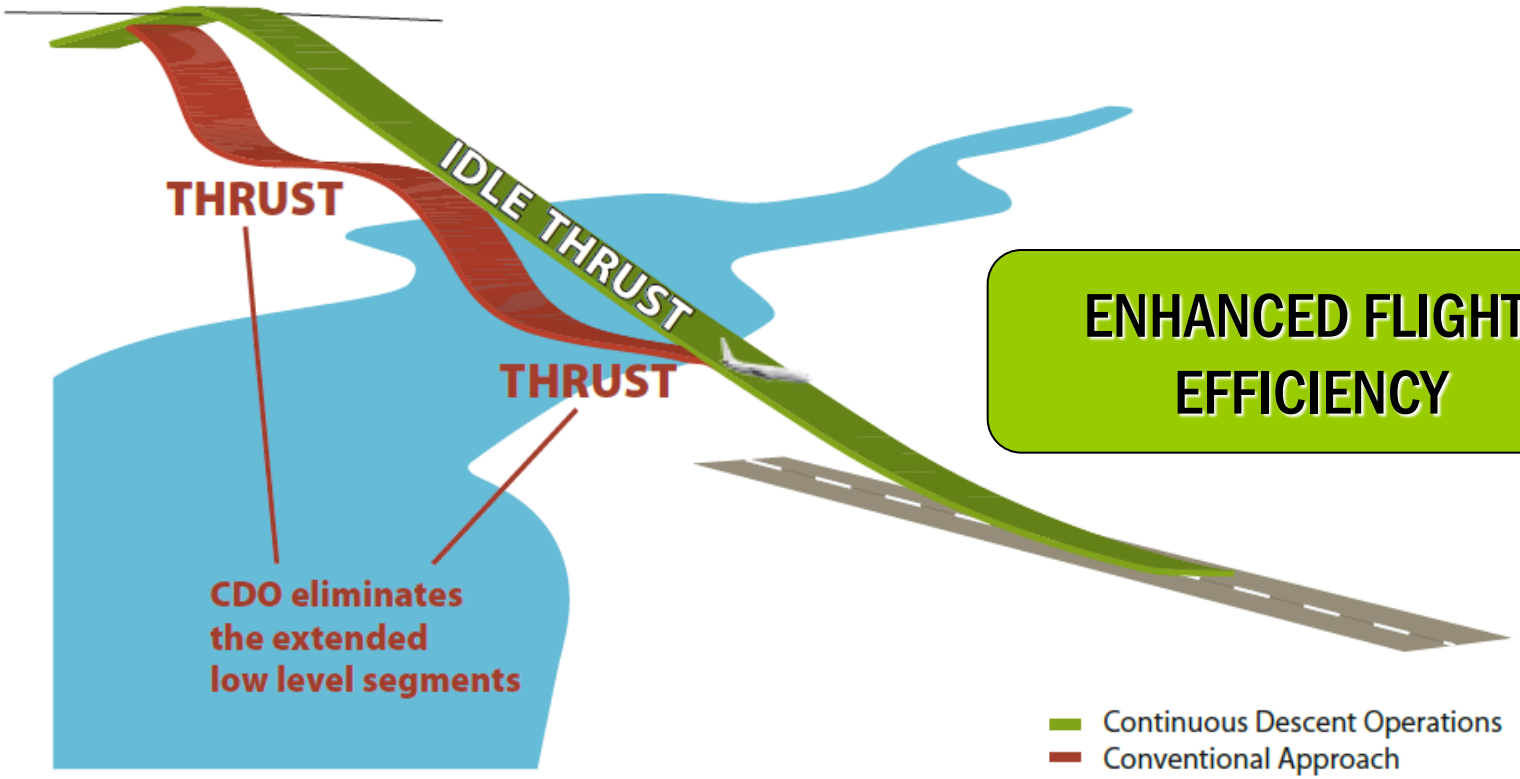

Navigation Application
Improved ATS Route design
More Route options
Better SIDs/STARs design
Stabilised Approaches
EKCH/CPH
KASTRUP
JEPPESEN
COPENHAGEN, DENMARK
GOLGA 1C [GOLG1C]
VEDAR 1C [VEDA1C]
RWY 22R
NOT TO SCALE
Initial climb clearance FL70 or as requested if lower
ROUTING
Climb on extended runway centerline to KAS 2 DME (RUBAT) or 1500', whichever is later - CH385 - MIRGO - TISKA - GOLGA
Climb on extended runway centerline to KAS 2 DME (RUBAT) or 1500', whichever is later - CH386 - NOVPO - VEDAR

