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INTERNATIONAL CIVIL AVIATION ORGANIZATION

Global Air Traffic Management Concept

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Overview

Global ATM Concept

The Global ATM Concept ensures safe, efficient, and harmonized worldwide air traffic management addressing growth and complexity.

Global Air Navigation Plan (GANP)

GANP provides a practical roadmap with global objectives and key enablers for seamless interoperable air navigation.

Doc 9854 provides the operational requirements; the Global Air Navigation Plan (Doc 9750) provides the strategic implementation plan

Aviation System Block Upgrades (ASBU)

ASBU offers a modular, performance-based modernization approach allowing incremental capability adoption maintaining interoperability.

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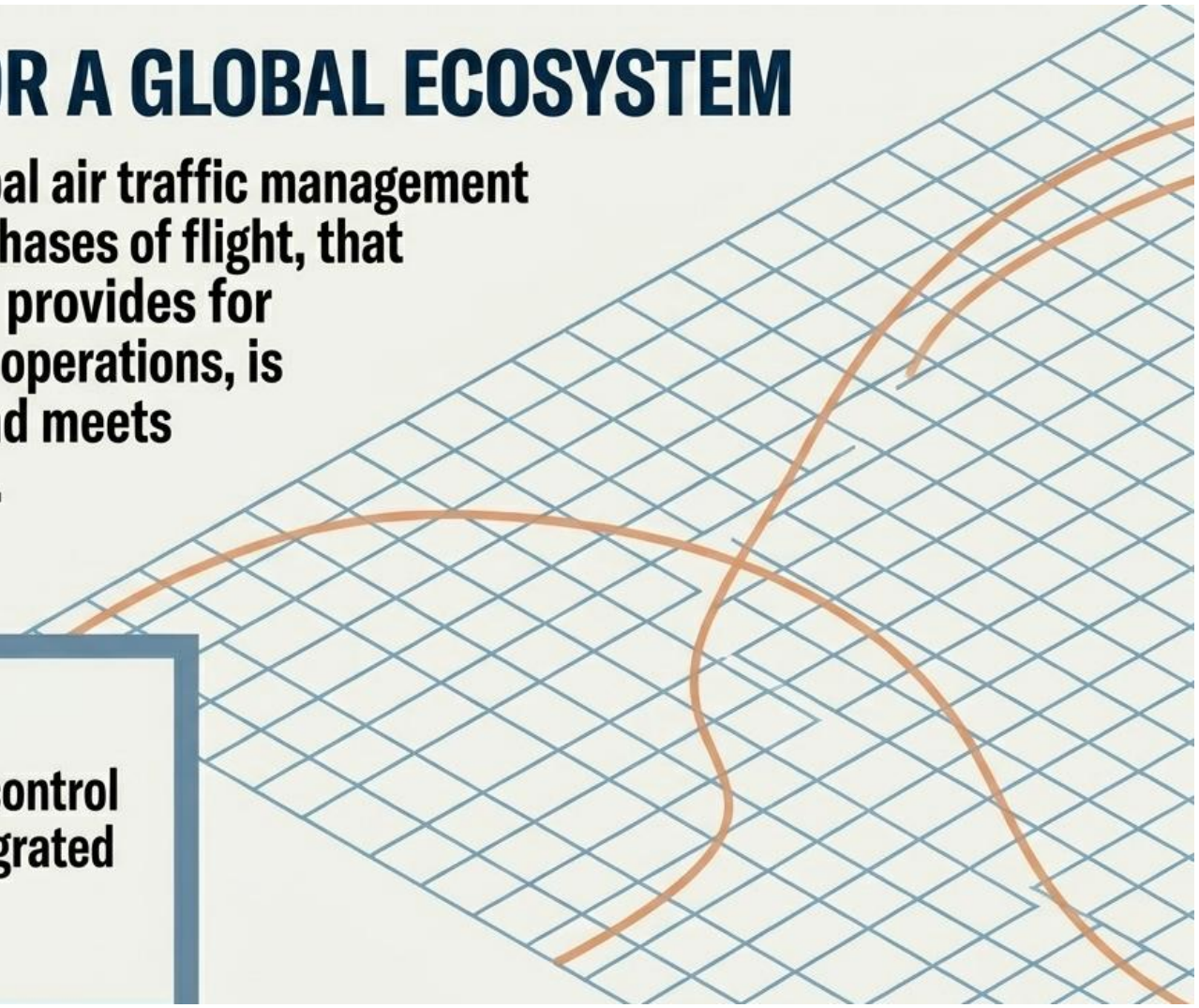
A UNIFIED VISION FOR A GLOBAL ECOSYSTEM

To achieve an interoperable global air traffic management system, for all users during all phases of flight, that meets agreed levels of safety, provides for provides for optimum economic operations, is environmentally sustainable and meets national security requirements.



KEY SHIFT:

