# The Free Route Airspace Implementation Workshop / 2

*Bangkok, Thailand*

*13th Nov 2024*

**This event is jointly organised with**

EU-CHINA APP | EU-ROK APP | APP EU-Japan | EU-SOUTH ASIA APP | EU-ASEAN SCOPE APP | Funded by the European Union | EASA European Union Aviation Safety Agency | EUROCONTROL

***EU - Asia Aviation Partnership Projects (APP)***

**FRA - Bringing the World Together**

# Regulations Supporting FRA Initiatives and CNS for FRA

Mr. Hyuk-Jin, Kwon

*ICAO Asia-Pacific*

*Regional Officer, Air Traffic Management (AOM-ASM)*

# Outline



ICAO

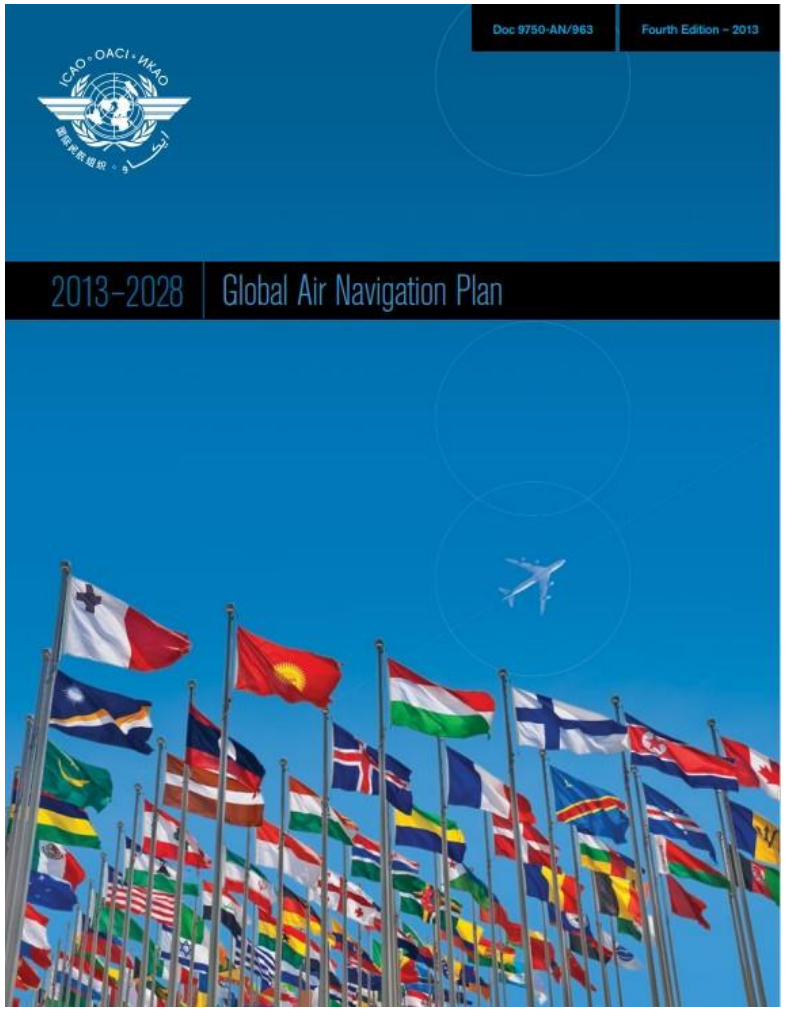
01

# Definition of FRA

# Where is the FRA originated from?

## FRA in ICAO Documents

- The ICAO Global Air Navigation Plan (GANP) identifies "Enable airspace users to fly their preferred trajectories" as **a Global Plan Initiative**. (Para 5.2.14)
- It will be provided by that "PIRGs identify dynamic/flexible planning elements for modernizing the regional air navigation systems, following a performance-based approach", aimed at accommodating preferred flight trajectories. (Para 2.2.4.4)