Navigation Application

# Improved descent profile

EUROCONTROL

AIRSPACE CONCEPT + good airspace design




ENHANCED FLIGHT EFFICIENCY

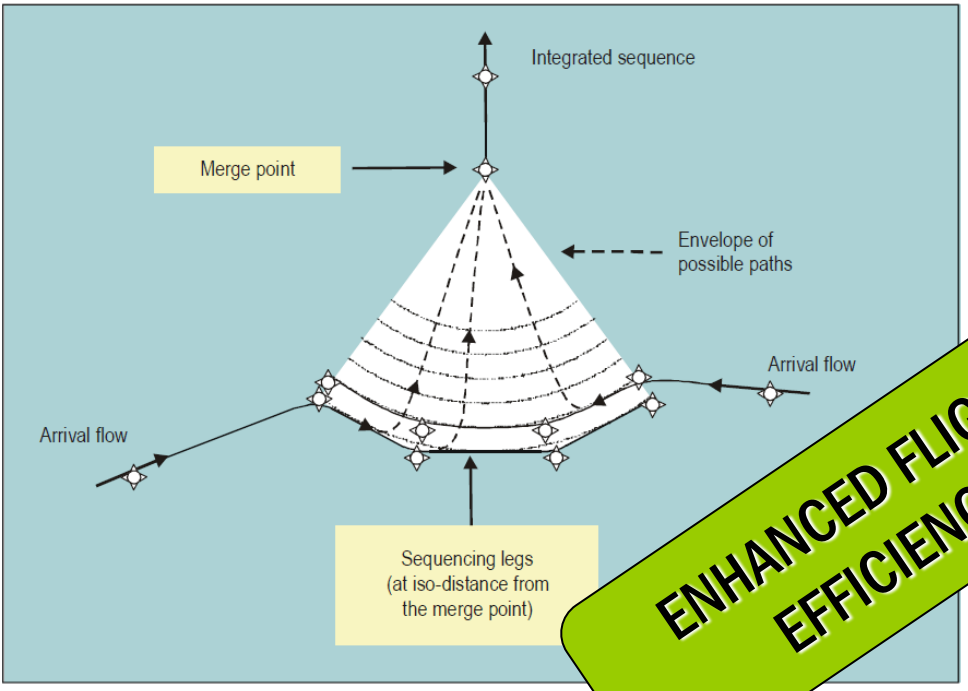
Navigation Application

# CDOs work better with PBN

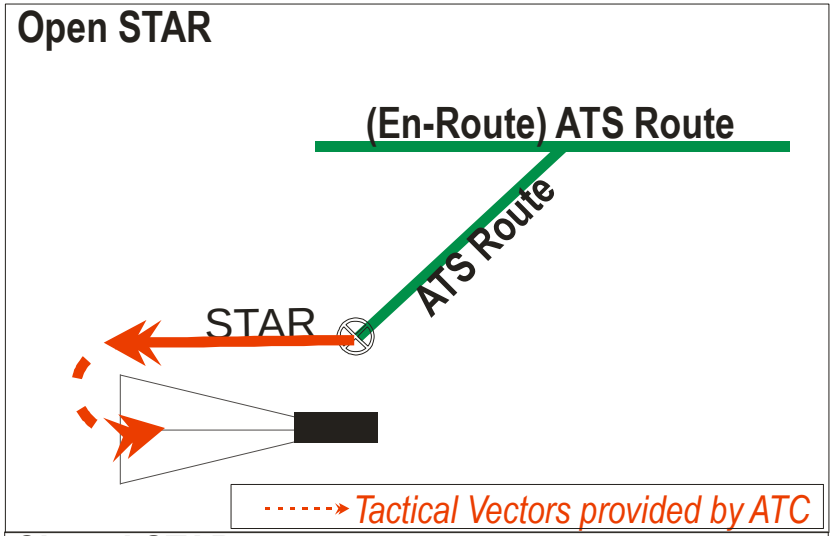
EUROCONTROL

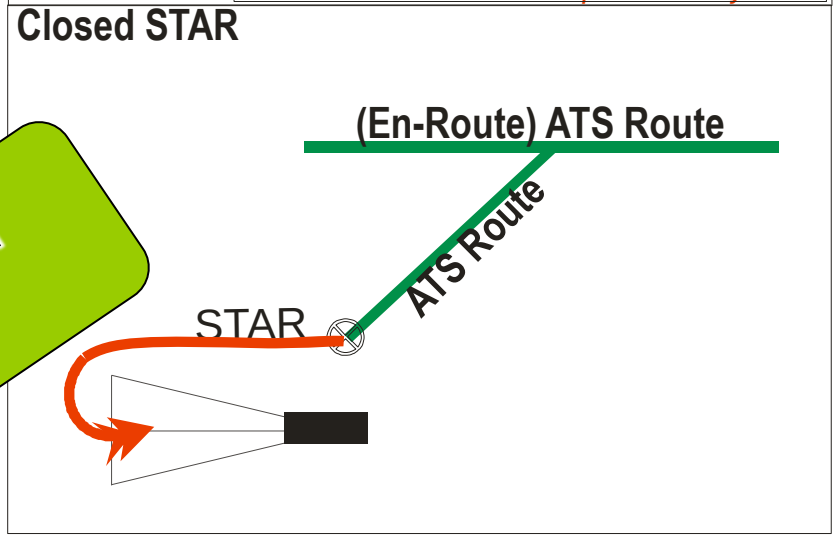
AIRSPACE CONCEPT + good airspace design

- Manual CDOs possible – Radar vectoring
