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ICAO DOC 9750 — EIGHTH EDITION

# The Global Air Navigation Plan

Concepts, structure, stakeholders and the roadmap to a globally interoperable air navigation system

Training session: ICAO GANP Portal

# What this briefing covers

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## 01 The GANP explained

Purpose, scope and the four-layer structure

## 02 How the plan is maintained

Governance, cycles and related global plans

## 03 Stakeholders in depth

Ten groups: who does what, and how they differ

## 04 Challenges and opportunities

Demand, technology, people, climate, resilience

## 05 Vision and performance ambitions

The targeted system and 11 key performance areas

## 06 The conceptual roadmap

Four evolutionary steps to 2050 and beyond

# What is the Global Air Navigation Plan?

A planning tool that sets global priorities for the evolution of the air navigation system, so that the system becomes integrated, harmonized, globally interoperable and seamless.

- Developed in collaboration with, and for the benefit of, all stakeholders across ICAO's 193 Member States
- A key contributor to ICAO's Strategic Objectives and to the UN 2030 Agenda, in particular SDG 9
- Technical scope: aerodrome operations, air traffic management, meteorology, aeronautical information and search and rescue, supported by air, ground and space-based CNS capabilities
- Operational scope: en-route to en-route, integrating airport operations and flight turnaround
- Community scope: every stakeholder providing or requiring air navigation resources

**96,577**

Flights operated every day worldwide

**2x traffic**

Air traffic expected to double within the next 15 years

**4 layers**

One plan, four levels tailored to different audiences

# The four-layer structure: one plan, four audiences



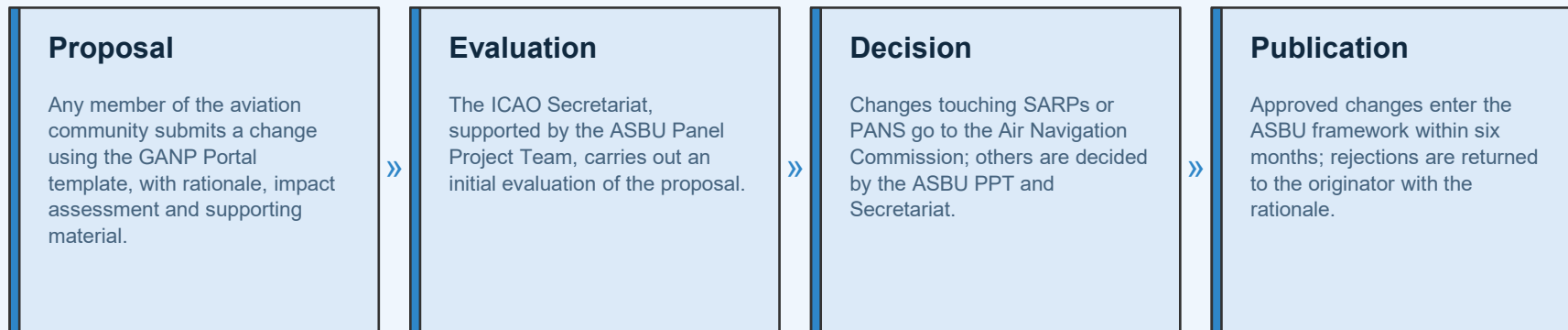
All four levels share a single entry point through the interactive GANP Portal, so no State or stakeholder is left behind.

# How the layers differ

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|                     | Global strategic                                  | Global technical                                            | Regional                                            | National                       |
|---------------------|---------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------------|--------------------------------|
| <b>Audience</b>     | Decision-makers                                   | Technical managers and experts                              | PIRGs, regional bodies                              | States and their partners      |
| <b>Horizon</b>      | 2050 and beyond                                   | Continuous, no end date                                     | Short to medium term                                | Short to medium term           |
| <b>Core content</b> | Vision, performance ambitions, conceptual roadmap | BBB and ASBU frameworks, performance objectives, KPIs       | Regional priorities, ANP Volumes I, II and III      | National air navigation plan   |
| <b>Owner</b>        | ICAO Assembly and Council                         | ICAO Secretariat with the ASBU Panel Project Team           | PIRGs with ICAO regional offices                    | The State                      |
| <b>Update cycle</b> | Reviewed before each triennial Assembly           | ASBU changes within six months of approval; BBBs biannually | Amendment process approved by Council, 18 June 2014 | Set by each State's own policy |

# How the plan is kept current



## Governance in brief

- Strategic level reviewed before each triennial ICAO Assembly session
- Basic Building Blocks updated biannually against SARPs and PANS
- A GANP study group steers the review and update teams

## Where it came from

- Fifth edition endorsed by the 39th Session of the Assembly in 2016
- The GANP Multidisciplinary Vision Team drafted the vision, ambitions and roadmap
- Presented to the Thirteenth Air Navigation Conference, Montréal, 9–19 October 2018

# Three complementary global plans

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## GANP

Doc 9750

Air navigation. Sets the vision, performance ambitions and roadmap for a globally interoperable system.