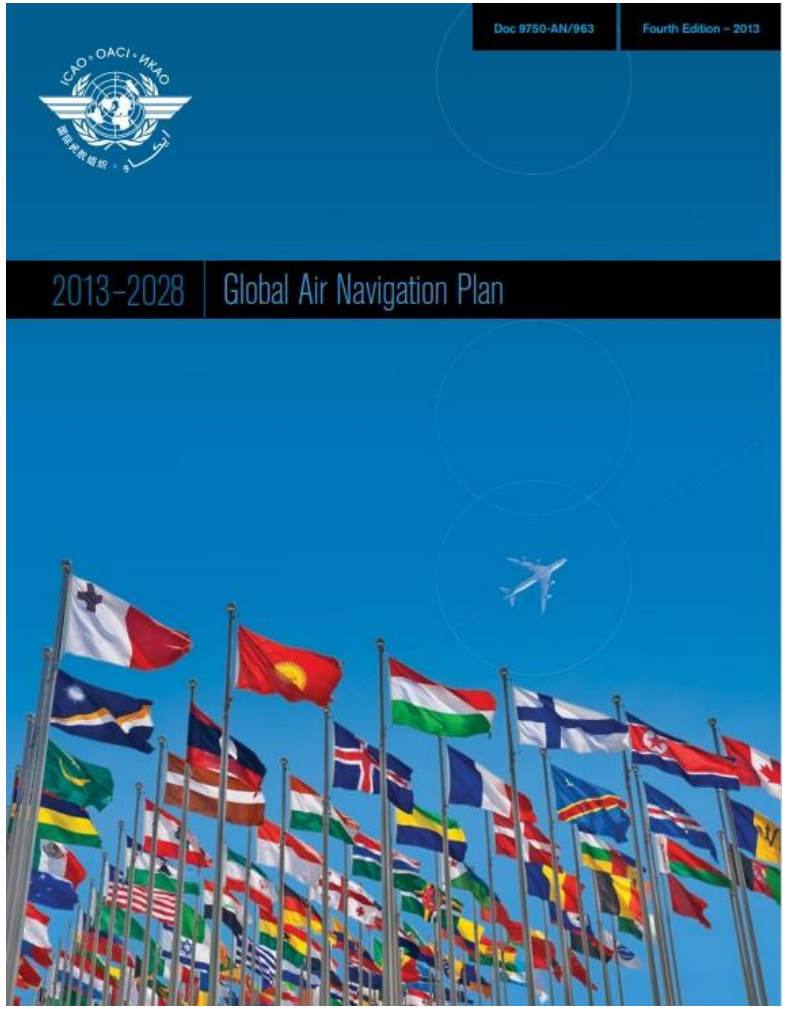


# Where is the FRA originated from?

## FRA in ICAO Documents

- Enabling airspace users to fly their preferred trajectories
  - ➢ It's often referred to as Free Route Airspace (FRA) in the aviation industry.

- Enhancing Direct Routings with FRA
  - ➢ The term FRA is used to describe the many variations of dynamic and flexible ATS route systems that have been implemented in different locations throughout the world.