- Systemised CDOs better – use PBN




ENHANCED FLIGHT EFFICIENCY



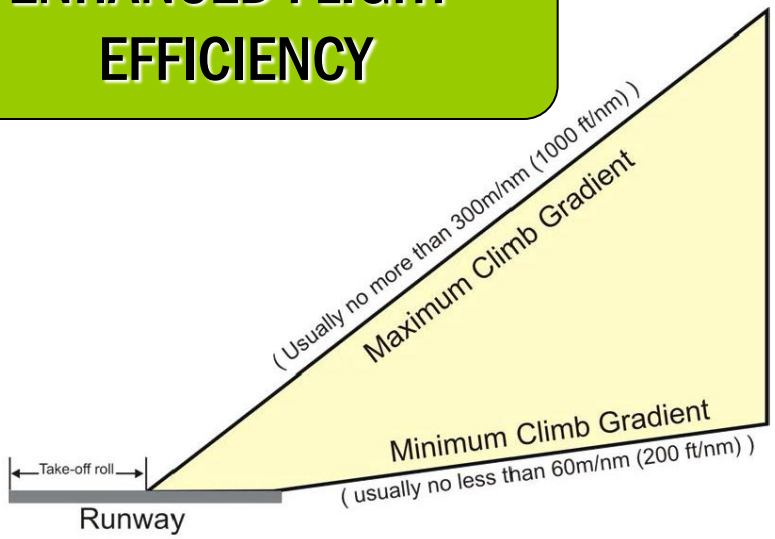
Navigation Application

# CCO – Continuous Climb Operations

EUROCONTROL

AIRSPACE CONCEPT + good airspace design

**ENHANCED FLIGHT EFFICIENCY**



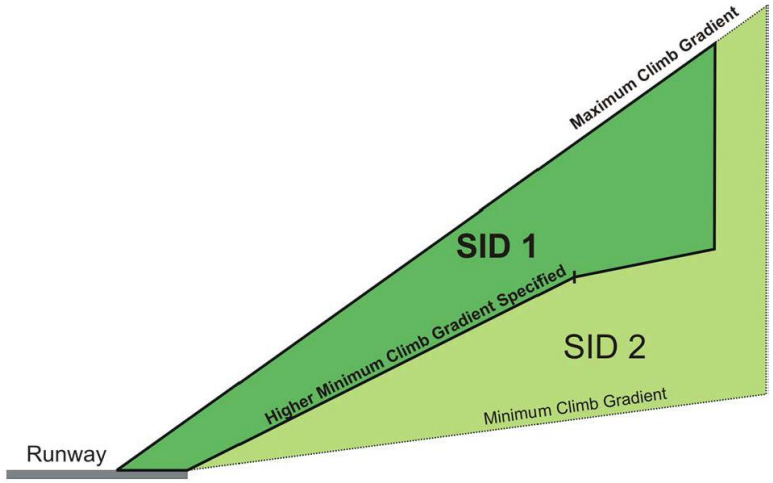



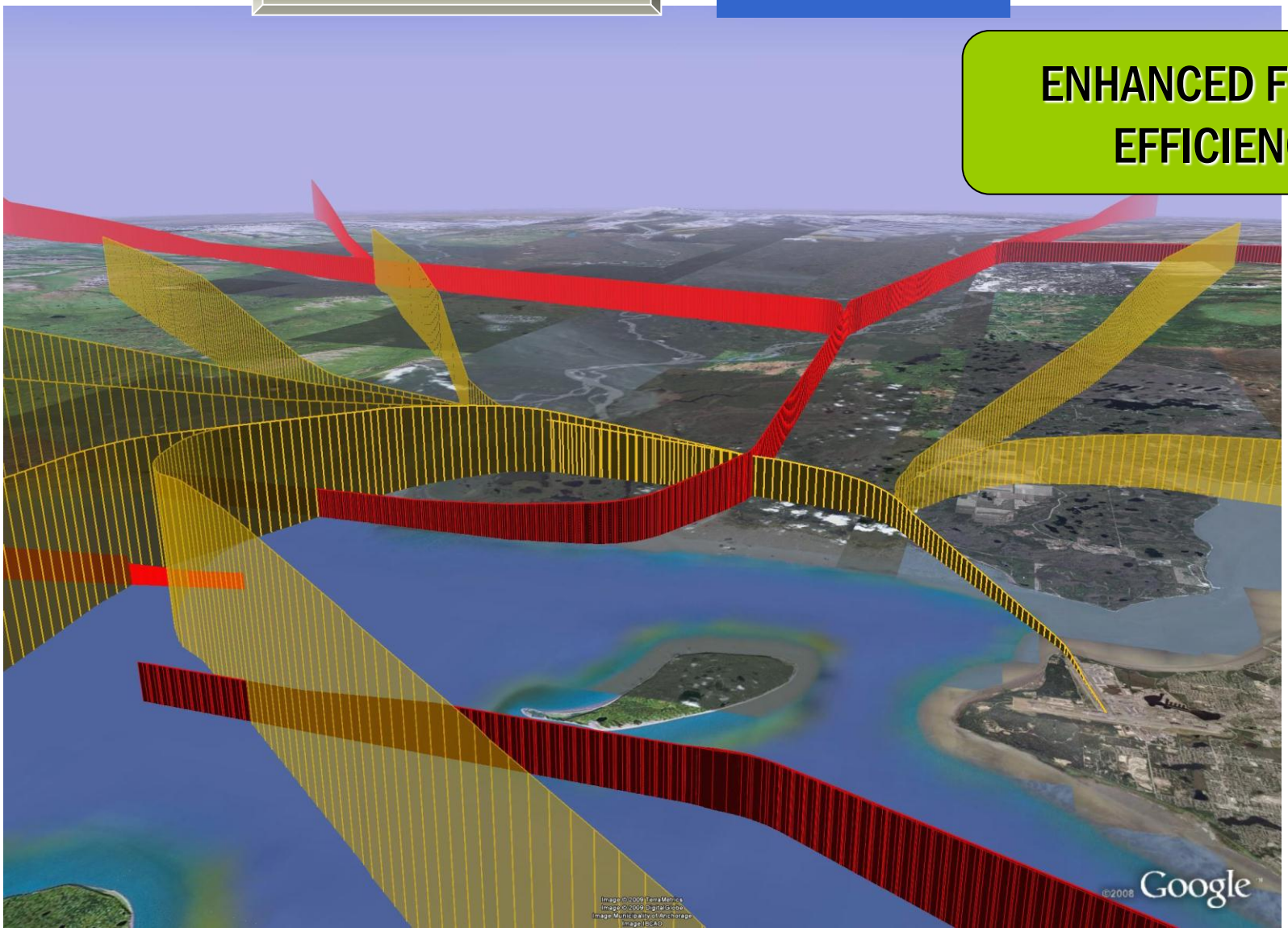

Figure 1.2. Multiple CCO SID Design – Profile View

