ICAO
Performance Based Approach

Regional Performance Framework Workshop, Baku, Azerbaijan, 10-11 April 2014
Aviation Traffic Flow
Global Shift in Traffic Flows

Comparing World Traffic Flow 2002-2010 by City Pair (International and ...
Zoom Drag and Click on line for more Info! Major Routes in Red, Orange, Yellow,
Green, Blue. How do Traffic Flow change in each Region?

Traffic Flow 2012

Traffic Flow 2002

This ICAO Map was created in 2012 with the AOG Data 2010, at that time:
We have 4,300 Cities for 43,875 Routes and 31,096,200 movements.
Each Channel is bidirectional, movements for each direction.

This ICAO Map was created in 2002 with the AOG Data, at that time:
We have 3,811 Cities for 33,705 Routes and 26,296,389 movements.
Each City pair is bidirectional, movements for each direction.
Challenges

HIGHEST TRAFFIC GROWTH IN ASIA

Accident Statistics and Accident Rates: 2011

<table>
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<tr>
<th>UN Region</th>
<th>Traffic (thousands)</th>
<th>Number</th>
<th>Rate¹</th>
<th>Fatal Accidents</th>
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<td>Africa</td>
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NO REGIONAL ACCIDENT RATE EXCEEDING TWICE THE GLOBAL AVERAGE

- 3.0 billion Passengers carried in 2012
- 31 million Aircraft departures in 2012
- 6.4 billion Forecasted passengers carried in 2030
- 59 million Forecasted aircraft departures in 2030

5.4 trillion Revenue Passenger-Kilometres in 2012

World passenger traffic expressed in terms of Revenue Passenger-Kilometres (RPK) on total scheduled services (i.e. international and domestic services combined) increased by 4.9 per cent in 2012 compared to 2011, according to data provided to the International Civil Aviation Organization by its Member States and ICAO estimates.

This represents the third consecutive positive growth for the air transport industry since 2009 and corresponds to an increase of 4.7 per cent over 2011 in the number of passengers carried, reaching 3.0 billion passengers in 2012.

-1.1% growth rate vs. 2012

The world air cargo market declined in 2012 (-1.1 per cent in term of Freight Tonne-Kilometres performed, compared to 2011). This represents the second consecutive negative growth since 2010. World scheduled freight traffic is forecasted to grow at an average annual rate of 3.5 per cent over the next twenty years.
ICAO vision on global harmonisation

• A global ATM system is envisioned as the foundation of a worldwide integrated, harmonised and interoperable air transportation system. This system is intended to integrate regional and local ATM systems as well as to interoperate and provide seamless services (across all regions, sub-regions and States) to all users in all phases of flight.

• A globally interoperable system will meet requirements for safety and security and provide optimum economic operations that are environmentally sustainable and cost effective.

• The ICAO vision of global harmonisation is therefore based on the need for:
  – Uniform level of safety across all regions, sub-regions and States
  – Optimised traffic flows across all regions, sub-regions and States
  – Physical system-to-system connectedness, sharing pertinent data across systems and regions
  – Common performance requirements, standards and operating procedures
  – Common aeronautical information exchange
  – Meeting environmental objectives
  – Meeting minimum and common security objectives
What is global ATM?
Integration and a common vision

Information rich environment

Aerodrome Operator

Management

Communications

Navigation

Surveillance

Aerodrome operations

Demand capacity balancing

Airspace user operations

Traffic synchronisation

Aircraft operations

Maintenance Engineering

Airspace User

Conflict Management

Airspace organization and Management

ATM service delivery management

ATM Service provider

People

Systems

Concept components
What is global ATM?
Seamlessness - Interoperability

• A seamless, interoperable, worldwide system based on:
  – Seamless safety across all regions
    • For all users during all phases of flight
  – Physical connectedness
    • Homogeneous ATM areas and Major Traffic flows
  – Common requirements, Standards and procedures
    • Integration (TMAs, aerodromes)
    • Performance based equipment carriage requirements
  – Common aeronautical information exchange models
  – Meets environmental objectives
What is global ATM?
Working together

- Toward a common vision
  - global ATM Operational Concept

- Using a common planning framework
  - Global Air Navigation Plan, the regional air navigation plans and several other documents and tools
  - Global Aviation Safety Plan (GASP)

- Utilizing performance objectives
  - Targets, metrics, indicators

- Global interoperability and harmonization are key to making further improvements
Air Navigation Conference 11
How did we start?

