



Towards a Harmonized Free Route Airspace Transition

A Strategic Roadmap for the
CAR, NAM and SAM Regions

Agenda Item 4:

Strategic Framework and Priorities of the AMCB Task Force



Establishing a Structured Starting Point for Regional Transition

What This Roadmap Does:

- Establishes a structured, phased starting point for the regional transition to FRA.
- Provides an initial framework to organize, Harmonize and guide ongoing efforts.
- Support the development of a common regional Reference under ICAO processes.
- Brings structure and order to the complex cross-border transition process.



The Strategic Context & Regional Alignment

Trajectory-Based Operations (TBO)

ICAO GANP Foundation

Aviation System Block Upgrade (ASBU) Methodology, Specifically B1-FRTO for Optimized ATS routing

Technical & Regulatory Alignment

Compliance with Doc 444 (PANS-ATM), Doc 7030 (Regional Supplementary Procedures), and Doc 9965 (PBN Manual).

Regional Interoperability

Harmonizing ICAO NACC and SAM Regional planning Initiatives (e.g., NEOSPACE) to ensure cross-border operations.

ICAO Global Standards

Why This Roadmap Matters NOW



Prevents fragmentation: Avoids uncoordinated FRA implementations that could introduce operational inconsistencies, boundary constraints, and potential safety risks.



Ensure Measurability: Provides a traceable baseline aligned with ICAO processes.



Enables Sustainability: Lays a secure Foundation for environmentally Responsible airspace transition.

One Concept, Different Reality

EUROPE (Centralized)

CAR/NAM/SAM (Decentralized)

Regional
Governance
& Mandate



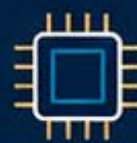
Mature regional institutional framework under a designated Network Manager (EUROCONTROL), integrating IFPS and network-level ATFM (ETFMS). Common legal mandate.



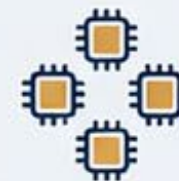
Decentralized Governance across ANSPs and States without a regional Network Manager or common legal framework

Sovereign
Airspace

Flight Plan
Processing



Integrated Initial Flight Plan Processing System (IFPS) validates 4d trajectories As a single node.



Decentralized flight data processing across multiple ANSP environments, without a single regional validation System.

Multiple ANSP
environments

Operational
Publication



A single, region-wide Route Availability Document (RAD) provides a centralized and authoritative source for routing constraints and airspace availability, ensuring consistent application across the network.



No single, region-wide publication mechanism for airspace availability or restrictions..