Navigation Application

# CDO & CCO – working together

AIRSPACE CONCEPT + good airspace design

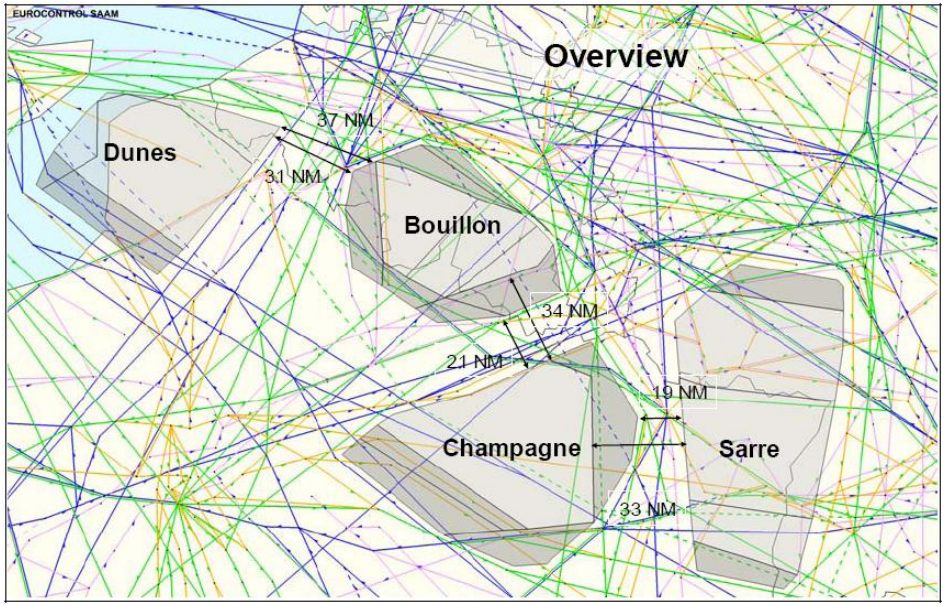
**ENHANCED FLIGHT EFFICIENCY**



Navigation Application

# Improved route spacing

- Tighter route spacing (also on turns: with **FRT**)
  - Expanding TSAs/TRAs
- Strategic separation of ATS Routes to/from Terminal airspace (Greater confidence in track keeping with **RNP**)