## GASP

Doc 10004

Safety. Gives States and service providers tools for a safety management approach through State safety programmes.

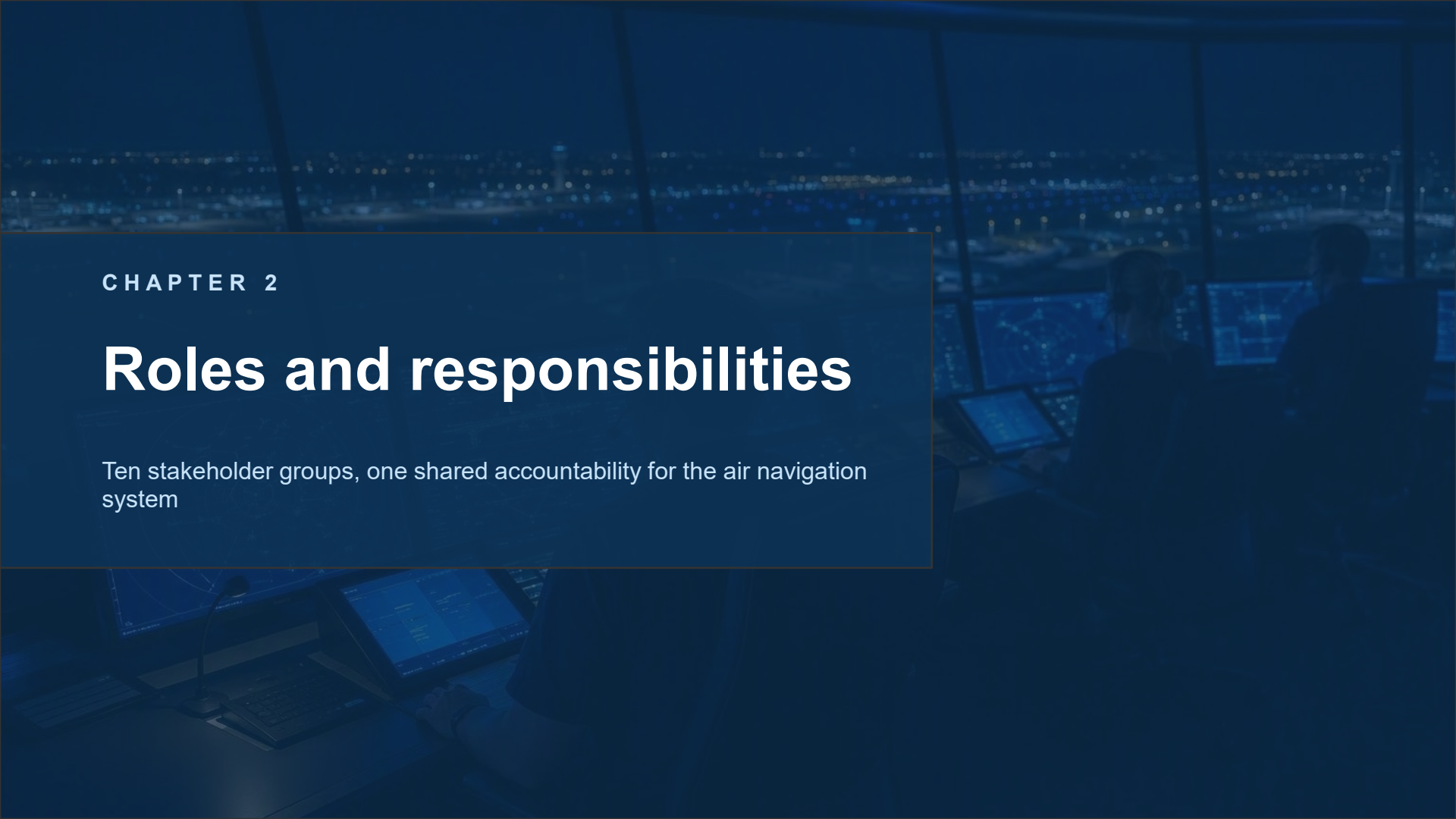
## GASeP

Doc 10118

Security. A foundation for States, industry and ICAO to enhance security, promote a security culture and improve oversight.