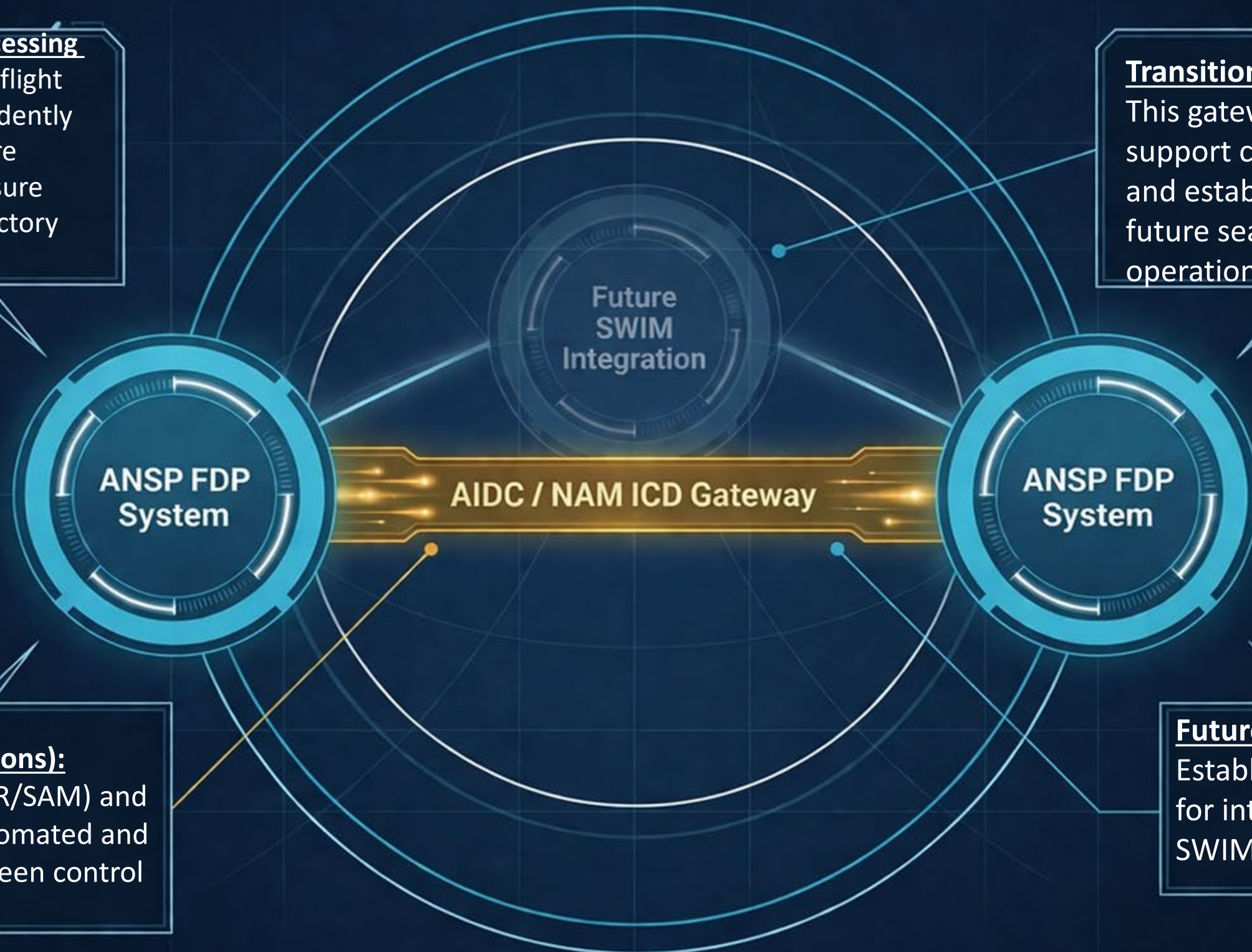
Fragmented
systems

Enabling Cross-Border Interoperability With Decentralized Engine

No central system — interoperability is achieved through coordinated, distributed systems across ANSPs.

Harmonized Flight Data Processing (FDP) Without a central IFPS flight plans are processed independently by each ANSP. FRA will require greater harmonization to ensure consistent cross-border trajectory management.

Transition Approach: This gateway-based solution could support cross-border coordination and establish the foundation for future seamless cross-border FRA operations.



Interoperability Bridge (Interfacility Communications): Enabled through AIDC (CAR/SAM) and NAM ICD gateways for automated and reliable coordination between control centers

Future Integration Path: Establishes a scalable foundation for integration with future SWIM-based environments

The Phased Transition Strategy

Phase 1: Readiness & Foundation.

Understanding local operational, technical and regulatory Baselines.

Phase 2: Harmonization & Visibility.

Establishing standardized terminology, publication, and Dynamic readiness mapping.