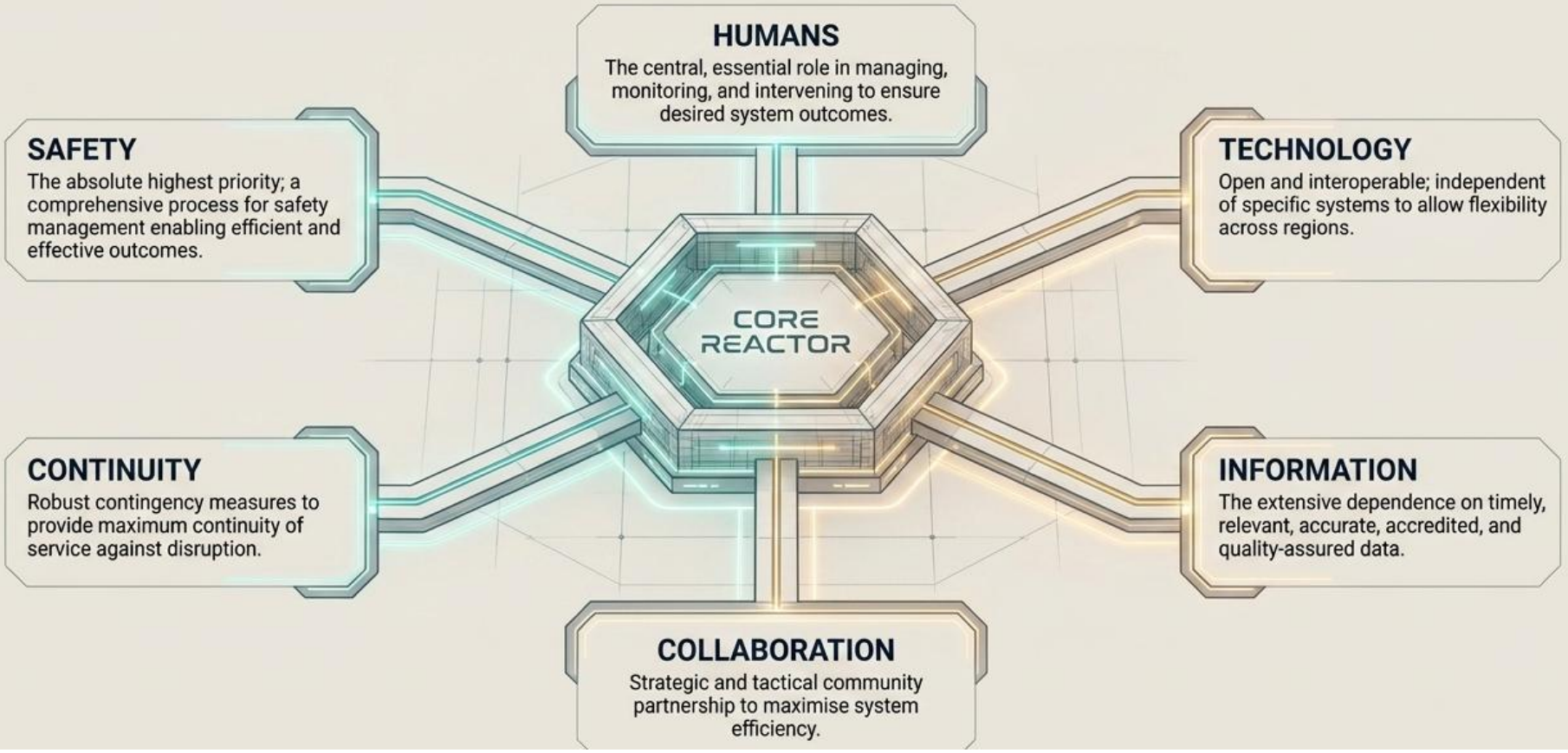
Moving from tactical, reactive control to a strategic, dynamically integrated management of air traffic and airspace.