## Supporting concepts and manuals

- GATMOC (Doc 9854): the technology-independent statement of the envisaged operational concept
- Doc 9882 on ATM system requirements and Doc 9883 on global performance
- Eleven key performance areas define community expectations and are all equally important
- Every operational improvement must rest on a documented safety risk assessment

A dimly lit air traffic control room at night. Two controllers are seated at a console with multiple computer monitors displaying flight data. Large windows in the background show a city skyline with lights. The overall atmosphere is professional and focused.

## CHAPTER 2

# Roles and responsibilities

Ten stakeholder groups, one shared accountability for the air navigation system



# The ten GANP stakeholder groups

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All stakeholders — traditional or emerging — share the same aim: moving passengers and goods without delay, at minimum cost, safely, securely and sustainably. Each must take accountability for its role at the relevant GANP level.

|                          |                                                   |                                  |                                                  |                                                              |
|--------------------------|---------------------------------------------------|----------------------------------|--------------------------------------------------|--------------------------------------------------------------|
| 01<br><br>States         | 02<br><br>ICAO and standards-making organizations | 03<br><br>PIRGs                  | 04<br><br>Aerodrome community                    | 05<br><br>ANSPs and information service providers            |
| 06<br><br>Airspace users | 07<br><br>State aviation and the military         | 08<br><br>Manufacturing industry | 09<br><br>Research and development organizations | 10<br><br>International and professional staff organizations |

# States and ICAO: regulation and global convergence

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## States

- Contribute local and regional expertise and the operational insight needed to meet ICAO provisions
- Develop national air navigation plans that guarantee essential services and drive modernization
- Share best practices and lessons learned from implementation challenges
- Perform cost-benefit analyses and assess environmental impact, human performance and safety
- Provide a clear, stable regulatory framework that is still flexible, agile and scalable enough for innovation

## ICAO and standards-making organizations

- Serves as the global forum where the aviation community agrees a common strategy
- Provides the technical tools and identifies which stakeholders must be involved for each operational improvement
- Develops global provisions that ensure interoperability of systems and harmonization of procedures
- Coordinates regional plans and PIRG activity, and keeps PIRGs aligned with Regional Aviation Safety Groups
- Facilitates access to resources, technical assistance and capacity-building for States in need

# PIRGs: turning global direction into regional plans

- Provide the medium-term planning and implementation horizon for States and other stakeholders
- Own the regional level of the GANP and define regional priorities aligned with it
- Identify air navigation deficiencies and may propose ASBU amendments based on lessons learned

## Nine ICAO air navigation regions

**AFI · ASIA · CAR · EUR · MID · NAM · NAT · PAC · SAM**

Article 28 of the Convention on International Civil Aviation makes each contracting State responsible for providing the necessary air navigation services.

## The three volumes of an Air Navigation Plan

### Volume I

Stable planning elements — the assignment of responsibilities to States for aerodrome and air navigation facilities and services.

### Volume II

Dynamic planning elements — current to medium-term mandatory regional requirements agreed under regional air navigation agreements, including BBB requirements.

### Volume III

Flexible modernization elements — regional priorities and performance objectives linked to GANP key performance areas, KPIs and ASBU operational improvements.

# Aerodromes and service providers

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## The aerodrome community

- Both airside and landside activities fall within the scope of the plan
- Airport operators pursue efficiency for regulators, airlines, ANSPs, passengers and local residents
- Work with regulators so airports become fully integrated into the air navigation system
- Airport collaborative decision-making already maximizes limited infrastructure; fully integrated airport operations centres are the natural next step
- Supply data, forecasts and resources so infrastructure is optimally designed and operated

## ANSPs and information service providers

- Plan, organize and manage the air navigation system for optimum performance
- The term covers every provider across aerodrome operations, ATM, meteorology, aeronautical information and search and rescue
- Provision may be delegated to others under a proper regulatory framework
- Information and data providers need reliable networks and accurate, dynamic databases
- Work with civil aviation authorities to bridge executive and technical levels and secure transparent, timely funding

# Airspace users: three very different profiles

## Airlines

Most ICAO-compliant operations are commercial. Scheduled services form a worldwide network underpinning business, tourism and growth. Airlines identify future trends and the infrastructure needed for sustainable growth.

## General aviation

From aerial work to personal transport, and historically the entry point, training ground and talent source for the industry. The community supplies the GA perspective so States and ANSPs can account for constraints.

## New entrants

Differ in vehicles, preferred CNS capabilities, ways of operating and pace of innovation. Existing protocols constrain them and regulators are still writing rules, so the GANP acts as the coalescing framework.