- Endorsement of the global ATM operational concept already at 11th Air Navigation Conference in 2003
- ICAO is requested to:
  - develop ATM system requirements
  - address interoperability and seamlessness
  - define requirements for global AIM
  - publish the operational concept
  - amend the Global Plan
  - develop a performance framework
Air Navigation Conference 11
The role of States and PIRGs

• That States and PIRGs consider the Global Air Navigation Plan for CNS/ATM Systems as a catalyst for change, providing a global safety and interoperability framework while allowing regional or local adaptation to efficiently meet regional and local needs

• That States and PIRGs agree on a set of metrics related to key performance areas, incorporate these metrics into the performance monitoring process and review their results on a regular basis (EANPG, RASG)
The Conference unanimously endorsed the Aviation System Block Upgrades (ASBUs) framework introduced by ICAO to set goals in terms of operational improvements on a consensus-driven basis.

The Conference also endorsed the draft 4th edition of the Global Air Navigation Plan (Doc 9750), as unified planning mechanism, which has been approved by the ICAO Assembly in September 2013.

ICAO is tasked to include the key policy principles in the GANP, develop financial policies, SARPS development plan, define a stable and efficient process to update the GANP.

ICAO (through Regional Offices) will provide guidance and assistance on ASBUs implementation to States, establish a group and mechanism for inter-regional cooperation.
Recommendation 1/15 – Performance monitoring and measurement of air navigation systems

The Committee noted that the implementation of “One Sky” would require the use of a common “language” regarding performance monitoring and measurement. This implies a coordinated approach across States and stakeholders for data provision, collection, storage, protection, dissemination, indicator calculation and use of the results to support the various ATM improvement processes. It was agreed that there was a need to develop a global methodology, to identify metrics and indicators which could be used to allow States and regions to measure and evaluate the effectiveness of their ATM performance initiatives. In doing so, particular attention should be given to avoiding duplication of efforts and to use, to the maximum extent possible, existing arrangements and solutions.

That ICAO:

a) establish a set of common air navigation service performance metrics supported by guidance material, building on existing ICAO documentation (e.g. Manual on Global Performance of the Air Navigation System (Doc 9883) and the Manual on Air Navigation Services Economics (Doc 9161));

b) promote the development and use of “leading safety indicators” to complement existing “lagging safety indicators” as an integral and key component to drive improvement in performance and in the achieved management of risk; and;

c) encourage the early and close involvement of the regulator and oversight bodies in the development, proving of concepts and implementation of the aviation system block upgrades and regional programmes.
GANP and GASP Advantages

• A globally harmonized and time-wise synchronized set of ATM improvements to direct the work of States, ANSPS, AOs, airports, ICAO and other international and standard making organizations

• A globally agreed ATM baseline through commitment to implement Block 0

• A systematic approach to ATM improvements, a packaged solution that includes standards/guidance, technology, procedures, regulatory framework, business case, performance measurements
ICAO EANPG

• Ensure that air navigation system development plans and actions within the EUR Region remain coherent and compatible with the ICAO Strategic Objectives, with the ICAO global plans (especially GANP and ASBUs, parts of GASP), with those of the adjacent ICAO Regions and with other world-wide provisions.

• Manage the EUR Air Navigation Plan (Performance directives and associated requirements for facilities and services established through regional air navigation agreements, in support of the global air navigation infrastructure) and facilitate the implementation of the international operational requirements contained therein.

• Promote and facilitate the harmonisation and co-ordination of the air navigation related programmes (e.g. SESAR, State ATM Corporation modernisation program, NextGen) of other international organisations such as the European Commission, the European Civil Aviation Conference (ECAC), Eurocontrol and the Interstate Aviation Committee of the Commonwealth of Independent States (IAC/CIS).