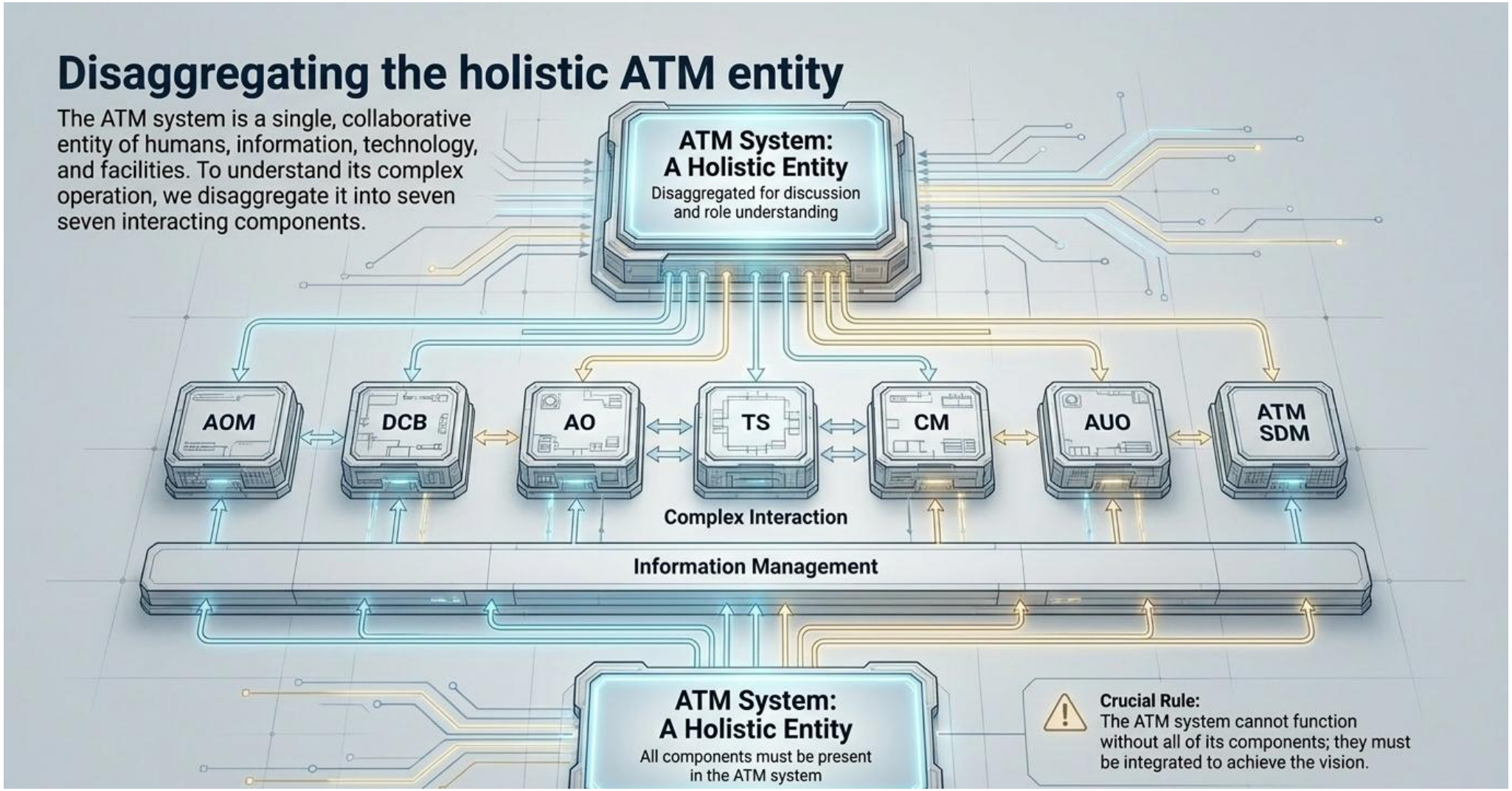
The evolutionary paradigm shift

Legacy System (2000)	Concept Vision (2025+)
Rigid national boundaries	Dynamic, flexible airspace adjusted to flows
Tactical separation reliance	Strategic conflict management (reducing need for tactical intervention)
Congested voice radio	Information-rich, system-wide data fusion
Fixed, circuitous routing	Dynamically optimised 4-D trajectories
Isolated planning	Collaborative gate-to-gate management

THE STRUCTURAL FOUNDATION: SIX GUIDING PRINCIPLES

A framework for a safe, efficient, and resilient future ATM system.

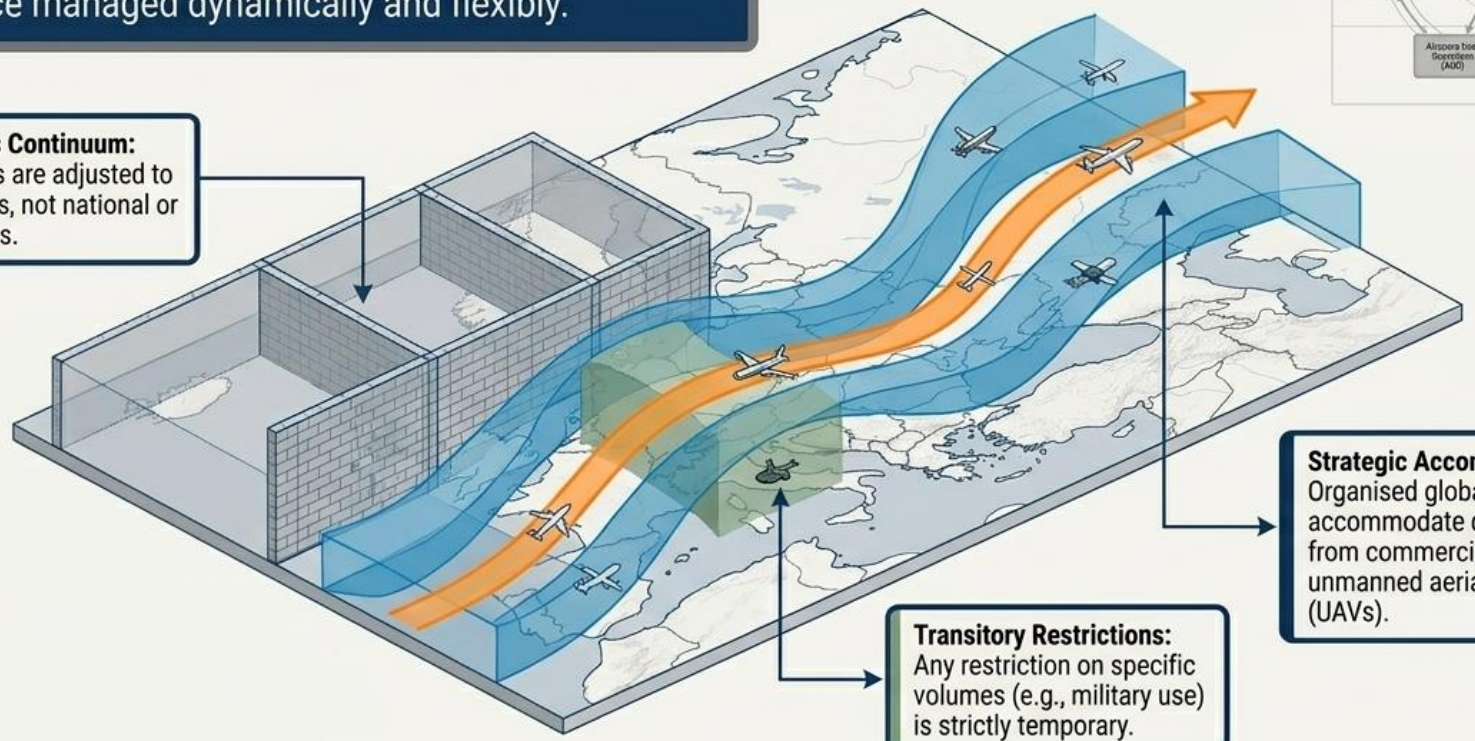



Disaggregating the holistic ATM entity
The ATM system is a single, collaborative entity of humans, information, technology, and facilities. To understand its complex operation, we disaggregate it into seven seven interacting components.
ATM System:
A Holistic Entity
Disaggregated for discussion and role understanding
AOM
DCB
AO
TS
CM
AUO
ATM SDM
Complex Interaction
Information Management
ATM System:
A Holistic Entity
All components must be present in the ATM system
Crucial Rule:
The ATM system cannot function without all of its components; they must be integrated to achieve the vision.

Component 1 | **Airspace Organisation & Management (AOM)**

Core Principle: All airspace is a single, usable resource managed dynamically and flexibly.

Borderless Continuum: Boundaries are adjusted to traffic flows, not national or facility lines.