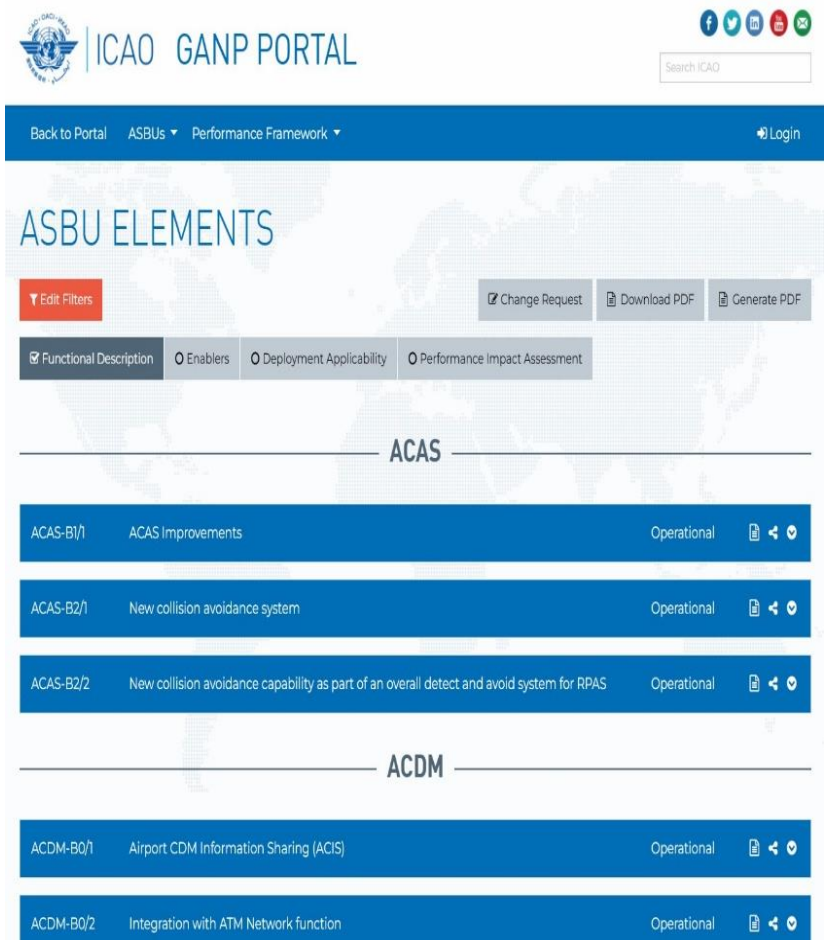





**FRA - Bringing the World Together**

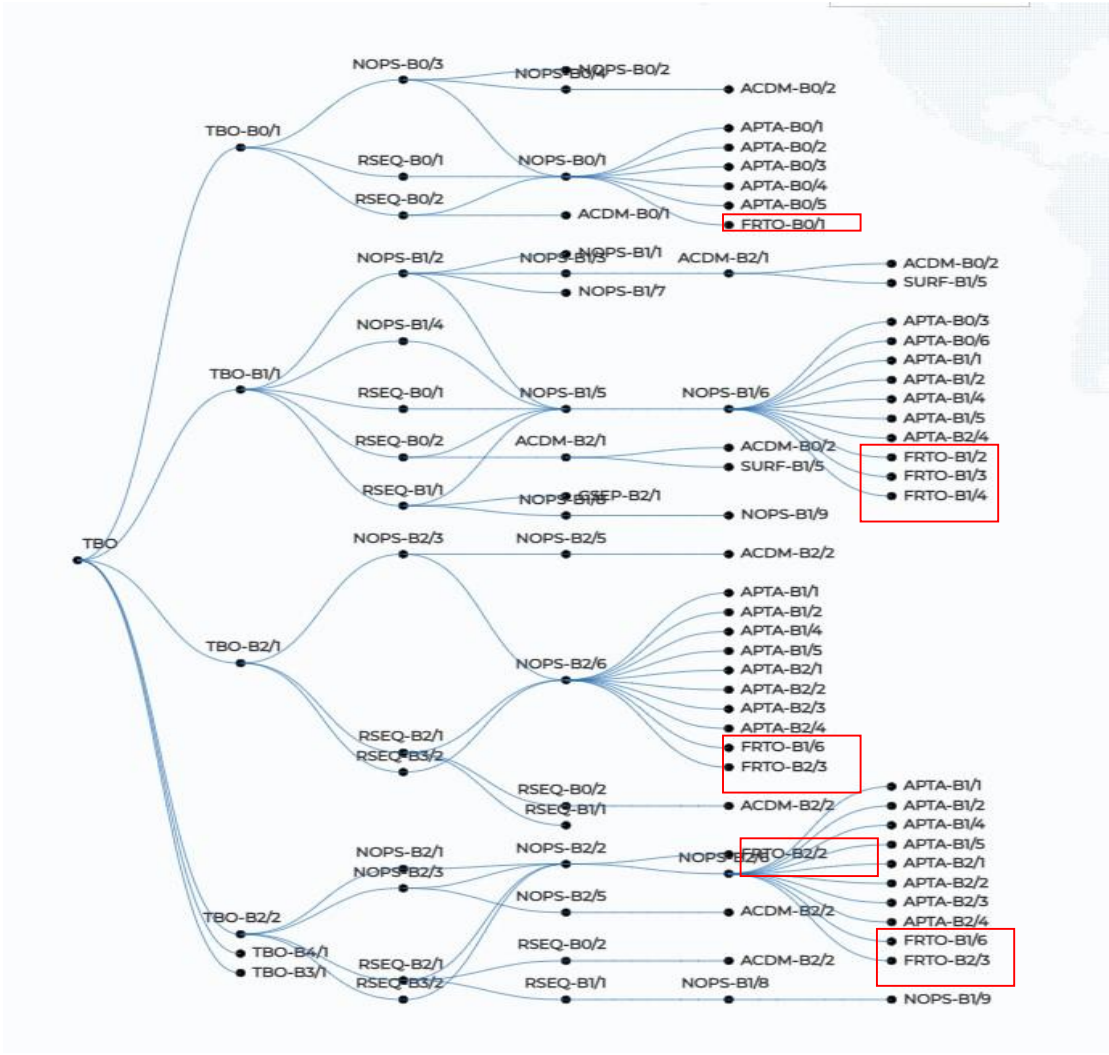
# How and where does the FRA define?