## State aviation and the military

- The military is often aircraft operator, regulator, ANSP and airport operator at once
- Some State aircraft cannot comply with ICAO provisions for operational or technical reasons
- Stating operational requirements early protects airspace access, mobility, interoperability and confidentiality
- Civil-military collaboration is essential to a seamless system and to global interoperability

# Industry, research and the professional community

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## Manufacturing industry

- Brings up-to-date industrial standards, technical insight and cross-domain expertise
- The performance-based approach gives flexibility to develop and standardize solutions
- Life-cycle costs fall because upgrades no longer require rewriting prescriptive requirements
- Acts as a consultant during implementation to find the most cost-effective equipment and services

## Research and development

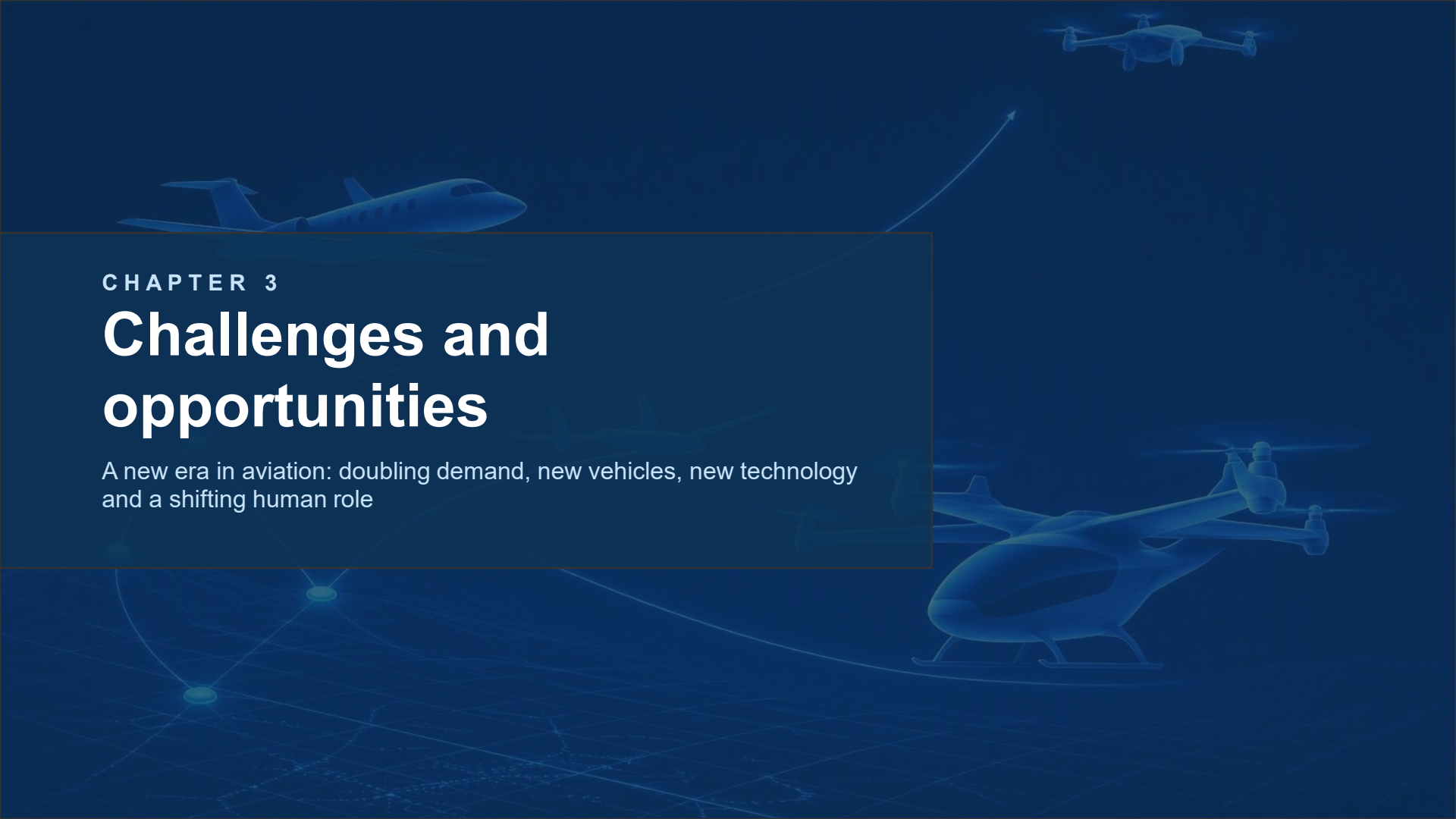
- The plan gives a common strategy that points joint research efforts in the same direction
- Delivers in-depth insight and solutions tied to real performance needs
- Usually contributes through State or regional programmes involving all stakeholders
- Now active across all areas of aviation, including academia, ensuring knowledge transfer to the next generation

## International and professional staff organizations

- Share information with members and raise awareness of compliance requirements
- Convey operational requirements so they feed into the technical frameworks
- Flight crews, cabin crews and controllers adhere to standard operating procedures
- Ensure technology and procedures respect human factors, and report deficiencies for continuous improvement