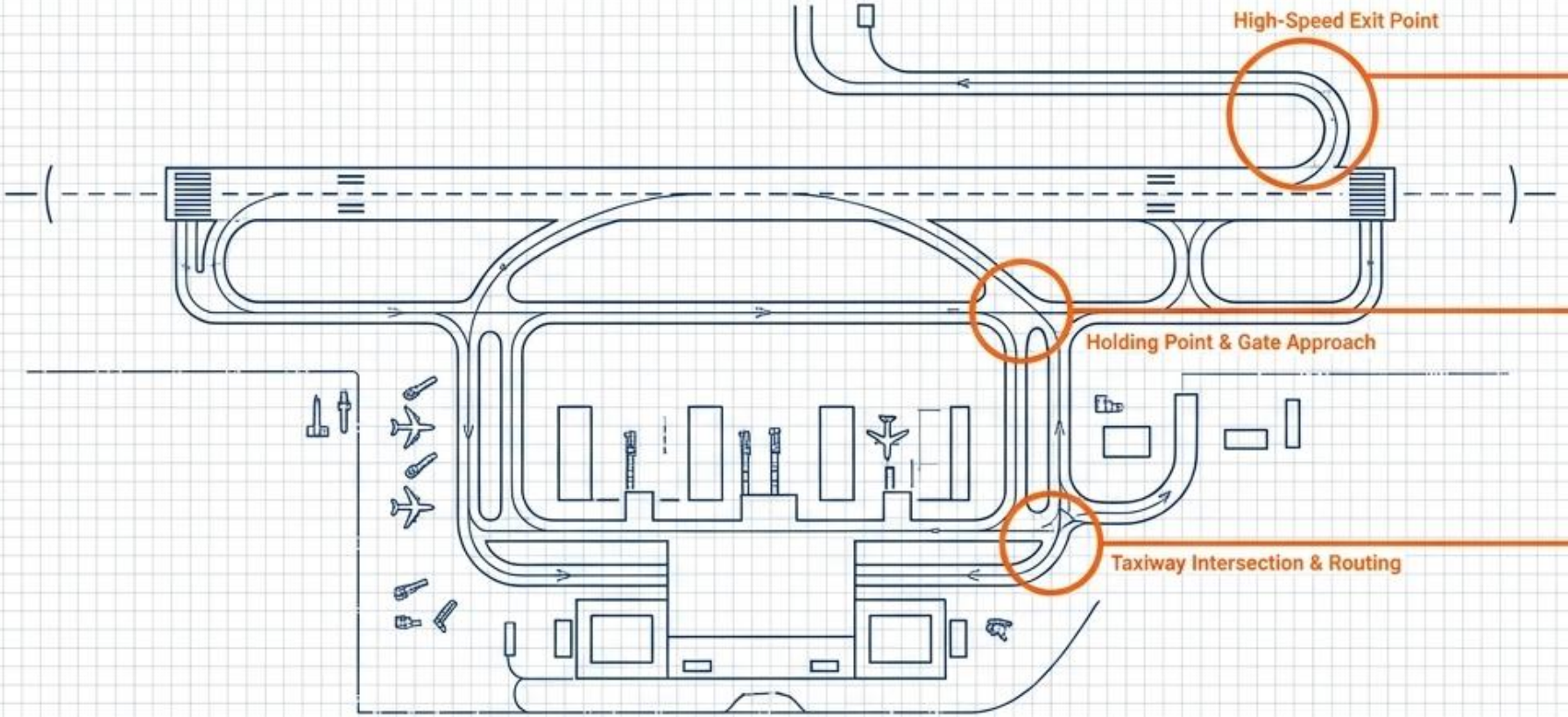


Strategic Accommodation: Organised globally to accommodate diverse users, from commercial jets to unmanned aerial vehicles (UAVs).

Transitory Restrictions: Any restriction on specific volumes (e.g., military use) is strictly temporary.

Component 2 | Aerodrome Operations (AO)

Core Principle: Maximising airside capacity and integrating the surface into the en-route trajectory.



Runway Optimisation:

Precise surface guidance and optimal exit geometry minimize runway occupancy time.

All-Weather Capacity:

Advanced situational awareness maintains throughput regardless of visibility.