- The ASBU is a methodology developed by the ICAO to enhance global air navigation.
- Key Components of ASBU
  - ASBU Blocks, Modules, Threads
- How does it implement?
  - The ASBU framework is designed to be implemented in phases.



# Where is the FRA in place of aviation?

- This is the **TBO tree** in operational thread of ASBU.



# What is the definition of FRA?

## In ASBU an enabler as Block 1-1 in FRTO

| FRTO-B1/1 | Free Route Airspace (FRA) | Operational |
|---|---|---|

☐ Sixth edition of the GANP

**Main Purpose**

The Free Route Airspace (FRA) concept brings significant flight efficiency benefits and a choice of user preferred routes to airspace users.

As a step to full trajectory-based operations, the FRA concept brings increased flight predictability, reduced uncertainty for the ATM network function, which in turn can lead to potential capacity increases for ATM, which will also benefit the user.

**New Capabilities**

FRA is a specified volume of airspace within which users may freely plan a route between a defined entry point and a defined exit point, with the possibility to route via intermediate (published or unpublished) waypoints, without reference to the ATS route network, subject to airspace availability. Within this airspace, flights remain subject to air traffic control.

FRA enables airspace users to fly as close as possible to what they consider the optimal trajectory without the constraints of a fixed route network structure.

# What is the Free Route Airspace (FRA)?

- Free Route Airspace is for "Giving airspace users the freedom to plan a route within specified airspace."

  - It's the concept of corridor airspace as specified operating time and predefined vertical, horizontal boundaries to use it.

# FRA in Asia Pacific

## In Seamless ANS Plan for APAC region

7.29 Within Category R airspace, ADS-C surveillance and CPDLC should be enabled to support PBN-based separations, as well as UPR and DARP, consistent with **COMS-B0/1 – 2** and **FRTO-B0/1-4** and **FRTO-B1/1 – 7**.

En-Route Operations

7.51 ACCs should enable, where practicable, Free Route Airspace, RNP routes, Advanced FUA and Airspace Management (ASM), Dynamic Sectorisation, Enhanced Conflict Detection Tools and Conformance Monitoring and Multi-Sector Planner Function consistent with **FRTO-B1/1 – 7**.