# How the stakeholder roles differ

| Stakeholder                                  | Primary GANP level             | Distinctive contribution                                                                     |
|----------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------|
| <b>States</b>                                | National                       | Regulate, fund and plan; guarantee essential services and stable yet flexible rules          |
| <b>ICAO and standards bodies</b>             | Global strategic and technical | Convene the community; issue provisions ensuring interoperability and harmonization          |
| <b>PIRGs</b>                                 | Regional                       | Set regional priorities, maintain ANP Volumes I–III, identify deficiencies                   |
| <b>Aerodrome community</b>                   | National and regional          | Integrate airports into the system through data, forecasts and collaborative decision-making |
| <b>ANSPs</b>                                 | National and regional          | Operate and modernize services; manage new digital enablers                                  |
| <b>Airspace users</b>                        | All levels                     | State the operational requirements the system must satisfy                                   |
| <b>Military and State aviation</b>           | National                       | Reconcile mission needs with civil operations through civil-military coordination            |
| <b>Manufacturing industry</b>                | Global technical               | Supply standards and cost-effective technology solutions                                     |
| <b>R&amp;D organizations</b>                 | Global technical               | Mature innovation and de-risk industrialization                                              |
| <b>International and staff organizations</b> | All levels                     | Carry human factors and frontline experience into the design                                 |



## CHAPTER 3

# Challenges and opportunities

A new era in aviation: doubling demand, new vehicles, new technology and a shifting human role



# Aviation by the numbers (2023, USD)

**\$4.1 trillion**

Global economic activity supported

**86.5 million**

Jobs supported worldwide

**4.4 billion**

Passengers carried

**35.3 million**

Scheduled commercial flights

**1,138**

Commercial airlines

**4,072**

Airports with scheduled flights

**29,039**

Commercial aircraft in service

**162**

Air navigation service providers

**67,300**

ATS routes

**8.17 trillion**

Passenger kilometres

**61.4 million**

Tonnes of cargo, worth \$8 trillion

**33%**

Of all international trade by value

Traffic reached one billion passengers a year in 1985, two billion by 2004 and 4.6 billion fifteen years later. After the deepest crisis since the Second World War, the sector regained 2019 levels in 2024.

# Seven forces reshaping the system

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## Social well-being

Aviation is the safest and fastest way to travel and the backbone of tourism and trade; it must keep delivering that value.

## Rising and new demand

Infrastructure must absorb twice today's traffic within 15 years, plus electric, vertical-lift, unmanned and higher-airspace vehicles.

## Advanced technologies

From automated support to machine learning; anything that can be connected will be connected, raising the premium on cyber resilience.

## Automation and AI

Used for nominal, off-nominal and contingency operations, guided by UN principles and keeping the human in the loop.

## Human capability

Automation must relieve repetitive work, team with operators and let humans focus on complex decisions.

## New business models

A system of systems is also a business of businesses; regulators must set performance standards rather than prescribe components.

## Climate and resilience

Net-zero carbon by 2050 for international aviation, plus architectures and contingency plans that absorb disruption.

## Net zero by 2050

The long-term aspirational goal adopted at the 41st Session of the ICAO Assembly for international aviation.

# Three levels of automation

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01

## Manual or human-controlled

Humans keep full control. Automation assists, simplifies tasks and reduces workload.

02

## Assisted or supervised

Humans set the parameters and intervene when needed, in collaborative human-automation teaming.

03

## Autonomous

The system adapts to varied scenarios and manages tasks independently while humans set the goals.

### Guiding principles for artificial intelligence

- Do no harm; defined purpose, necessity and proportionality; safety and security
- Fairness and non-discrimination, sustainability, privacy and data governance
- Human autonomy and oversight, transparency and explainability, accountability, inclusion

### What automation must deliver for people

- Free operators from repetitive tasks so they concentrate on complex decisions
- Analyse large volumes of information in new ways, even when operator and technology are far apart
- Human capital remains critical: people improvise in situations designers never anticipated