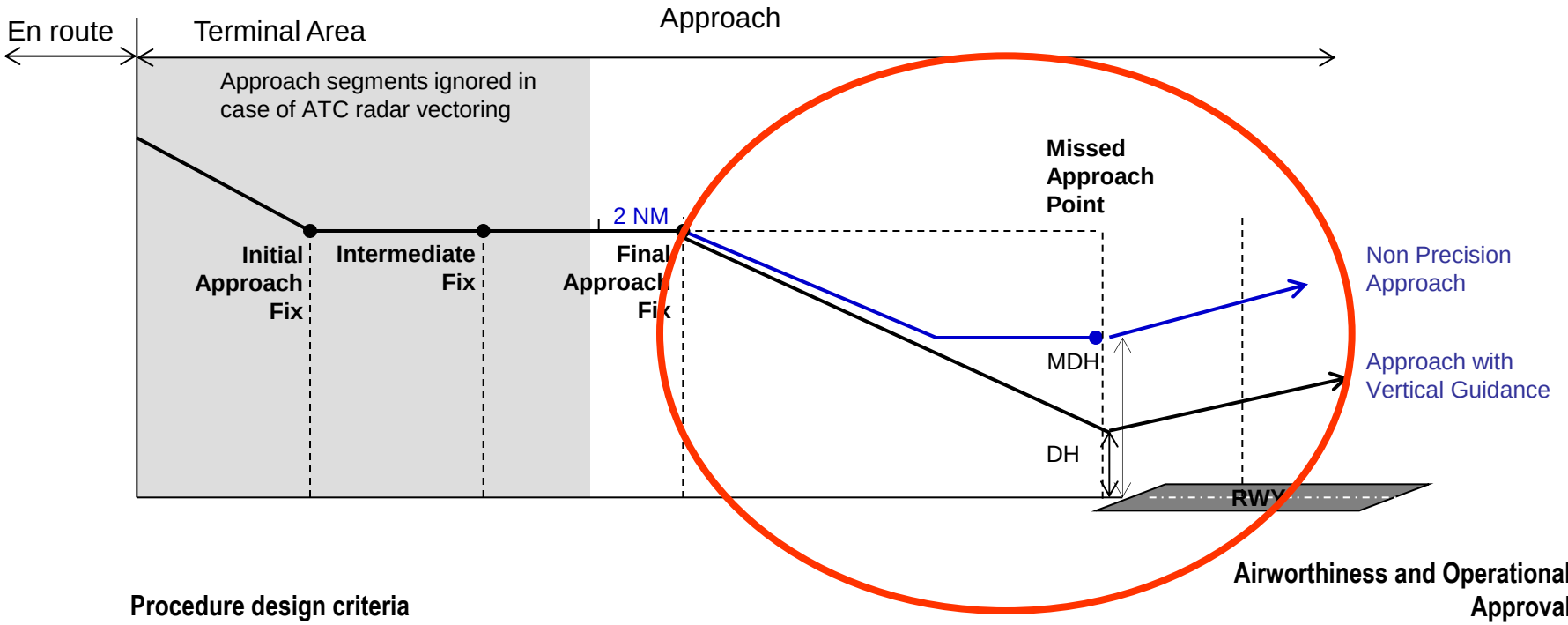



**ENHANCED FLIGHT EFFICIENCY**

**INCREASED CAPACITY**

# RNP APCH (APV)

**SAFETY, ACCESS TO AIRPORTS**




Lateral Navigation (LNAV)

Lateral and Vertical Navigation (LNAV/VNAV)

Localizer Performance with Vertical Guidance (LPV)