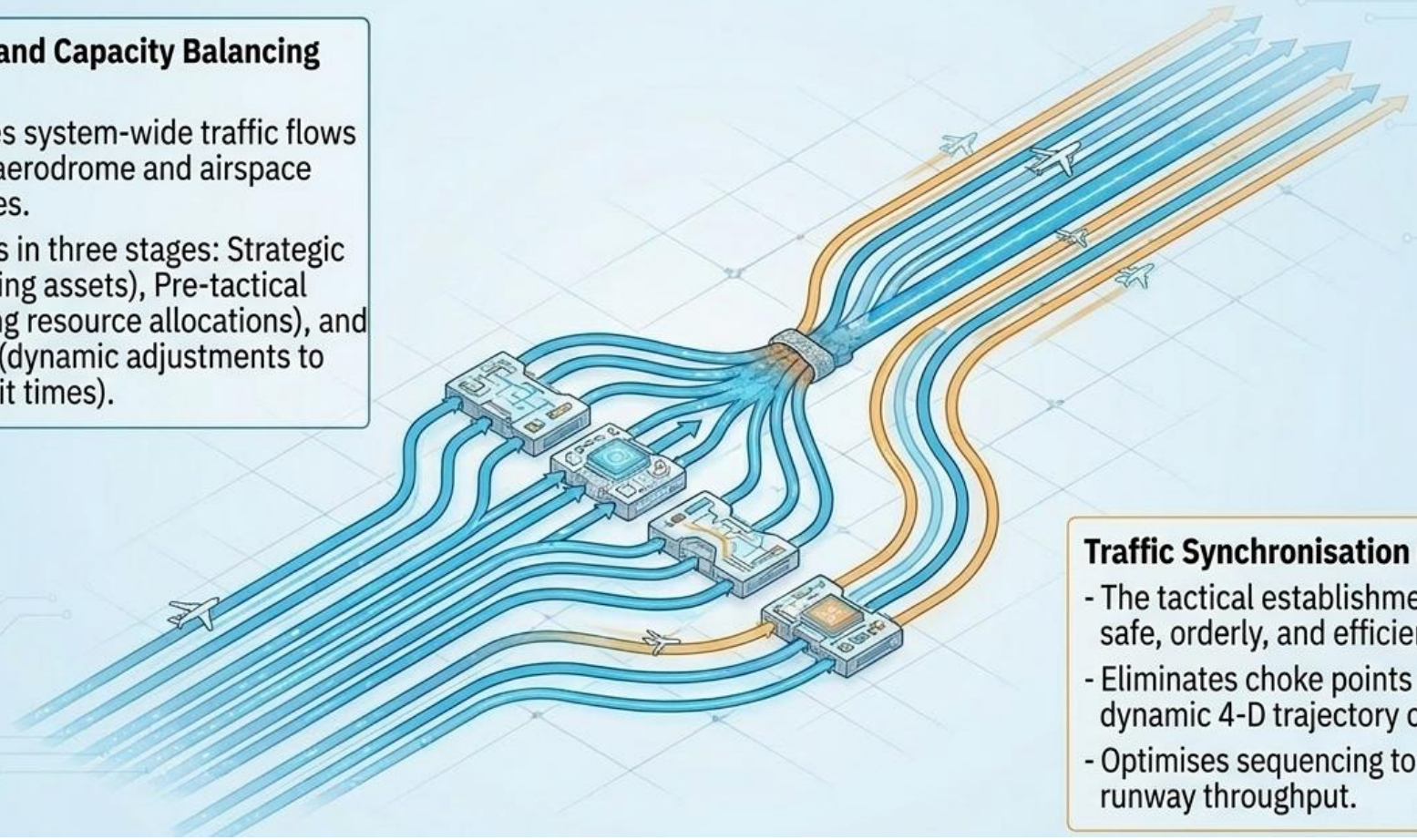
Surface Integration:

Every vehicle and aircraft's position and intent are tracked, linking the taxi plan directly to en-route slot management.

The Strategic Flow: Balancing demand and sequence

Demand and Capacity Balancing (DCB)

- Evaluates system-wide traffic flows against aerodrome and airspace capacities.
- Operates in three stages: Strategic (optimising assets), Pre-tactical (adjusting resource allocations), and Tactical (dynamic adjustments to entry/exit times).

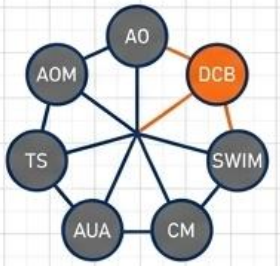


Traffic Synchronisation (TS)

- The tactical establishment of a safe, orderly, and efficient flow.
- Eliminates choke points through dynamic 4-D trajectory control.
- Optimises sequencing to maximise runway throughput.

Component 3 | Demand & Capacity Balancing (DCB)

Core Principle: Mitigating ATM constraints through collaborative, system-wide traffic flow evaluations.



Months Out

Strategic Stage

Strategic Stage (Months to Years): Optimising assets, planning route structures, and setting predictable schedules based on historic and seasonal data.

Pre-tactical Stage

Pre-Tactical Stage (Days out): Adjusting resource allocations, modifying projected trajectories, and allocating aerodrome entry/exit times.

Tactical Stage

Tactical Stage (Real-time): Dynamic adjustments to airspace organisation and entry times based on immediate weather or disruption.

Day of Operation

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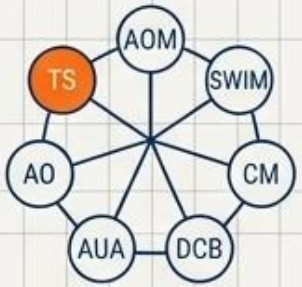
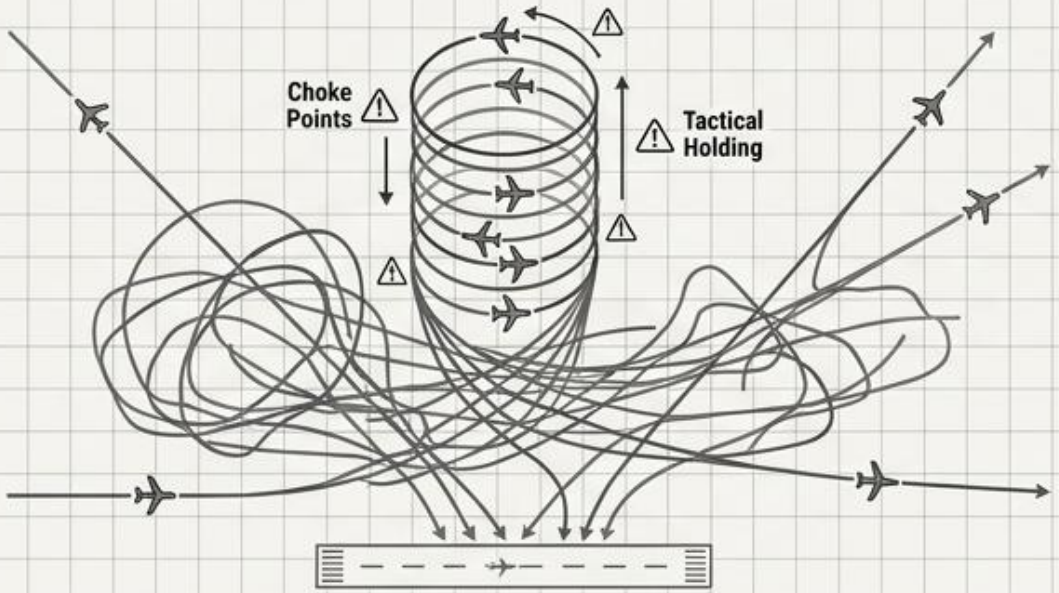
Component 4 | Traffic Synchronisation (TS)