# Turning challenges into opportunities

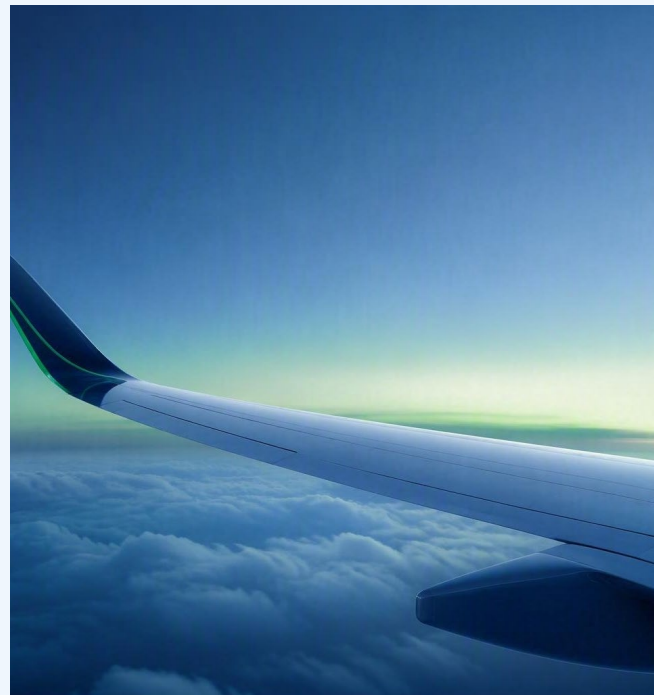
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## Three levers for climate goals

- Improve operational efficiency in every flight phase, cutting airborne delays and fuel burn
- Accommodate a more diverse sky with flexible, adaptive services that preserve flight efficiency
- Leverage emerging technologies through regulation that encourages innovation

## Building resilience

- Grow the next generation of professionals and protect competency and well-being
- Design agile, diverse capabilities with redundancy and soft failure modes
- Provide cost-effective, scalable services through service-oriented architecture
- Capture lessons learned for contingency, resilience and communications planning



# The targeted air navigation system

*“A safe, secure, efficient and sustainable system in which air and ground, including airports, act as a single integrated infrastructure — fully harmonized, built on agreed performance-based standards, and leaving no country or stakeholder behind.”*

## A single integrated infrastructure

Air and ground systems, including airports, operate as one in an intermodal environment, with remotely-piloted and unmanned platforms extending traditional business models.

## Digitally information-rich

Shared information fuels collaborative decision-making in a network-centric context, enabling management by trajectory and supporting human-machine collaboration.