AMC 20-27

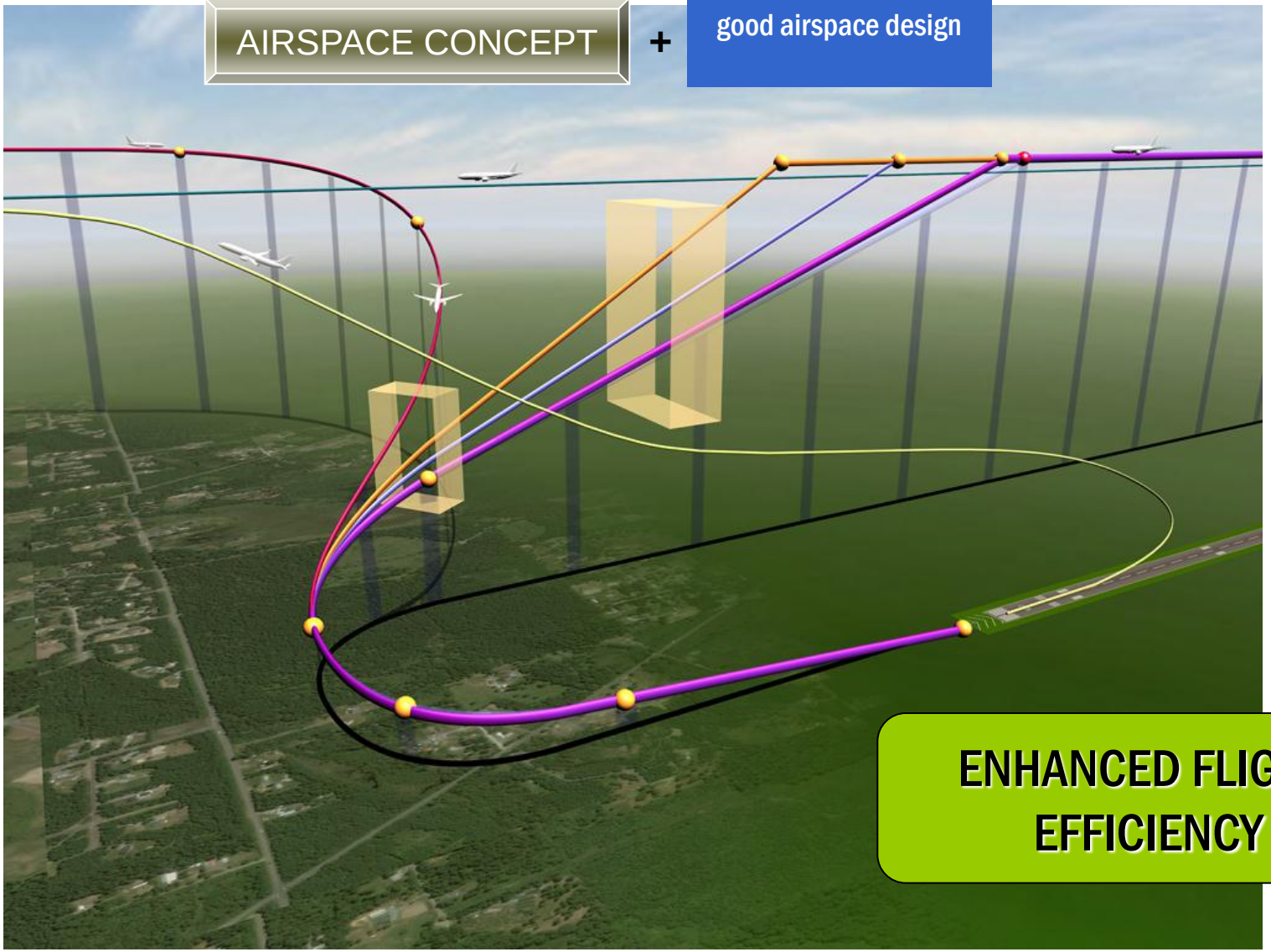
AMC 20-28

# PBN Implementation across flight phases

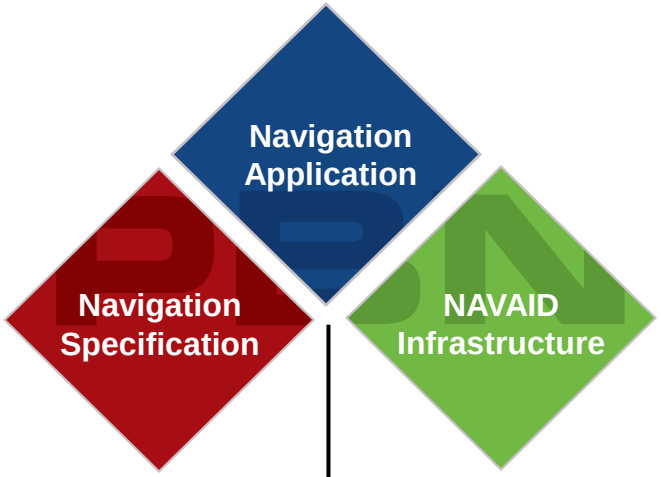
- PBN Implementation must SEAMLESSLY CONNECT **between flight phases and to other applications:**
  - Link Oceanic > En Route > Terminal > Approach
  - Link SID/STARs/IAP <> Final Approach procedures e.g.
    - ILS/MLS
    - GLS (using GBAS)
    - PBN RNP APCH (LNAV or LNAV/VNAV or LP or APV)