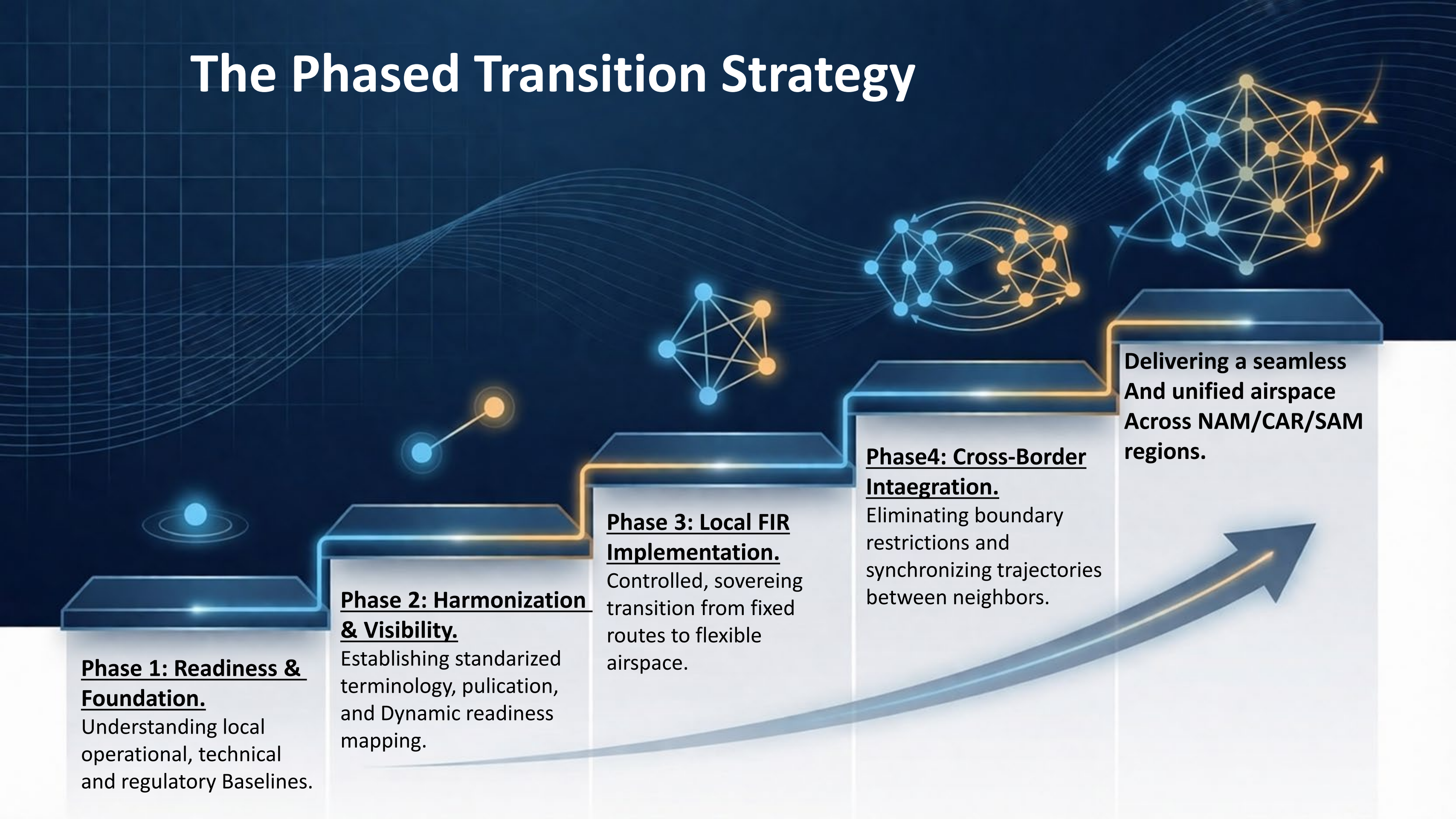
Phase 3: Local FIR Implementation.

Controlled, sovereign transition from fixed routes to flexible airspace.

Phase 4: Cross-Border Integration.

Eliminating boundary restrictions and synchronizing trajectories between neighbors.

Delivering a seamless And unified airspace Across NAM/CAR/SAM regions.



Indicative Implementation Timeline

A phased and overlapping implementation horizon spanning approximately 8 years (T0–T+96 months).