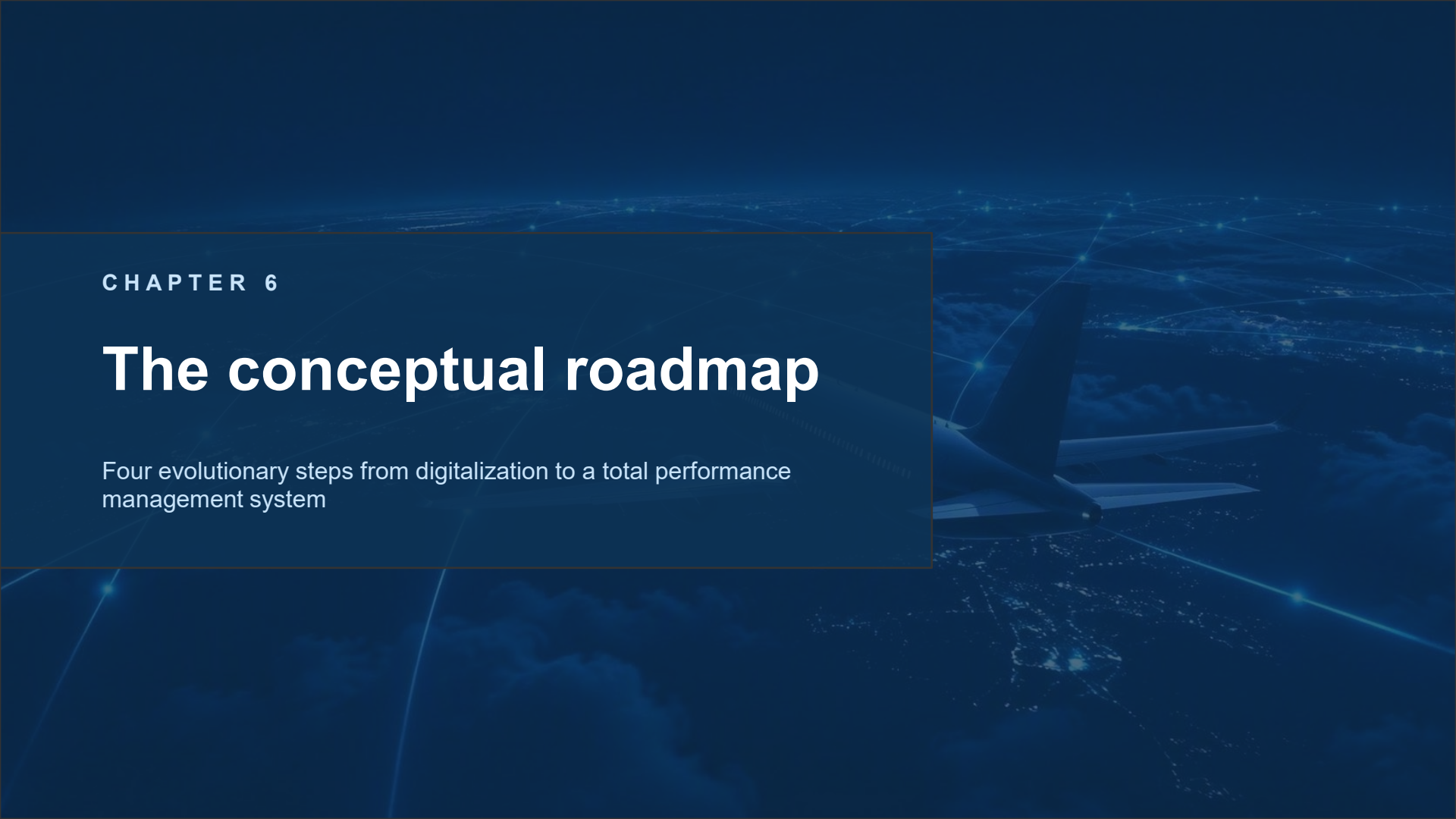
## Harmonized and scalable

Agreed performance-based standards give interoperable, scalable systems; users gain access to resources in line with the performance requirements they meet.

# Eleven key performance areas for 2050 and beyond

| Key performance area               | Ambition                                                                                          |
|------------------------------------|---------------------------------------------------------------------------------------------------|
| Access and equity                  | No member of the aviation community excluded or treated unfairly                                  |
| Capacity                           | Nominal capacity easily scalable with demand, and service maintained through disruptive events    |
| Cost-effectiveness                 | No increase in total direct cost of services, with a significant rise in productivity             |
| Efficiency                         | A reduced gap between achieved flight efficiency and the user's desired optimum trajectory        |
| Environment                        | Minimize climate impact through operational improvements, and local noise and air-quality impacts |
| Flexibility                        | Absorption of required changes to individual business and operational trajectories                |
| Interoperability                   | Compatibility of systems at both operational and technical level                                  |
| Participation by the ATM community | A pre-agreed level of participation for maximum shared use of resources                           |
| Predictability                     | No increase in the variability of service delivery, including asset availability                  |
| Safety                             | Continual safety performance improvement in every ICAO region                                     |
| Security                           | Zero significant disruptions due to cyber incidents                                               |

Safety remains paramount: the commitment is to eliminate air navigation service-related accidents entirely and halve related serious incidents.

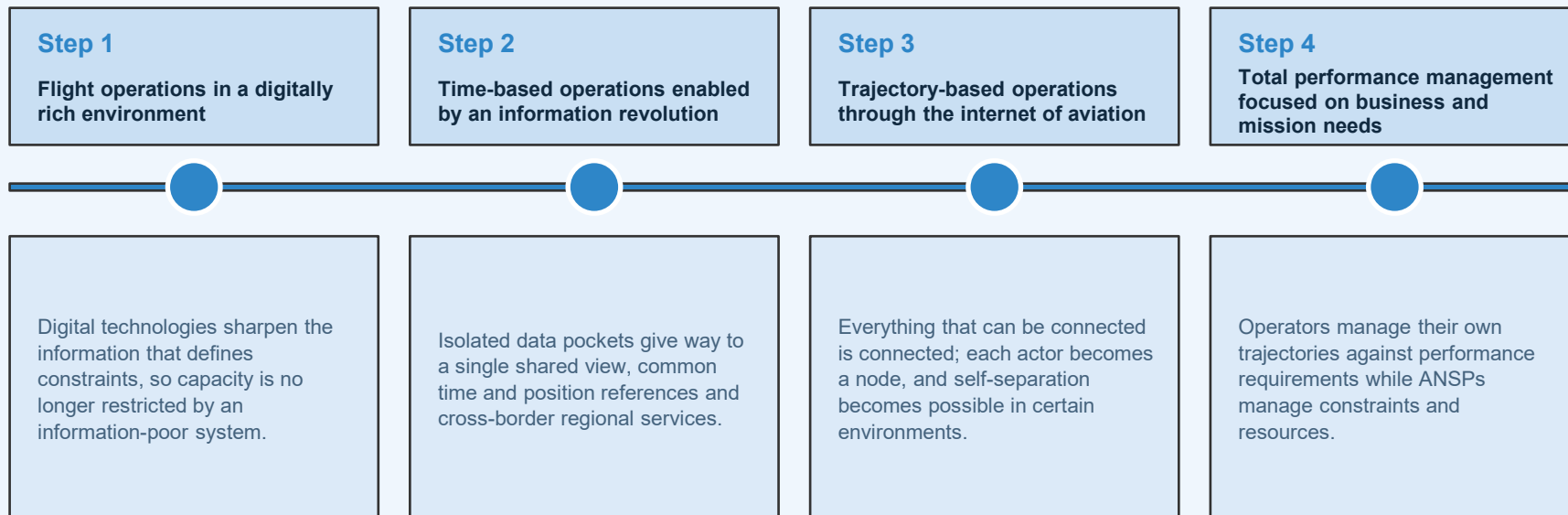


## CHAPTER 6

# The conceptual roadmap

Four evolutionary steps from digitalization to a total performance management system