• Ensure the interoperability of the EUR CNS/ATM systems with those of adjacent regions and in line with the ICAO GANP.

• Assist States in their planning and implementation efforts, if and when required.
The wider ATM perspective

- A wider (more regional, if not even global vision) perspective is needed to make even greater gains in capacity and efficiency
- A far-reaching cooperation is necessary in order to support the implementation of facilities and services over larger geographical areas
- Enhanced planning perspectives and a global framework for performance measurement is required to support the implementation activities
- States and all aviation stakeholders should
  - work together towards a common vision (global ATM Operational Concept)
  - use a common planning framework
    - Global Air Navigation Plan (GANP), the regional air navigation plans and several other documents and tools (e.g. European ATM Masterplan)
    - Global Aviation Safety Plan (GASP)
      - utilize harmonised performance objectives (targets, metrics, indicators)
- Interoperability and harmonization are key factors in order to ensure the required improvements for the future
Global ATM Operational Concept

- Endorsed by 35th Session of the Assembly
- Vision:
  - Globally interoperable
  - All users & flight phases
  - Safe, economic, environmental & secure
- ATM user expectations are drivers for change, requiring:
  - Safety case
  - Business case
- Foundation for ATM System Requirements
- Air Navigation Conference 2012
Performance Based Approach

- Performance Based Approach is based on the following three principles:
  - Strong focus on desired/required results
  - Informed decision making, driven by the desired/required results
  - Reliance on facts and data for decision making
Focus on desired/required results

- In stead of prescribing *solutions*, desired/required *performance* is specified.
- Management attention is shifted from a resource and solution centric view (how will we do it) towards a primary focus on desired/required (performance) results (what is the outcome we are expected to achieve).
- This implies finding out
  - what the current performance situation is,
  - what the most appropriate results should be,
  - clarifying who is accountable for achieving those results.
“Informed decision making” requires that decision makers develop a good understanding of the mechanisms which explain how drivers, constraints, shortcomings, options and opportunities influence (i.e. contribute to, or prevent) the achievement of the desired/required results.

This means working “backwards” from the “what”—the primary focus—to decisions about the “how”.

Only then can decisions—in terms of priorities, trade-offs, selection of solutions and resource allocation—be optimised to maximise the achievement of the desired/required (performance) results.
Reliance on facts and data

• In the Performance Based Approach the desired/required results as well as the drivers, constraints, shortcomings and options are expressed in quantitative terms, rather than just in a qualitative way.
• The rationale for this is that “if you can’t measure it, you can’t manage it”, i.e. unless you measure something you don't know if it is getting better or worse.
• When facts and data are used, they should be relevant and reflect reality.
  – This requires the adoption of a (performance) measurement culture.
  – It also necessitates associated investments in data collection and management.
The advantages of the Performance Based Approach are:

1. It is result oriented, allows customer focus and promotes accountability;

2. Policy making becomes much more transparent when the goals to be reached are publicly stated in terms of performance outcome rather than solutions;

3. The shift from *prescribing solutions* to *specifying desired/required performance* also gives more freedom and flexibility in selecting suitable solutions, which in turn is a catalyst for more cost effectiveness. Furthermore, solutions can be more easily adapted in a diverse and changing environment;

4. Exclusive bottom-up approaches ("technology driven approach" and "solutions searching for a problem to solve") are easier to avoid;
More PBA advantages

5. Reliance on anecdotal evidence can be replaced by a more rigorous scientific approach employing quantitative and qualitative methods;

6. The focus on desired/required results helps decision makers to set the right priorities, make the most appropriate trade-offs, choose the right solutions and perform optimum resource allocation;

7. Organisations will be more successful in reaching goals, i.e. the general effect of the approach is that it ensures improved predictability of benefits;

8. It is worth the investment: the adoption of a Performance Based Approach typically results in cost savings (cost avoidance) which is orders of magnitude larger than the cost of applying the approach.
Planning process outputs

- The transition to the operational concept is to occur in a focused way via a set of coordinated planning processes which operate at local, regional and global level.