Phase 1: Diagnosis, Baselines and Readiness Assessment



PBN & TMA Architecture
Assess and optimize PBN procedures. Align SIDs, STARs, and approaches to naturally separate traffic and enable smooth transitions to/from FRA entry (E) and exit (X) points.



Automation & Interoperability
Assess ATC automation capabilities to support trajectory-based operations (TBO), automated conflict detection (e.g., MTCD), and interoperable data exchange between systems.



Capacity & Constraints
Baseline demand and capacity to identify sector limitations, structural constraints, and operational bottlenecks.



Regulatory Mapping
Identify regulatory gaps, surveillance limitations, and safety requirements to support operations in flexible trajectory-based environments.

TMA Optimization as an Enabler of FRA

The Optimization (En-Route FRA)

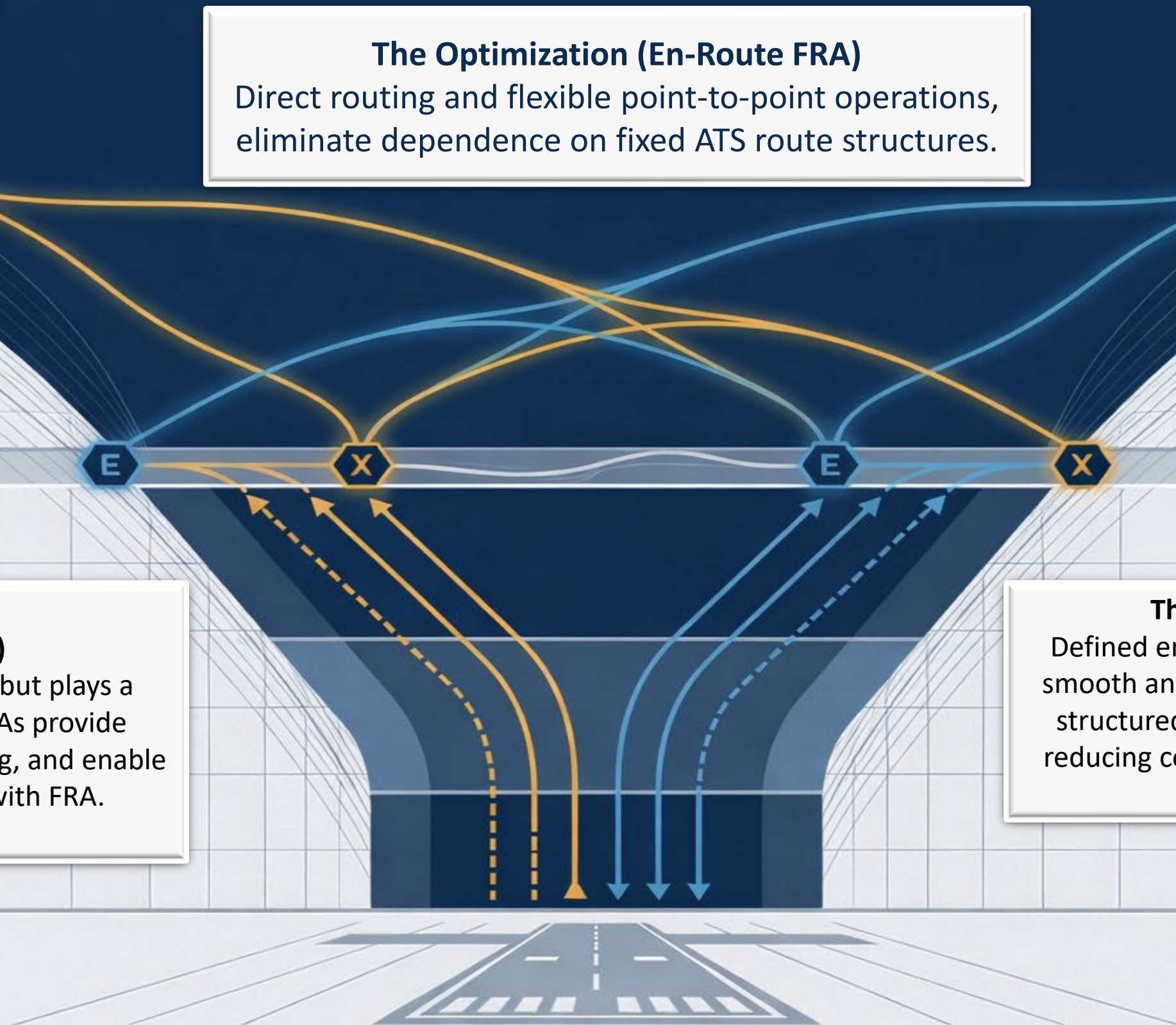
Direct routing and flexible point-to-point operations, eliminate dependence on fixed ATS route structures.