# Four evolutionary steps



The next twenty years are a period of transformational change built on management by trajectory, progressive automation and harmonized ground and air systems — with cyber security and cyber resilience as system-wide priorities.



# From digitalization to time-based operations

## Step 1 — Digitally rich environment

### WHAT CHANGES

- Digital technologies improve the quality of information defining volume, time and position constraints
- Greater data storage, processing and distribution beyond the front-line actor
- More stakeholders take part in decision-making

### WHAT STANDS IN THE WAY

- Large investment required
- Information often locked to front-line actors over costly point-to-point links
- Fragmentation creates multiple views and isolated automation

## Step 2 — Information revolution

### WHAT CHANGES

- Data referenced to common time and position systems and shared through globally accepted exchange models
- Cloud storage, big data analysis and machine learning
- Network management supporting a resilient regional network with seamless cross-border services

### WHAT STANDS IN THE WAY

- Some data still estimated rather than taken from source
- Legacy aircraft protocols carry limited data sets
- Automation not yet at the level trajectory-based operations require

# Connectivity and performance management

## Step 3 — Internet of aviation

### WHAT CHANGES

- Every actor becomes a node, both source and user of information
- Constraints shrink through near-instantaneous processing and continuous recalculation of trajectories
- Network management becomes a globally shared endeavour, free of cross-regional boundary inefficiencies
- Pre-flight deconfliction and advanced on-board technology allow self-separation in certain environments

### WHAT STANDS IN THE WAY

- A global approach to information security is indispensable
- Solutions must shift from aviation-specific to performance-based architecture
- Decision-making principles are still held at ANSP level

## Step 4 — Total performance management

### WHAT CHANGES

- Roles are redistributed: operators manage their own trajectory against defined performance requirements
- ANSPs concentrate on managing constraints and air navigation resources
- Airspace organization becomes harmonized and increasingly automated
- Collaborative decisions are driven by business and mission objectives

### WHAT STANDS IN THE WAY

- Access and equity must be protected so the fastest IT capability does not dominate
- Capacity rationing gives way to a gradual introduction of market rules
- Regulation must adapt without harming overall network performance

# From concept to operations

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## The Basic Building Blocks framework

The foundation of a robust system — the State's commitment under the Convention on International Civil Aviation to provide the essential services international civil aviation depends on.

## The ASBU framework

A structured list of what is available and what is under development, mapping operational improvements and their benefits to the four evolutionary steps of the roadmap.

## Principles that govern implementation

### One size does not fit all

Traffic, infrastructure, motivation and resources differ by airport, airspace, State and region.

### Leapfrogging is allowed

Some members enhance existing infrastructure; others invest directly in advanced operations and skip legacy cost.

### Think global, act local

Nobody implements everything everywhere; regional and national performance objectives deliver seamless quality.

### Incentives can accelerate

Prioritized access or operational benefits for the most capable users, coordinated with all stakeholders.

# Planning that interlocks across three levels

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## Global

ICAO

The GANP is the global basis for every regional and national plan; performance management rests on results, facts and collaborative decisions.

## Regional

PIRGs and ICAO regional offices

Air navigation plans in three volumes translate global direction into mandatory regional requirements and performance objectives across nine ICAO regions.

## National

States

National plans start from user requirements, traffic density and complexity, and accurate forecasts of movements, passengers and freight to justify investment.

Who pays and who benefits should be settled collaboratively and transparently. States are ultimately responsible for defining, planning and funding modernization, yet remain interconnected with regional partners and industry. National air navigation plans should sit inside a broader civil aviation master plan linked to the State's national development plan.

# What to remember

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## **One plan, four layers**

The GANP speaks to decision-makers, experts, regions and States in the same coherent framework.

## **Ten stakeholder groups**

Each has a distinct role, and none can deliver the transformation alone.

## **Performance, not prescription**

Eleven key performance areas set the ambitions; technology choices stay flexible.

## **A roadmap, not an end date**

Four evolutionary steps guide a continuous transformation toward 2050 and beyond.

*The leadership shown in this plan ensures a relevant air navigation evolution for all stakeholders, so that no country is left behind.*