Navigation Application

# Part of FULL CONOPS and airspace design



# ICAO & European PBN Roadmap




RNAV → RNP → 4D

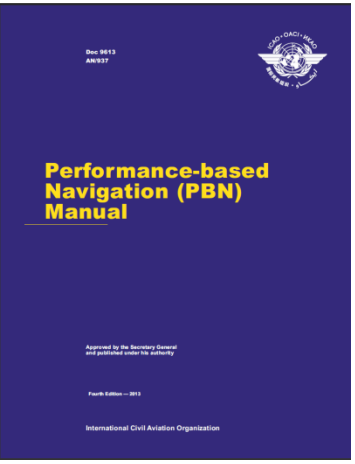
B-RNAV
P-RNAV → Advanced RNP
RNP APCH

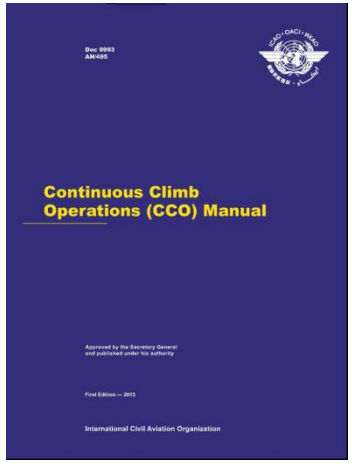
Allows for initial TBO

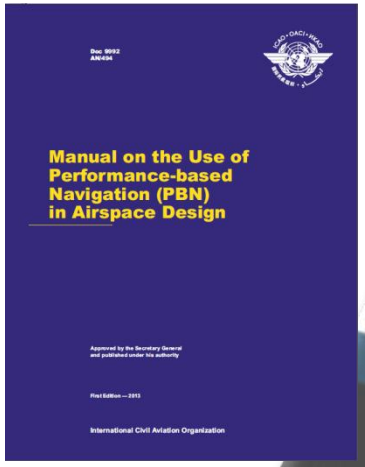
20 years

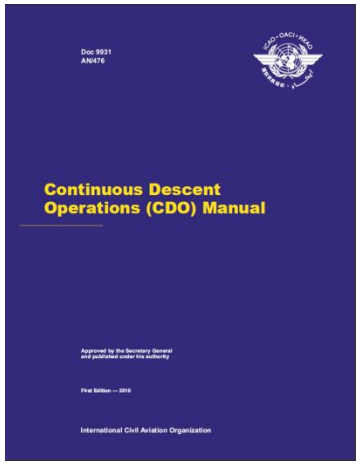
1998 — 2020+

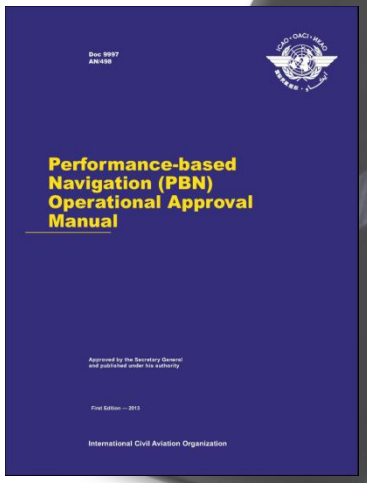
# ICAO & EUROCONTROL Guidance



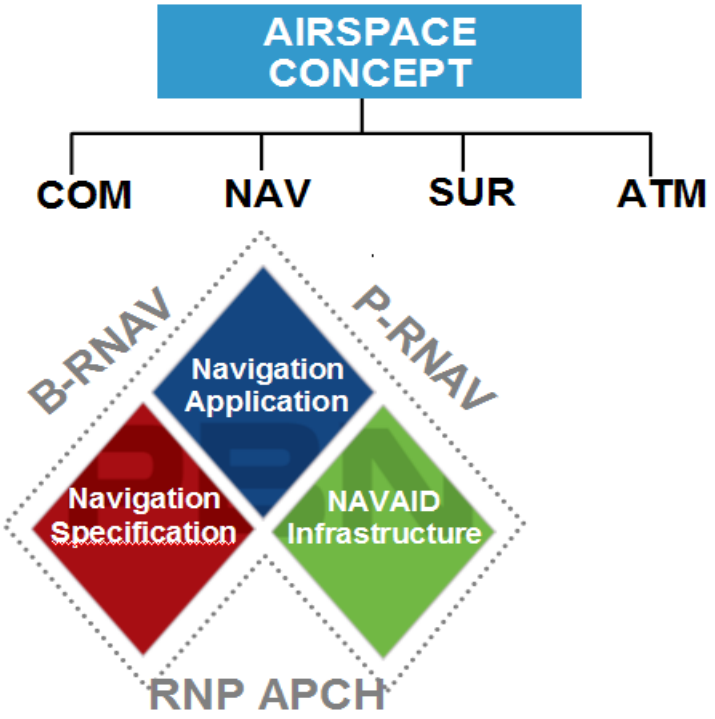
# PBN in Europe … it is not new…

## Europe has been doing it for years:

- B-RNAV (1998)
- P-RNAV (2001)
- RNAV GNSS (2001)

**The PBN concept 'used' RNAV and RNP …. clarified - re-packaged – improved – made them more digestible *AND***

**INTEROPERABLE**



# The PBN Mandate

- **Subject**
  - ”Mandate to Eurocontrol to assist the European Commission in the development of an interoperability implementing rule on Performance Based Navigation (PBN).”
- **Purpose**
  - Define navigation performance requirements
  - Identify the functionalities required in en-route and terminal airspace, including arrival and departure, and also approach
  - Address the implementation of ICAO Resolution A37-11

**Developed in coordination and cooperation with EASA**

# Why is a PBN IR required?

- **Harmonisation** of navigation performance and functionalities within EATMN to avoid potential fragmentation
- **Commitment** to coordinated and harmonised introduction of navigation capabilities and deployment of PBN routes and procedures
- **Operational benefits**
  - Improved flight efficiency
  - Increased capacity
  - Enabling new concepts of operation

# Overview of timescales

Mandate issued by European Commission to EUROCONTROL

Implementing Rule published by European Commission

Applicability Dates

2010 2012 2014 2016 2018 2020 2022 2024 2026

Development of the draft IR

Implementation Actions by Stakeholders

# Partnership and teamwork - a must!

OEMs; Industry; Data Houses; Engineers; Regulators; Airspace & Procedure Designers; Pilots; Controllers; ALL Airspace Users

# Questions


**Sasho Neshevski**

EUROCONTROL

sasho.neshevski@eurocontrol.int