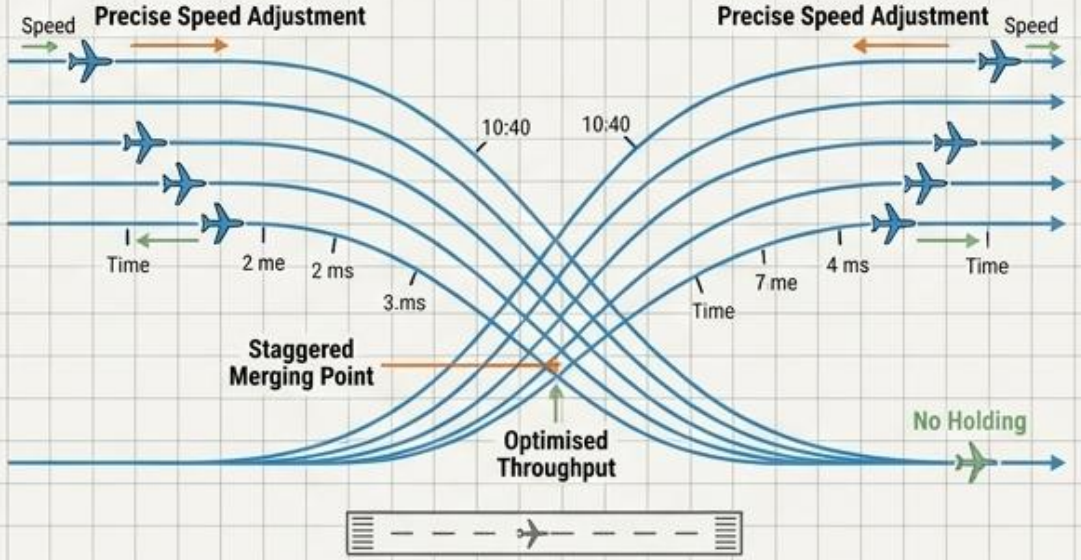


Core Principle: Eliminating choke points through tactical sequencing and **4-D** trajectory control.

Legacy: Choke Points & Tactical Holding

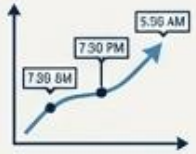


2025 Vision: 4-D Control & Staggered Merging



4-D Trajectory Control:

Flights are given a precise time profile to optimise aerodrome throughput.



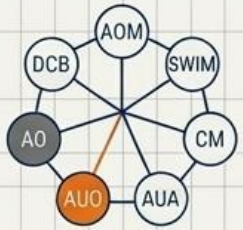
Delegated Spacing:

Shifting maintenance of group spacing to the flight deck to increase throughput and reduce ground workload.

Dynamic Sequencing:

Utilising aircraft parameters to minimise wake vortex constraints dynamically.

Component 5 | Airspace User Operations (AUO)



Core Principle: Enabling diverse airspace missions through collaborative decision making and trajectory negotiation.

1. User Request:
User calculates and submits an optimum 4-D trajectory based on business needs.

5. Dynamic Updates:
Changes in weather or system constraints trigger a rapid re-negotiation.

Airspace User

Trajectory Negotiation Loop

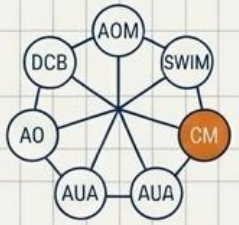
ATM System

2. ATM Assessment:
System assesses request against constraints and capacity.

3. Collaborative Decision Making:
Tolerances and alternatives are negotiated dynamically.

4. Agreed Trajectory:
A 'contract' is formed.

Component 6 | Conflict Management (CM)



Core Principle: Limiting collision risk through a multi-layered approach, extending the conflict horizon as far as possible.

The Separator Matrix

Airspace users are the predetermined separators (Self-Separation) unless safety or system design requires an ATM service provider.

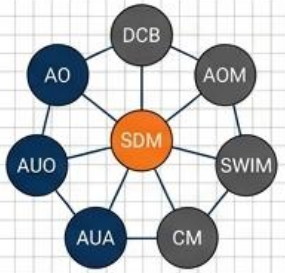
Ring 1: Strategic Conflict Management
Preventing conflicts before they happen via airspace organisation, balancing, and synchronisation.

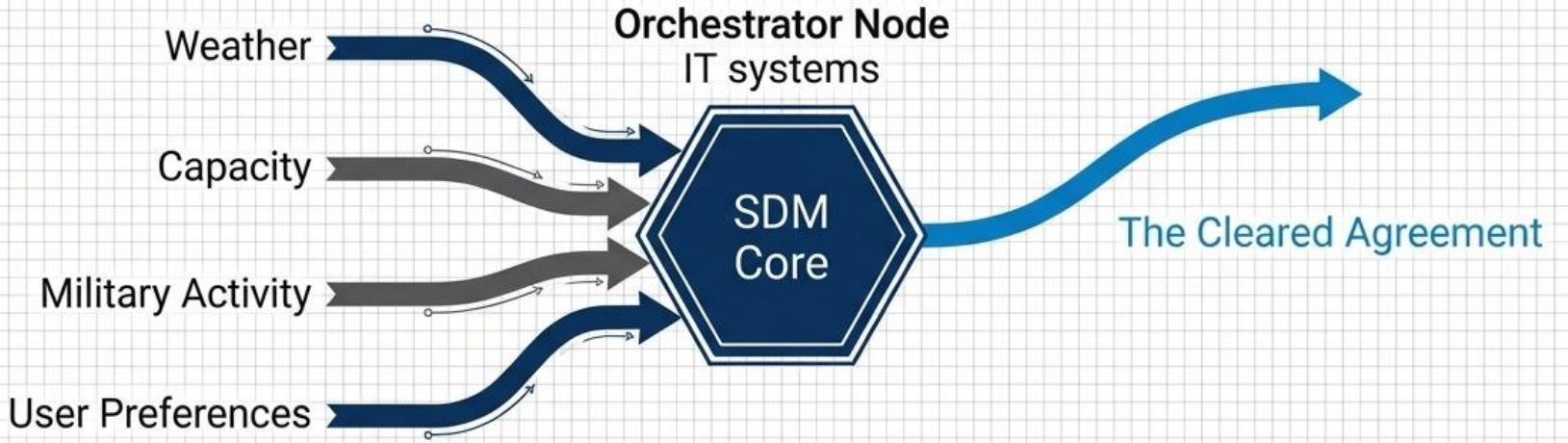
Ring 2: Separation Provision
Tactical intervention to keep aircraft away from hazards by defined minima.