- In terms of level of detail, these planning processes produce three kinds of outputs which will be regularly updated according to the need:
  - **Transition roadmaps**, which are a high level representation of the selection of operational improvements and their deployment interdependencies (in terms of prerequisites), adapted to the needs of a particular planning area (at regional or local level).
  - **Implementation plans**, which are intended to be derived from the short term part of transition roadmaps. They lay out a detailed set of development and deployment actions — including their timing — for all involved members of the ATM community.
  - **Research plans**, which lay out the research needed today to develop the medium and long term parts of transition roadmaps to a level of maturity suitable for turning them into implementation plans.
Global Air Navigation Plan
Alignment of planning

• Misalignment of data, performance measurement and assessment between regions/States leads to transition roadmaps and plans based on different assumptions.

• Transition planning is conducted at regional/local levels using a certain planning Cycle. Same cycle should be used by regions/States and these cycles should be synchronized.

• Standard cycle considers planning horizon of 20 years
  – After each 5 year cycle, implementation should be reviewed to assess operational improvements
  – Operational improvements planned in previous short term plan will now become operational
  – Research should have progressed the knowledge about transition roadmap
  – Initial research should have been completed for first part of the long term period.
How to understand performance

• The past and now: Performance Review
  – (performance) Data capturing
  – Data analysis (trends)
  – Reporting

• How to improve: Performance Planning
  – Understanding performance impact
  – Validation

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Global Operational Outcomes and KPI’s

GOO 5: Optimized Airspace and Route Structures

- Demand vs. Capacity
- CO2 Emissions
- Cost
Performance terms

- **Performance objectives:** Specific, Measurable, Achievable, Relevant & Timely (SMART) objectives defined to satisfy ATM community expectations.

- **Performance indicators:** to measure achievement of performance objective

- **Performance targets:** value of performance indicators that need to be reached/exceeded to fully achieve performance objective.

- **Performance gaps:** Performance indicators compared against performance targets identifying gaps

- **Performance assessment metrics:** determine which data needs to be collected to calculate values of performance indicators
Performance measurement

Expectations

KPA

Objectives

Quantitative

Indicators

Targets

Objective is met when indicators meet or exceed targets
Performance assessment

- **Assess current performance**: establish baseline & track progress towards performance objectives
- **Identification/diagnosis performance gaps**: Performance gaps denote current/anticipated mismatch (unfavorable) between current/planned performance and performance target.
- **Addressing performance gaps**: Operational improvements in terms of changes to ATM system that are on transition path towards Global ATM Operational Concept and result in a direct performance enhancement.
- **Developing list of options for operational improvements**: Operational improvements made possible by technical systems, human factors, procedure and industrial enablers in terms of feasibility, timing, cost and impact on operational change. Global Air Navigation Plan (Doc 9750) is one of the sources, which can be used.
- **Building/updating transition roadmaps**: Performance gaps identify the affected performance objectives. Categorization of operational improvements according to performance objectives leads to development of appropriate shortlist of candidate solutions. If the solution is not included in the transition roadmap, then it should be selected on the basis of maturity or research, if no mature solution is available.
Some of the important guidance materials, which can be referred for harmonization planning process are as follows:

- a) *Global ATM Operational Concept* (Doc 9854)
- b) Generic (global) list of available options for *operational improvements* in Doc 9854
- c) Global list of *ATM community expectations* as given in Doc 9854
- d) Region specific list of available options for *operational improvements* for regional/local planning
- e) *ATM community expectations* at the regional level and their priorities for use in regional/local planning
- f) *Global* and *regional* set of *performance objectives* to be used at regional/local level
- g) *Global* and *regional* guidance on measuring performance (including common definitions)
- h) *Global* and *regional* guidance on long term traffic forecast
STEP 1

1. What are the ATM community expectations?
2. What are the performance objectives?
3. How to measure performance?
4. What is the current traffic and the expected traffic evolution?
5. What are the performance targets?

STEP 2

6. What are the current roadmaps and plans?
7. What is the current and planned ATM performance?
8. What are the current and anticipated performance gaps and their reasons?

