Global Air Traffic Management Operational Concept

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Background and History

- FANS
- Tenth Air Navigation Conference
- CNS/ATM Systems
- Global Coordinated Plan for Transition to ICAO CNS/ATM Systems
- Planning and Implementation Regional Groups embarked on an extensive effort
- SARPs, PANS, Guidance material
- Global Air Navigation Plan for CNS/ATM Systems (Doc 9750)

Air Traffic Management Operational Concept Panel (ATMCP)

- Technology was not an end in itself
- Task: To develop a comprehensive concept for an integrated, global ATM system, based on clearly-established operational requirements
- Concept endorsed by the 11th Air Navigation Conference
- Concept endorsed by the 35th Assembly (2004)
- Next steps
  - ATM system requirements
  - Transition strategies
  - Performance framework

Global Air Traffic Management Operational Concept

- The ATM operational concept is a vision that describes how an integrated global ATM system should operate
- The concept provides States and industry with clearer objectives for the design and implementation of ATM and supporting CNS systems

Vision statement

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 optimum economic operations
- is environmentally sustainable and
- meets national security requirements.

Future Air Traffic Management

Air traffic management is the dynamic, integrated management of air traffic and airspace — safely, economically and efficiently — through the provision of facilities and seamless services in collaboration with all parties

Scope of the ATM concept

The global ATM operational concept addresses what is needed to

- increase user flexibility and
- maximize operating efficiencies

in order to

- increase system capacity and
- improve safety levels in the future air traffic management system.

Fundamentals

- ATM Community
- Guiding principles
- Expectations
- Concept components
- Expected benefits

ATM Community

The aggregate of organizations, agencies or entities that may participate, collaborate and cooperate in the planning, development, use, regulation, operation and maintenance of the ATM system

Members of the ATM Community

- Aerodrome community
- Airspace providers
- Airspace users
- ATM service providers
- ATM support industry
- ICAO
- Regulatory authorities
- States

Guiding Principles in six main areas:

- Safety
- Humans
- Technology
- Information
- Collaboration
- Continuity

Guiding Principles: Safety

- The attainment of a safe system is the highest priority in air traffic management
- A comprehensive process for safety management will be implemented, enabling the ATM community to achieve efficient and effective outcomes

Guiding Principles: Humans

- Humans will play an essential and, where necessary, central role in the global ATM system
- Humans are responsible for managing the system, monitoring its performance and intervening, when necessary, to ensure the desired system outcome
- Due consideration to human factors must be given in all aspects of the system

Guiding Principles: Technology

- No reference to any specific technology
- Openness to new technologies
- CNS systems, and advanced information management technology will functionally combine the ground-based and airborne system elements into a fully integrated interoperable and robust ATM system
- flexibility across regions, homogeneous areas and major traffic flows

Guiding Principles: Information

The ATM community will depend extensively on the provision of timely, relevant, accurate, accredited and quality-assured information to collaborate and make informed decisions. Sharing information on a system-wide basis will allow the ATM community to conduct its business and operations in a safe and efficient manner.

Guiding Principles: Collaboration

- Strategic and tactical collaboration in which the appropriate members of the ATM community will participate in the definition of the types and levels of service
- The ATM community will collaborate to maximize system efficiency by sharing information, leading to dynamic and flexible decision making.

Guiding Principles: Continuity

The realization of the concept requires contingency measures to provide maximum continuity of service in the face of major outages, natural disasters, civil unrest, security threats or other unusual circumstances

Eleven Expectations (in alphabetical order)

- Access and Equity
- Capacity
- Cost-effectiveness
- Efficiency
- Environment
- Flexibility
- Global interoperability
- Participation by the ATM community
- Predictability
- Safety
- Security

Access and Equity

- A global ATM system should provide an operating environment that ensures that all airspace users have right of access to the ATM resources needed to meet their specific operational requirements and that the shared use of airspace by different users can be achieved safely.
- The global ATM system should ensure equity for all users that have access to a given airspace or service.