Ring 3: Collision Avoidance
Emergency systems activated only when separation is compromised.

Component 7 | ATM Service Delivery Management (SDM)

Core Principle: Gate-to-gate orchestration and consolidation of all ATM services.





On-Request Services:
Services are established by collaborative system design and provided when requested by the user.

Management by Trajectory:
Developing an agreement that extends through all physical phases of flight, updated incrementally via clearances.

Continuous Balancing:
Fusing non-flight-specific infrastructure data with traffic demand to maintain situational awareness and trigger necessary trajectory revisions.

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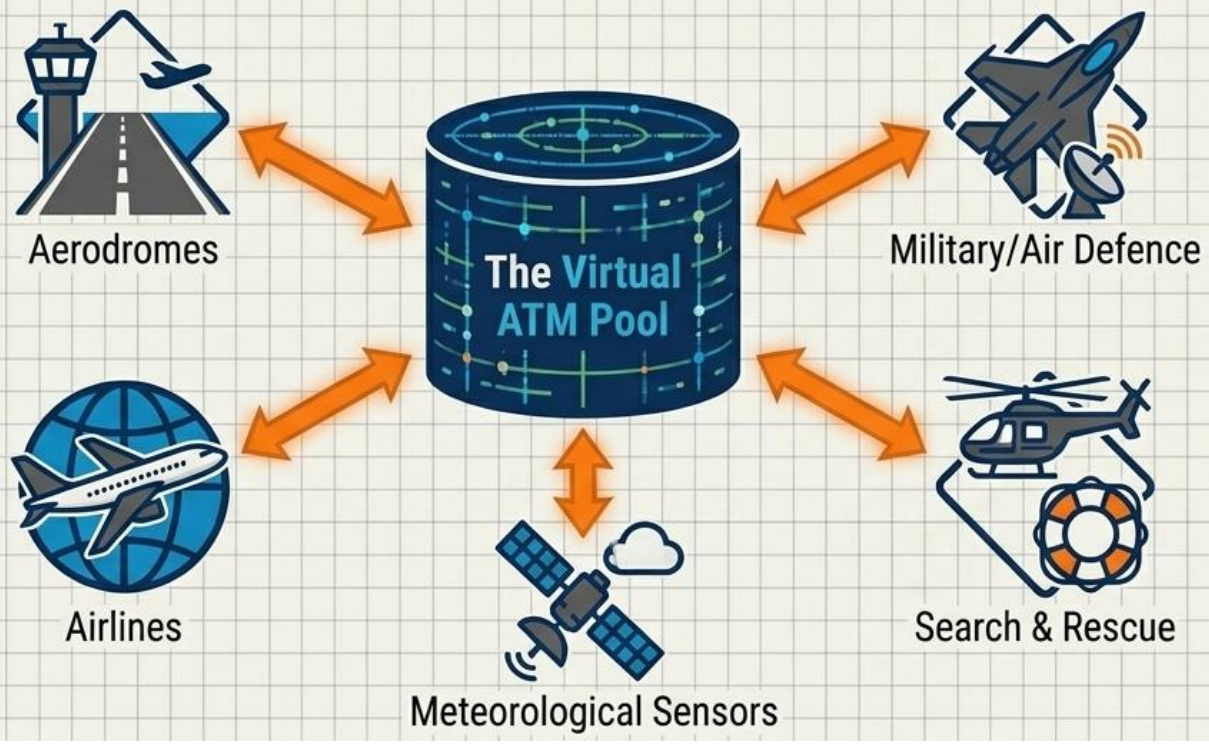
The Catalyst | System-Wide Information Management (SWIM)

Core Principle: The migration from point-to-point messaging to a many-to-many information distribution model.



The Virtual ATM Pool:

A shared, real-time picture of the historical, current, and predicted state of the airspace.