STEP 3

9. What is the Global ATM Operational Concept and associated system requirements?
10. What are the available options for operational improvement?
11. What selection and sequence of operational improvements addresses current and anticipated performance gaps?
12. What are the resulting updates to current roadmaps and plans?
An example: airport approaches/environment noise
An example: airport approaches/environment noise

STEP 1

1. What are the ATM community expectations?
2. What are the performance objectives?
3. How to measure performance?
4. What is the current traffic and the expected traffic evolution?
5. What are the performance targets?

- e.g. number of noise complaints
- e.g. number of noise violations

- Target: max number 20 noise violations in 2015
- Target: 50% of complaints from 2010

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.

Noise emissions and their impacts are minimised for each flight to the extent possible.

Aerodrome annual traffic volume is expected to be 73% higher in 2020 than in 2005 (measured in flights).
An example: airport approaches/environment noise

**STEP 2**

6. What are the current roadmaps and plans?

7. What is the current and planned ATM performance?

8. What are the current and anticipated performance gaps and their reasons?

Maintain Conventional Arrivals

![Graph showing the relationship between noise violations and time](image)

- Target e.g. 20 violations
- Expected Performance
- Performance Gap
- e.g. 2015
An example:
airport approaches/environment noise

Current Roadmap: Conventional Arrivals

Conventional

Courtesy DFS
An example: airport approaches/environment noise

STEP 3

9. What is the Global ATM Operational Concept and associated system requirements?

10. What are the available options for operational improvement?

11. What selection and sequence of operational improvements addresses current and anticipated performance gaps?

12. What are the resulting updates to current roadmaps and plans?

Ensure that environmental issues are considered in the design, development, and operation of all aspects of the ATM system.

Understanding performance Influence Trade-offs
An example: airport approaches/environment noise

Understanding Performance Influence

- Airspace Design
  - Navigation Applications
  - ATC Procedures & Intervention

- Controller Support
  - Timely delivery of aircraft

- Noise abatement procedures
- Aircraft configuration management
- Airfield environmental management procedures
- Useable airport capacity

- Sound source position
- Sound emission time of day
- Sound level

AIR
NOISE

GROUND NOISE

AIRCRAFT OPERATIONS AT AIRPORTS
An example: airport approaches/environment noise

From Conventional to RNAV Arrivals

Harmonising aircraft performance

Courtesy DFS
An example: airport approaches/environment noise

Continuous Descend Arrivals

- Basic Continuous Descent Approach profiles
- ‘Conventional’ approach Profiles
- Potential for avoidable unnecessarily extended level segment at low level
- Area of noise benefit

Establish on the Instrument Landing System

Runway
The collaborative planning process will be aided substantially by the development of a virtual planning environment, with the transfer of information conducted in real time within a distributed information network.

It will place all materials required for information decision making at easy access – including process used by other States/regions to make their decisions, and important lessons learned.

Thus States/regions can take guidance from each other.

It is expected that ICAO would develop, operate and maintain this planning environment within the context of global ATM planning support.
In Summary

• **Understanding** Performance is key for successful transition from past and current to the future

• **Working** under one common umbrella
  – Performance based transition
  – Continued operational improvements
  – Toward a common vision
  – Using the ICAO framework

• **Using** the 3-step transition approach
  – Set targets
  – Identify and understand performance gaps
  – Select and plan Operational Improvements

• **Supporting** the goal of a more seamless and performance based Global Air Navigation System
Global … or more regional ATM

• A wider perspective (more regional, if not even global vision) is needed to make even greater gains in capacity and efficiency
• A far-reaching cooperation is necessary in order to support the implementation of facilities and services over larger geographical areas
• Enhanced planning perspectives and a global framework for performance measurement is required to support the implementation activities
• States and all aviation stakeholders should
  – work together towards a common vision (global ATM Operational Concept)
  – use a common planning framework
    • Global Air Navigation Plan (GANP), the regional air navigation plans and several other documents and tools (e.g. European ATM Masterplan)
    • Global Aviation Safety Plan (GASP)
  – utilize harmonised performance objectives (targets, metrics, indicators)
• Interoperability and harmonization are key factors in order to ensure the required improvements for the future