Capacity

- The global ATM system should exploit the inherent capacity to meet airspace user demands at peak times and locations while minimizing restrictions on traffic flow.
- To enable future growth, capacity must increase, while ensuring that there are no adverse impacts on safety, and giving due consideration to the environment.

Cost-effectiveness

- The ATM system should be cost-effective, while balancing the varied interests of the ATM community
- The cost of service to airspace users should always be considered when evaluating any proposal to improve ATM service quality or performance.
- ICAO policies and principles regarding user charges should be followed.

Efficiency

- Efficiency addresses the operational and economic cost-effectiveness of gate-to-gate flight operations from a single-flight perspective.
- In all phases of flight, airspace users want to depart and arrive at the times they select and fly the trajectory they determine to be optimum.

Environment

- The ATM system should contribute to the protection of the environment by considering noise, gaseous emissions and other environmental issues in the implementation and operation of the global ATM system.

Flexibility

Flexibility addresses the ability of all airspace users to modify flight trajectories dynamically and adjust departure and arrival times, thereby permitting them to exploit operational opportunities as they occur.

Global interoperability

The ATM system should be based on global standards and uniform principles to ensure the technical and operational interoperability of ATM systems and facilitate homogeneous and non-discriminatory global and regional traffic flows.

Participation by the ATM community

The ATM community should have a continuous involvement in the planning, implementation and operation of the system to ensure that the evolution of the global ATM system meets the expectations of the community.

Predictability

- Predictability refers to the ability of airspace users and ATM service providers to provide consistent and dependable levels of performance.
- Predictability is essential to airspace users as they develop and operate their schedules.

Safety

- Safety is the highest priority in aviation
- ATM plays an important part in ensuring overall aviation safety
- Uniform safety standards and risk and safety management practices should be applied systematically to the ATM system
- Safety needs to be assessed in accordance with appropriate and globally standardized safety management processes and practices

Security

Adequate security is a major expectation of the ATM community and of citizens. The ATM system should therefore contribute to security, and the ATM system, as well as ATM-related information, should be protected against security threats.

The Operational Concept

- An operational concept is a vision
- describes what is envisaged on the basis of services
- These services form an integrated whole
- an information rich environment, that solves most problems strategically, through a collaborative process

Seven Concept Components

- Airspace organization and management
- Aerodrome operations
- Demand and capacity balancing
- Traffic synchronization
- Airspace user operations
- Conflict management
- ATM service delivery management

Role of Information Services

Will ensure the cohesion and linkage between the seven concept components

Key Conceptual Changes

Airspace Organization and Management (strategic)

- All airspace will be the concern of ATM and will be a useable resource
- Any restriction on the use of any particular volume of airspace will be considered transitory
- Airspace management will be dynamic and flexible

Key Conceptual Changes
Aerodrome Operations

- Runway occupancy time will be reduced
- The ability to safely manoeuvre in all weather conditions
- Precise surface guidance to and from a runway
- The position and intent of all vehicles and aircraft operating on the manoeuvring and movement areas will be known

Key Conceptual Changes

Demand and Capacity Balancing (strategic)

- Through CDM at the strategic stage, assets will be optimized
- Through CDM at the pre-tactical stage, adjustments will be made to assets, resource allocations, projected trajectories, airspace organization, and allocation of entry/exit times
- At the tactical stage, dynamic adjustments to the organization of airspace to balance capacity; dynamic changes to the entry/exit times

Key Conceptual Changes

Traffic Synchronization

- Dynamic 4-D trajectory control and negotiated conflict-free trajectories
- Choke points will be eliminated
- Optimisation of traffic sequencing will achieve maximization of runway throughput.

Key Conceptual Changes

Airspace User Operations

- ATM data will be fused for an airspace user's situational awareness and conflict management
- Airspace user operational information will be made available to the ATM system
- Individual aircraft performance, flight conditions, and available ATM resources will allow dynamically-optimised 4-D trajectory planning

Key Conceptual Changes
Airspace User Operations

- Collaborative decision making
- Aircraft should be designed with the ATM system as a key consideration

Key Conceptual Changes
Conflict Management: Terms

- Conflict: Any situation involving aircraft and hazards in which the applicable separation minima may be compromised
- Conflict horizon is the extent to which hazards along the future trajectory of an aircraft are considered for separation provision

Key Conceptual Changes
Conflict Management : Terms

- Hazards that an aircraft will be separated from are
  - other aircraft
  - terrain
  - weather
  - wake turbulence
  - incompatible airspace activity
  - surface vehicles and other obstructions on the apron and manoeuvring area.