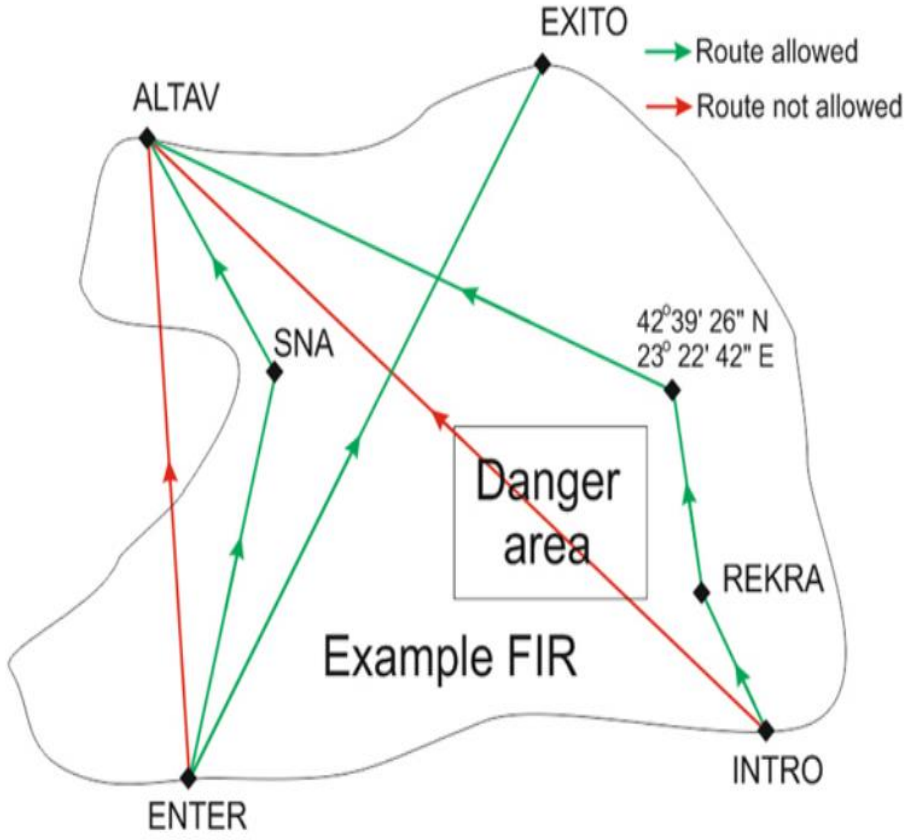
*Note: CPAR is a key enabler for 'free route airspace' and enroute UPR and DARP operations.*

02

# Understanding FRA Operation and Infrastructures

ICAO

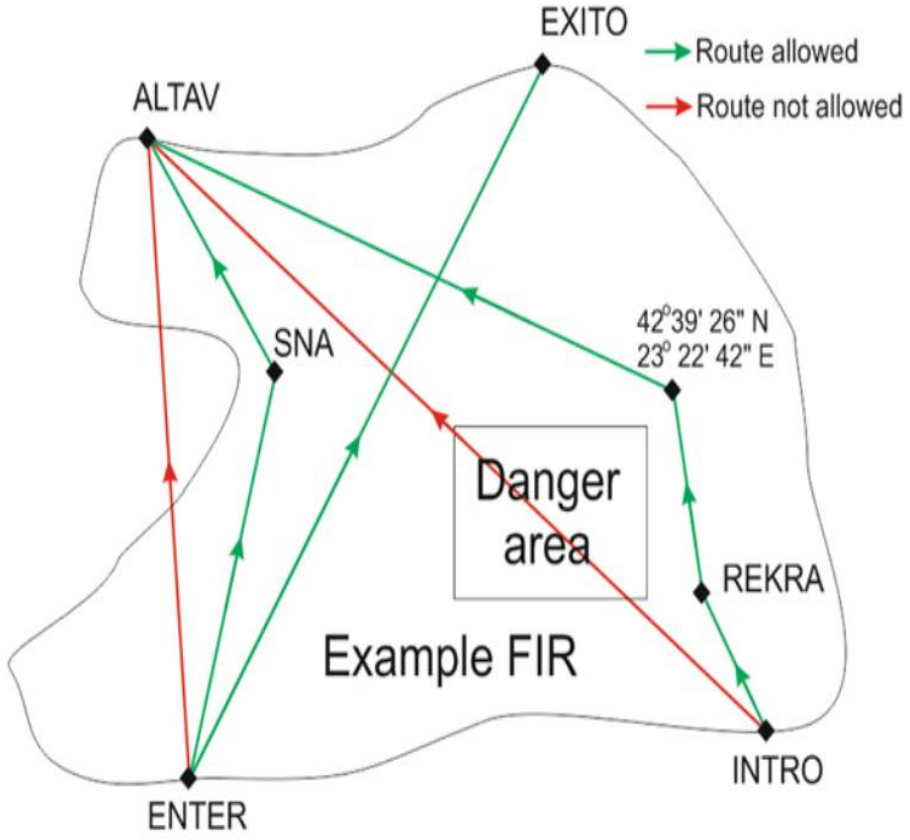
# Understanding FRA operation-1




- Definition and Concept of FRA
  - ➢ Flexibility vs. Standard Airway Usage
  - ➢ Route Determination in FRA boundaries
- Choosing Routes within FRA Boundaries
  - ➢ Limitations: Entry/Exit Points and Avoiding Restrictions
  - ➢ Using Navigational Aids and Turning Points
- Turning Points and Their Role
  - ➢ Navigational Aids, Published Points, and Coordinates
  - ➢ Visualizing FRA Rules