The Foundation (TMA)

TMA design remains unchanged but plays a critical role. Well-structured TMAs provide natural separation, reduce vectoring, and enable safe and efficient integration with FRA.

The Transition (E/X Points)

Defined entry (E) and exit (X) points ensure smooth and predictable transitions between structured TMA operations and open FRA, reducing controller workload and enhancing safety.



Phase 2: Standardized Visibility & Regional Harmonization

Harmonizing National AIPs

Standardizing Aeronautical Information Publications under a common regional framework to ensure consistent publication of FRA airspace, entry/exit points, and routing constraints.

Unified Digital Access Portal

Developing a single regional web portal (or shared dataset) to provide consistent, transparent, and predictable access to FRA routing information for airlines and flight planners.

Dynamic Readiness Mapping

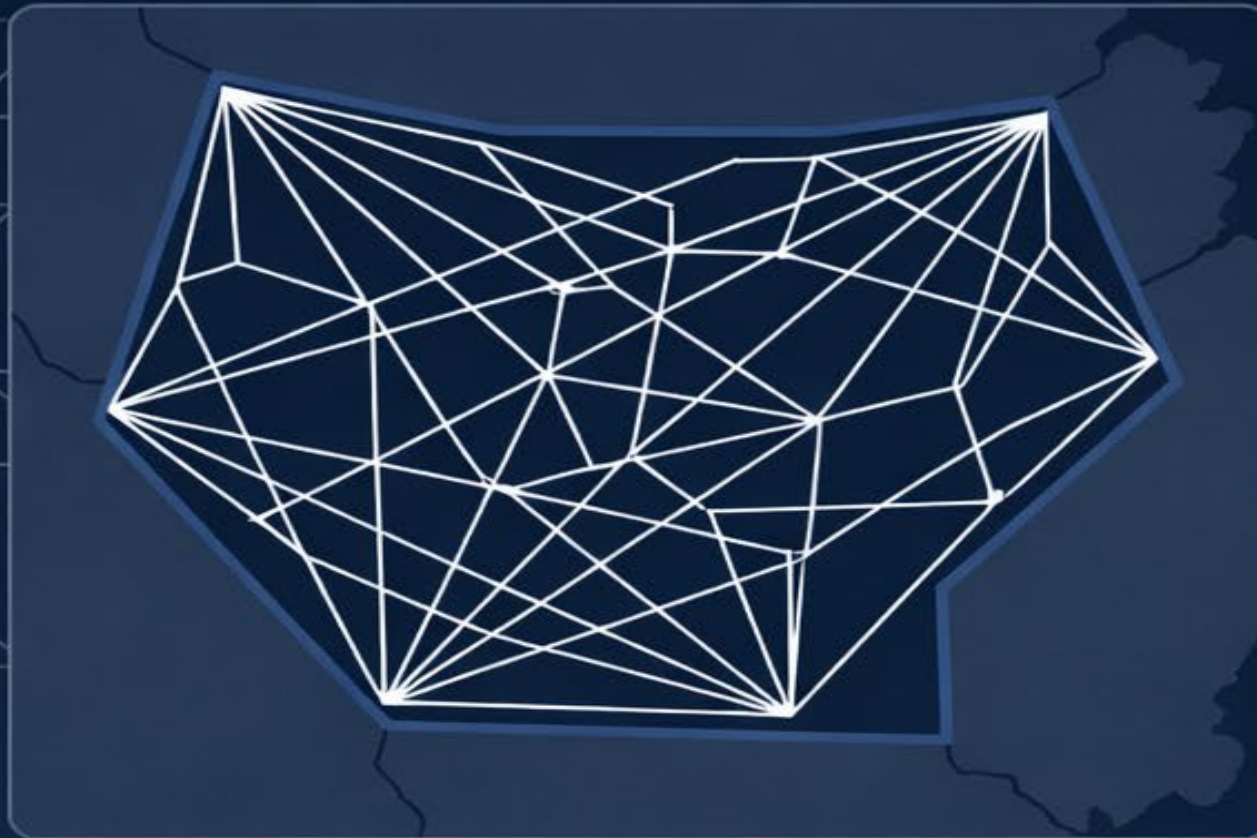
Implementing a regional FRA readiness map to assess FIR maturity levels and support targeted GREPECAS initiatives. Readiness.