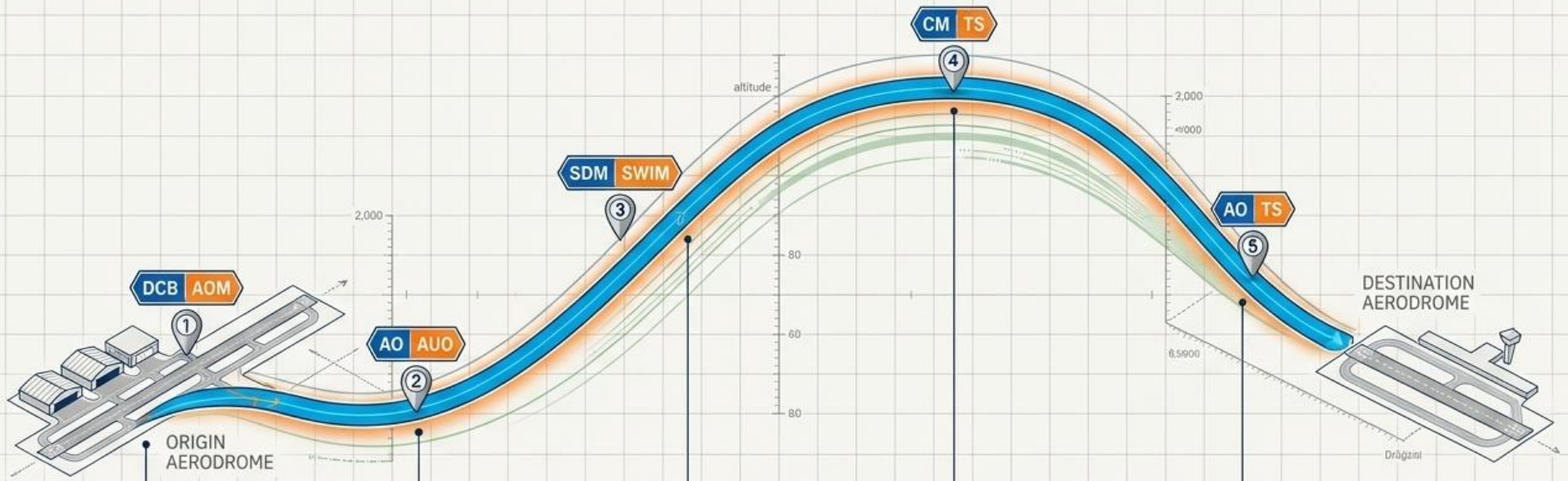
Quality-Assured Data:

Intelligent routing ensuring timely, accredited, and filtered data reaches users dynamically.

Total Connectivity:

Integrating meteorological data, military airspace reservations, and airport landside operations into a single operational truth.

Synthesis | The Gate-to-Gate Journey



Pre-Flight (Months out):
DCB optimises the schedule;
AOM structures the dynamic routing.

The Ramp:
AO tracks the taxi sequence;
AUO negotiates the final 4-D trajectory.

Take-off & Climb:
SDM orchestrates the departure clearance;
SWIM broadcasts intent.

En-Route:
CM manages an extended conflict horizon;
TS sequences a crossing point.

Arrival:
AO and **TS** execute time-based metering to an optimal runway exit.

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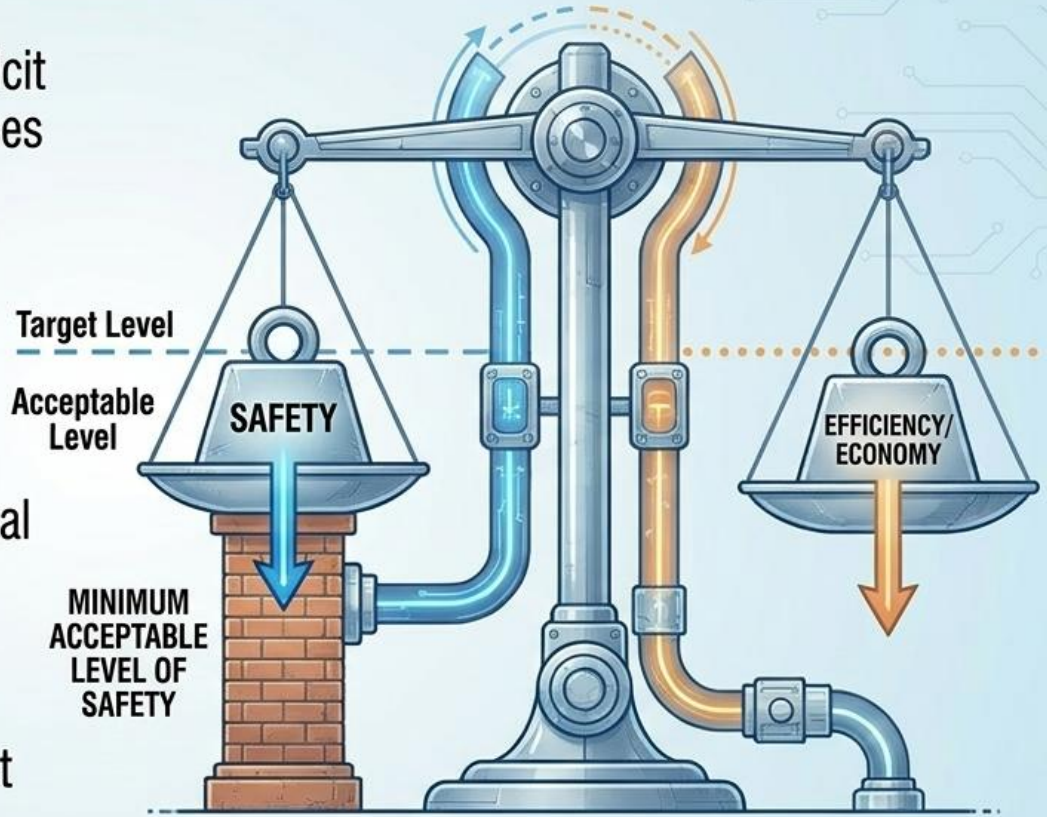
Safety: The uncompromisable core metric

System Safety Approach: A systematic, explicit approach integrated across all life-cycle phases (concept, design, development, operations).

Acceptable vs. Target Levels:

- **Acceptable Level**: The minimum safety required for system trust.
- **Target Level**: The goal, which must be equal to or better than the acceptable level.

- Safety is never traded for capacity. Every change to the ATM system must be subject to rigorous safety case analysis.



Safety Tension Model: The unyielding foundation.

2025 and beyond: The living ecosystem

The future ATM Operational Concept is not just a technological upgrade; it is a fundamental shift to an interoperable, living ecosystem.

- Built on six unshakeable principles.
- Driven by seven interlocking components.
- Measured by rigorous performance frameworks.

The result: A global airspace where every flight, anywhere in the world, is equitable, environmentally sustainable, and unequivocally safe.

Thank You

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