** From EuroControl Potal website*

# Understanding FRA operation-2




** From EuroControl Potal website*

- Diagram: Allowed and Not Allowed FRA Routes
  - ➢ Reasons for Route Rejection
  - ➢ Scope of FRA Implementation
- FRA within Sectors and FIRs
  - ➢ Extending FRA Across Multiple FIRs
  - ➢ Tactical Direct Routing and Its Limitations
- Tactical Direct Routing and Fuel Efficiency
  - ➢ Shortcomings: Adjustments and Fuel Costs
  - ➢ Customized Fuel-Efficient Routes in FRA
- Planning in Free Route Airspace
  - ➢ Benefits of Custom Route Planning

# Infrastructure for FRA implementation-1

- To apply and operate FRA, states need to have the necessary infrastructure.
  - Advanced ATM systems
  - Establish procedures for the coordination and communication
- More detail requirements
  - Safety Management
  - **Advanced CNS Technologies**
  - **Airspace Design and Configuration**
  - **Air Traffic Control Procedures**

# Infrastructure for FRA implementation-2

- More detail requirements
  - **Trajectory prediction and conflict detection tools**
  - **AIS publications to provide clear procedures**
  - Training and Education
  - **Air Traffic Flow Management** (ATFM)
  - Regulation and Standards
  - Performance Monitoring and Evaluation

03

# Comparing Relevant Concepts

ICAO

# Comparing Relevant Concepts - 1

- **Trajectory-Based Operations (TBO)**
  - ➢ The collaborative management concept of aircraft trajectories from departure to arrival
    - ✓ To enhance **predictability**
    - ✓ By collaborative decision making (**CDM**)
    - ✓ For optimizing aircraft **trajectories for fuel efficiency**
    - ✓ With **advanced automation** systems

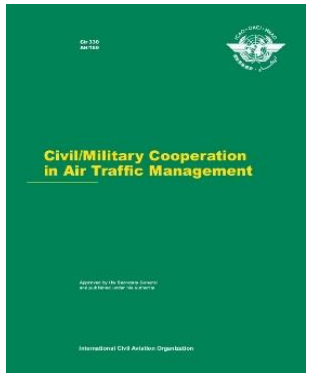
# Comparing Relevant Concepts - 1

## TBO vs FRA

| | TBO | FRA |
|---|---|---|
| **Scope** | Focuses on the **collaborative management** of aircraft trajectories | Focuses on **providing aircraft with the freedom to plan** and fly their own routes |
| **Planning Horizon** | Involves **long-term strategic planning** of aircraft trajectories | Focuses on the **flexibility of route selection** during flight within a predefined airspace |
| **Collaboration** | Typically involves **multiple stakeholders** | Coordination between **airspace users and ATM Service Providers** |

# Comparing Relevant Concepts - 2

- **Difficulties transitioning from fixed routes to FRA**
  - ➢ Created some modified FRA schemes
  - ➢ Without allowing complete free routing
- **Flexible Use of Airspace (FUA).**
  - ➢ Allowing flexible airspace use for both military and civil purposes
  - ➢ Enhancing direct routing benefits