Levels: Initial → Developing → Advanced → Implemented



Phase 3: Operational Deployment and Validation within FIRs

Before: Legacy Fixed Routes



After: FRA Implementation



Airspace Redesign

- Transition to a hybrid environment where FRA is enabled alongside existing ATS routes.
- Fixed routes remain available, while flexible point-to-point operations are introduced.
- Definition of Entry (E), Exit (X), and intermediate points to support seamless integration.

System Upgrades

- Deployment of advanced ATM capabilities, including automated trajectory processing and Conformance Monitoring (MONA).
- Enablement of dynamic sectorization aligned with regional integration.

Validation & Monitoring

- Execution of fast-time and real-time simulations (FTS/RTS) to assess capacity, safety, and operational performance.
- Conduct of live ATC trials to validate procedures prior to full operational use.

Phase 4: Unifying the Regional Cross-Border Transition



- **Automated Trajectory Coordination:** Consolidate ATC-to-ATC automated data exchange by standardizing existing interfacility protocols (AIDC in the CAR/SAM regions and the NAM ICD in North America)
- **Inter-FIR Agreements:** Finalize bilateral and multilateral LoAs that eliminate mandatory reporting waypoints at FIR boundaries and harmonize contingency plans.
- **Regional ATFM Integration:** Fully integrate cross-border FRA configurations into regional ATFM/CDM protocols to proactively manage network-wide traffic complexity.

Measuring Operational Performance: KPI Dashboard



KPI 1 — Environmental Impact & Fuel Efficiency

Reduction in CO₂ emissions and fuel burn enabled by user-preferred trajectories compared to fixed-route baselines.

Metric: Share of FRA trajectories vs. structured routes

Target: Measurable reduction in fuel consumption and emissions

KPI 2 — Horizontal En-Route Flight Efficiency (KEA)

Improvement in route efficiency through alignment with optimal great-circle distance.

Metric: Distance flown vs. great-circle distance (KEA)
Target: Reduced flight plan extensions and minimized tactical ATC vectoring

KPI 3 — Capacity & Workload Management

Optimized sector throughput and balanced workload distribution in an FRA environment.

Metric: Conflict rate and sector occupancy
Target: Increased capacity and smoother workload without exceeding ATC limits

POINTS OF CONSIDERATION

Acknowledge

The need for a phased and decentralized FRA implementation approach, recognizing the structural differences between Europe's centralized model and the more distributed operational environment across CAR/NAM/SAM regions.

Consider

The proposed 4-phase transition framework as a reference to support progressive regional alignment, while allowing flexibility to accommodate different levels of maturity and operational readiness.

Support

Enhancing existing regional coordination efforts by establishing a more dedicated and sustained focus on FRA, including guidance material, harmonization, implementation support, and continuous monitoring across participating States and ANSPs, to ensure safe and consistent implementation.

Cleared for Discussion