Key Conceptual Changes

Conflict Management: Terms

- Separation minima are the minimum displacements between an aircraft and a hazard that maintain the risk of collision at an acceptable level of safety
- Separation mode is an approved set of rules, procedures and conditions of application associated with separation minima
- Separation provision is the tactical process of keeping aircraft away from hazards by at least the appropriate separation minima

Key Conceptual Changes

Three Conflict Management Layers

- Strategic conflict management
- Separation provision
- Collision avoidance

Key Conceptual Changes
Strategic Conflict Management

- Achieved through airspace organization and management, demand and capacity balancing and traffic synchronization
- “Strategic” is used here to mean “in advance of tactical”
- Strategic conflict management measures aim to reduce the need to apply the second layer — separation provision

Key Conceptual Changes
Separation Provision

- The tactical process of keeping aircraft away from hazards by at least the appropriate separation minima
- Only used when strategic conflict management (i.e. airspace organization and management, demand and capacity balancing and traffic synchronization) cannot be used efficiently

Key Conceptual Changes
Separation Provision

- The separator is the agent responsible for separation provision for a conflict and can be either the airspace user or a separation provision service provider
- Self-separation is the situation where the airspace user is the separator for its activity in respect of one or more hazards
- Distributed separation occurs when, for an airspace user's activity, there are different separators for different hazards.

Key Conceptual Changes
Separation Provision

- A separation provision service will be available when safety or ATM design requires
- Full separation provision service occurs when the service provider is the separator for an airspace user's activity from all hazards

Key Conceptual Changes
Collision avoidance

- The third layer of conflict management
- Must activate when the separation mode has been compromised
- Collision avoidance is not part of separation provision
- Collision avoidance systems are not included in determining the calculated level of safety required for separation provision
- Collision avoidance systems will, however, be considered as part of ATM safety management.

Key Conceptual Changes
ATM Service Delivery Management

Principles include:

- Trajectory, profile, and aircraft or flight intent
- Management by trajectory
- Clearance

Key Conceptual Changes
Collaborative Decision Making

- Means achieving an acceptable solution that takes into account the needs of those involved
- Requires a spirit of cooperation
- Primarily invoked to resolve competing demands for an ATM resource and to organize a safe sharing of that resource among airspace users

Expected Benefits in General

- Improved safety management processes will ensure that safety performance remains the highest priority
- Business cases will ensure efficient and cost-effective ATM developments and operations
- Collaborative decision making and system-wide ATM information will enable airspace user participation in balancing the demands on the ATM system, thereby providing flexibility and predictability

Expected Benefits Specifically

- All airspace will be available as a usable resource, resulting in improved access, increased opportunity for user-preferred trajectories and, through community cooperation, increased capacity

Expected Benefits Specifically

- Improved surface management of the aerodrome will provide predictable departure and gate-arrival times, thereby improving overall ATM system predictability and subsequent capacity
  In particular, improved runway design, together with improved operational procedures, will increase capacity

Expected Benefits Specifically

- Improved information exchange and cooperation within the ATM community will maximize system capacity
- Improved all-weather operations will maintain maximum capacity
- Improved information concerning demand and system capabilities will prevent system overloads, ensuring manageable workloads

Expected Benefits Specifically

- Provision of accredited, quality-assured and timely information will allow an informed decision-making process
- The ATM community will contribute to the protection of the environment by taking into consideration the consequences of airspace activities

Conclusions

- CNS/ATM systems was a first step
- We needed a vision: the operational concept
- Concept consists of 7 integrated services
- The future system will be an information rich environment, that solves most problems strategically, through a collaborative process
- 35th Assembly endorsed the concept
- Future work consists of developing
  - ATM system requirements
  - Transition strategies
  - Performance framework

Thank You