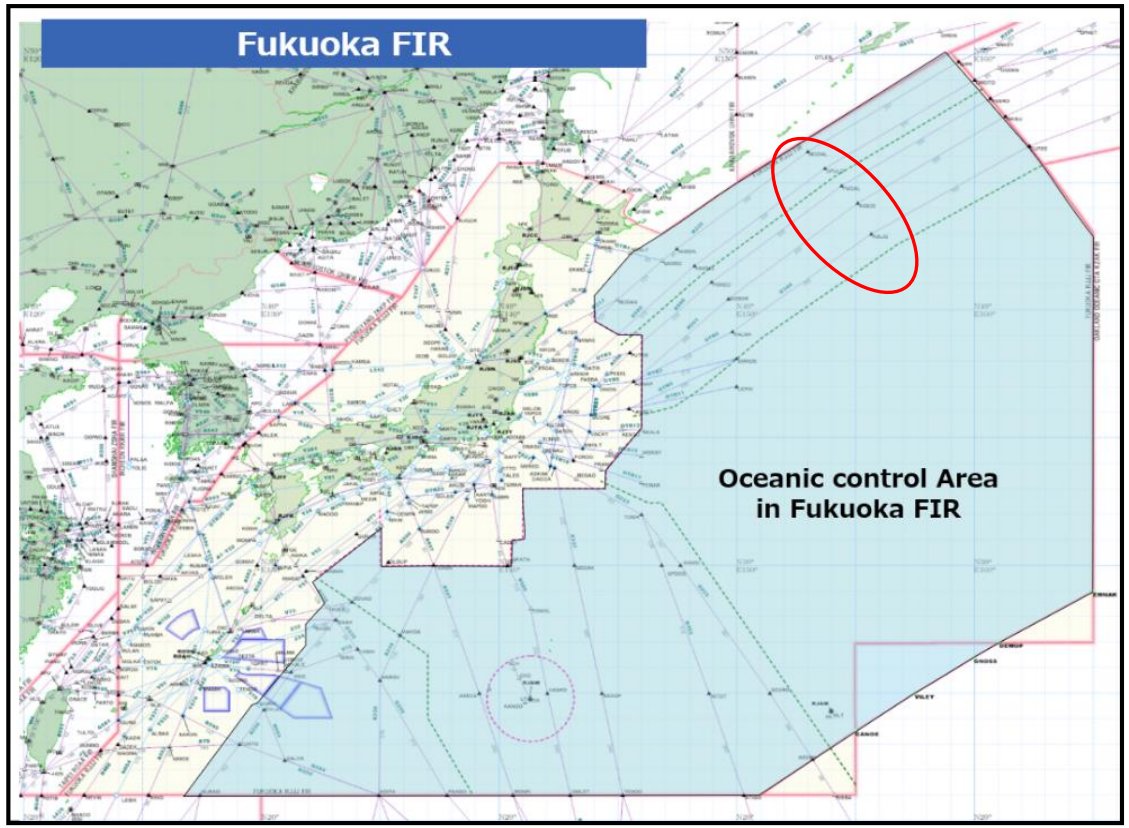



# Comparing Relevant Concepts - 3

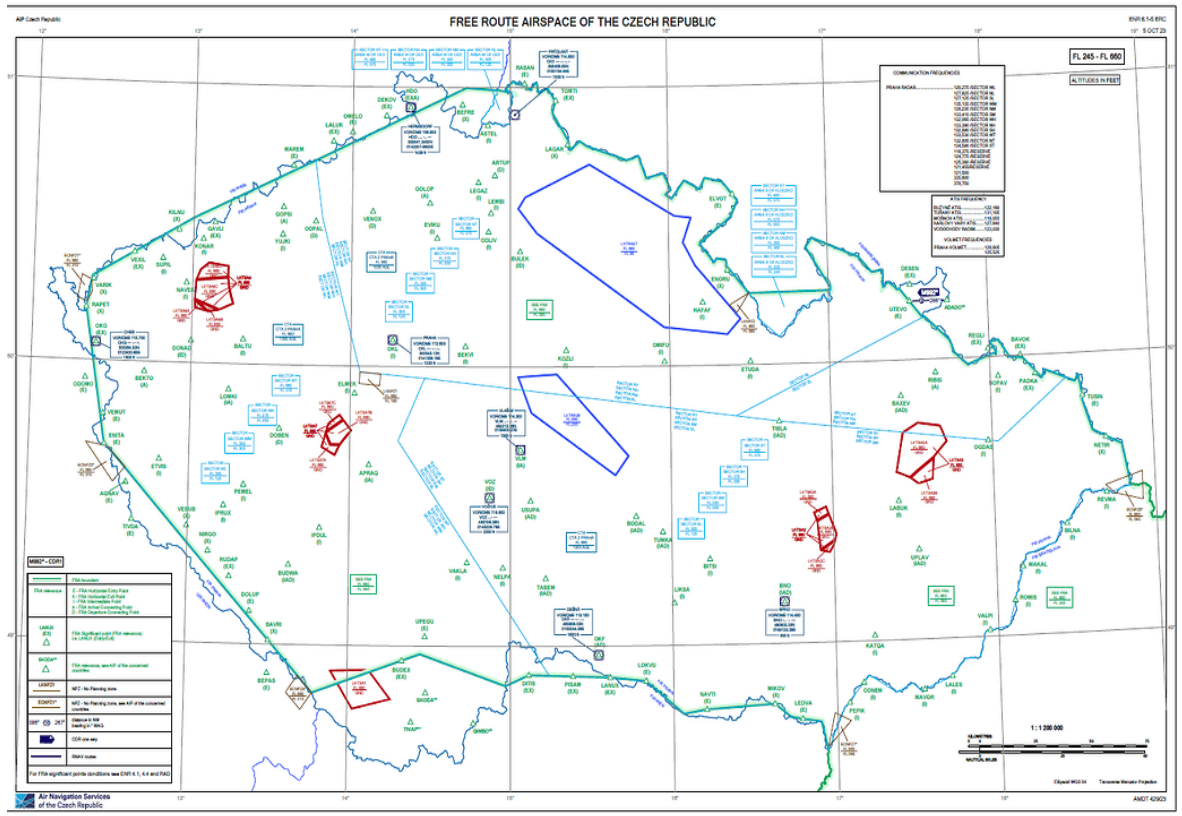
- **User Preferred Routes (UPR) vs FRA**
  - Airspace users could file UPRs that are accepted on a tactical basis.
  - It allows pilots to select a preferred route from a set of predefined routes.
  - FRA is an airspace operating concept that allows for more direct routing.

# Comparing Relevant Concepts - 3

- **User Preferred Routes (UPR) vs FRA**




* From : DGCA — 59/**DP (by Japan)**




* From : https://forum.navigraph.com

**FRA - Bringing the World Together**

ICAO

# Comparing Relevant Concepts - 4

- **Dynamic Airborne Reroute Procedure (DARP)**
  - ➢ A procedure that allows aircraft to change their flight plan while in flight.
    - ✓ For avoiding bad weather or taking advantage of favorable winds
    - ✓ More efficient flight paths, reduced fuel consumption and emissions

04

# Benifits of FRA Implementation

ICAO

# CNS for FRA - 1

- **Communication**: Essential Links for Efficient Operations
  - **Oceanic and Remote Airspace**: ADS-C and CPDLC for Long-Distance Communication
  - **High-Density Areas:** Mode S Surveillance, VDL Mode 2, and SATCOM for Reliable Data Exchange
  - **All ATC Units:** CRV Network and VoIP for Interoperable, Seamless Communication

- **Navigation**: Precision for Safe, Flexible Routes
  - **PBN-Based Operations:** RNP4 for Precise, Reduced Separation
  - **Dynamic Airspace Configurations:** Flexible Use of Airspace (FUA) and Route Adjustments
  - **Conflict Prediction & Resolution:** CPAR to Support Safety in Flexible Routes

# CNS for FRA - 2

- **Surveillance:** Real-Time Tracking Across All Areas
  - **Remote & Oceanic:** ADS-B and ADS-C for Continuous Monitoring
  - **High-Density Surveillance:** Mode S & DAPS for Enhanced Tracking
  - **Safety Nets:** STCA and MSAW for Conflict Detection and Route Adherence
- **Traffic Flow Management:** Optimizing Airspace Capacity
  - **ATFM Measures:** Dynamic Sectorization and Collaborative Planning
  - **Arrival Management:** E-AMAN for Efficient Sequencing and Slot Allocation

05

# Summary and Takeaways

ICAO

# Key takeaway

- Trajectory Based Operation (TBO) is the broadest concept encompassing free flight.
  - Free Route Operation (FRTO) is a method within TBO that enables this.
  - FRTO includes Free Route Airspace (FRA).
  - And **FRA is preceded by** User Preferred Route (UPR), Direct Route (DRT), Flexible Use of Airspace (FUA), Dynamic Airborne Rerouting Procedure (DARP), etc.

# Key takeaway

- **CNS Backbone Supporting FRA Implementation**
  - **Integrated Systems:** Communication, Navigation, and Surveillance Tools Enable Seamless FRA Operations
  - **Enhanced Safety, Efficiency, and Environmental Benefits**


# Thank You

ICAO