Development of a Performance Framework in support of the Operational Concept

Henk J. Hof
Manager Strategy and Performance
(EUROCONTROL)
henk.hof@eurocontrol.int

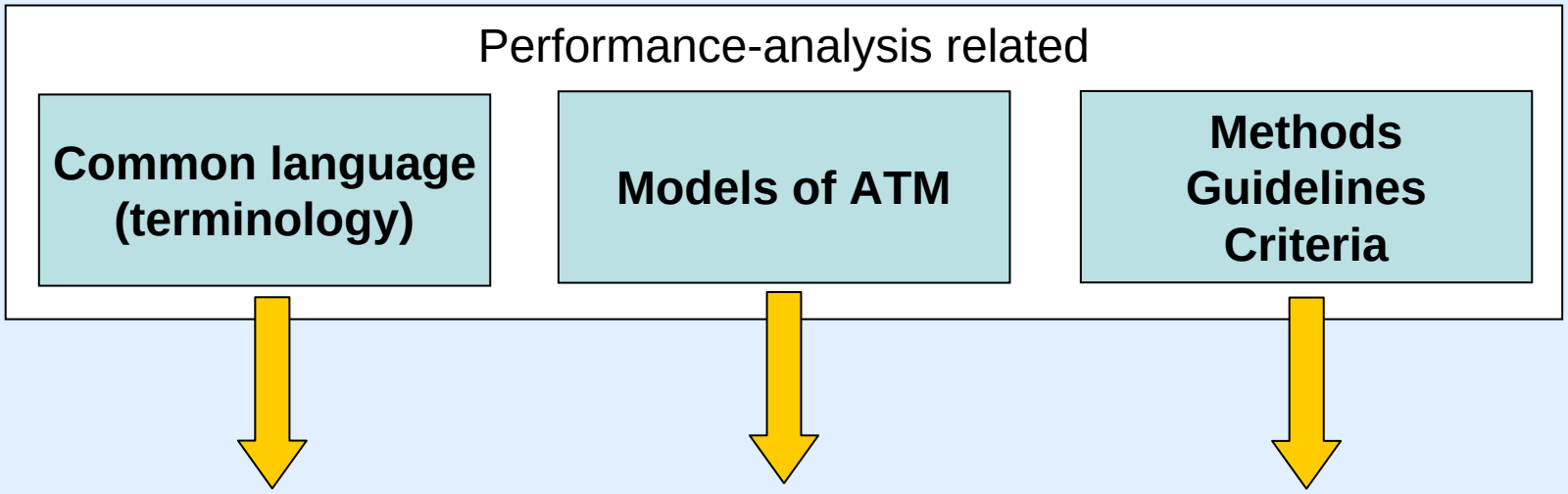
ICAO Mid Region Global ATM
Operational Concept
Training Seminar

Cairo, Egypt 28 Nov – 1 Dec 2005

Performance

ATM Performance is a measure of how well the ATM system satisfies the ATM Community expectations in each of the Key Performance Area's (KPA). Performance is measured at the level of individual performance objectives, using performance indicators.

ATM Performance Framework (APF)

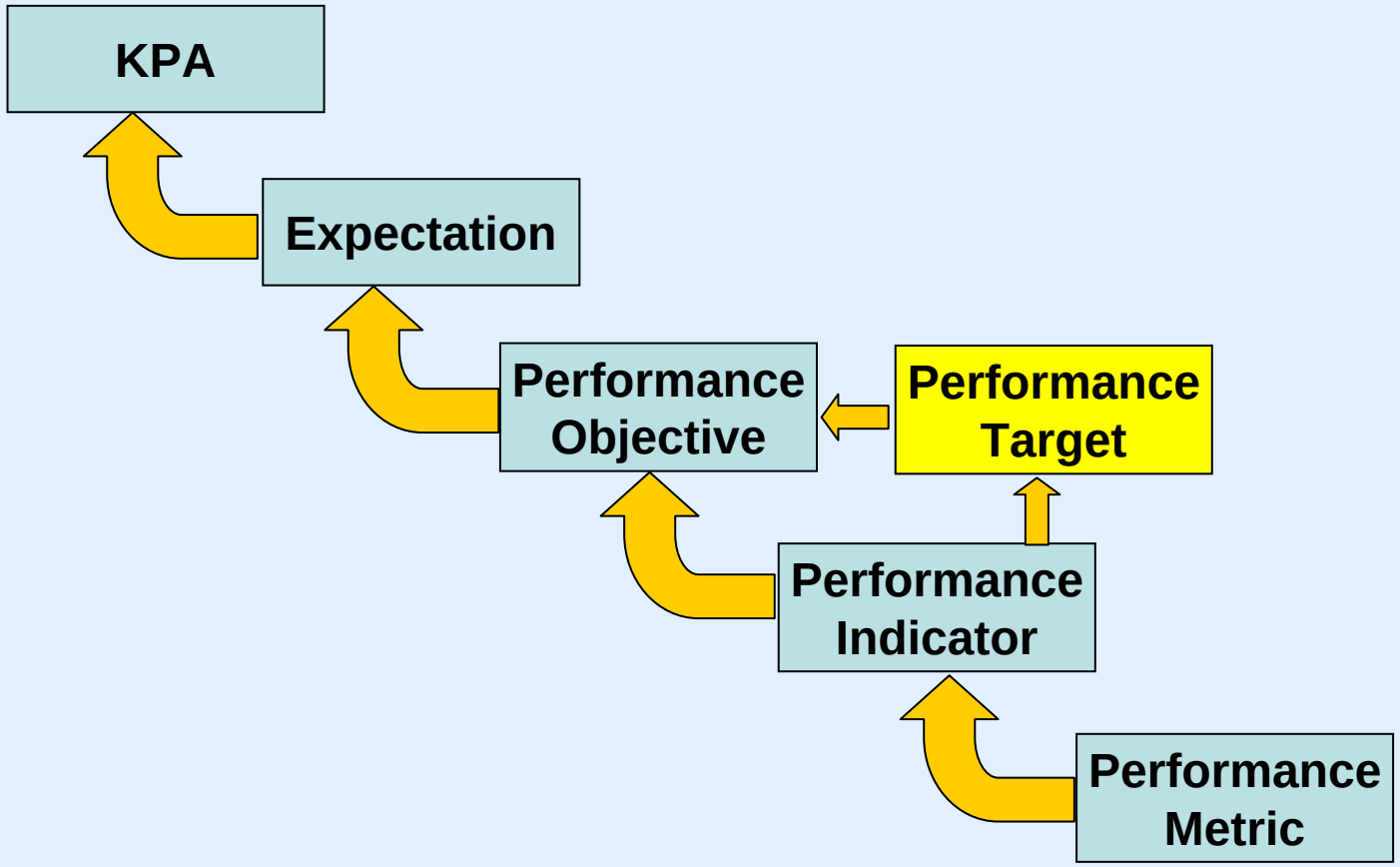


- "Methodology" aspect of the performance planning process:
  - How to apply a layered (hierarchical) performance planning approach
  - How to work with expectations, performance objectives, indicators and targets
  - How can models be usefully applied to contribute to the performance driven approach

Overview

- Terminology
- Key Performance Areas/practical examples-guidance
- Layered performance planning
  - Performance models

Terminology



Terminology

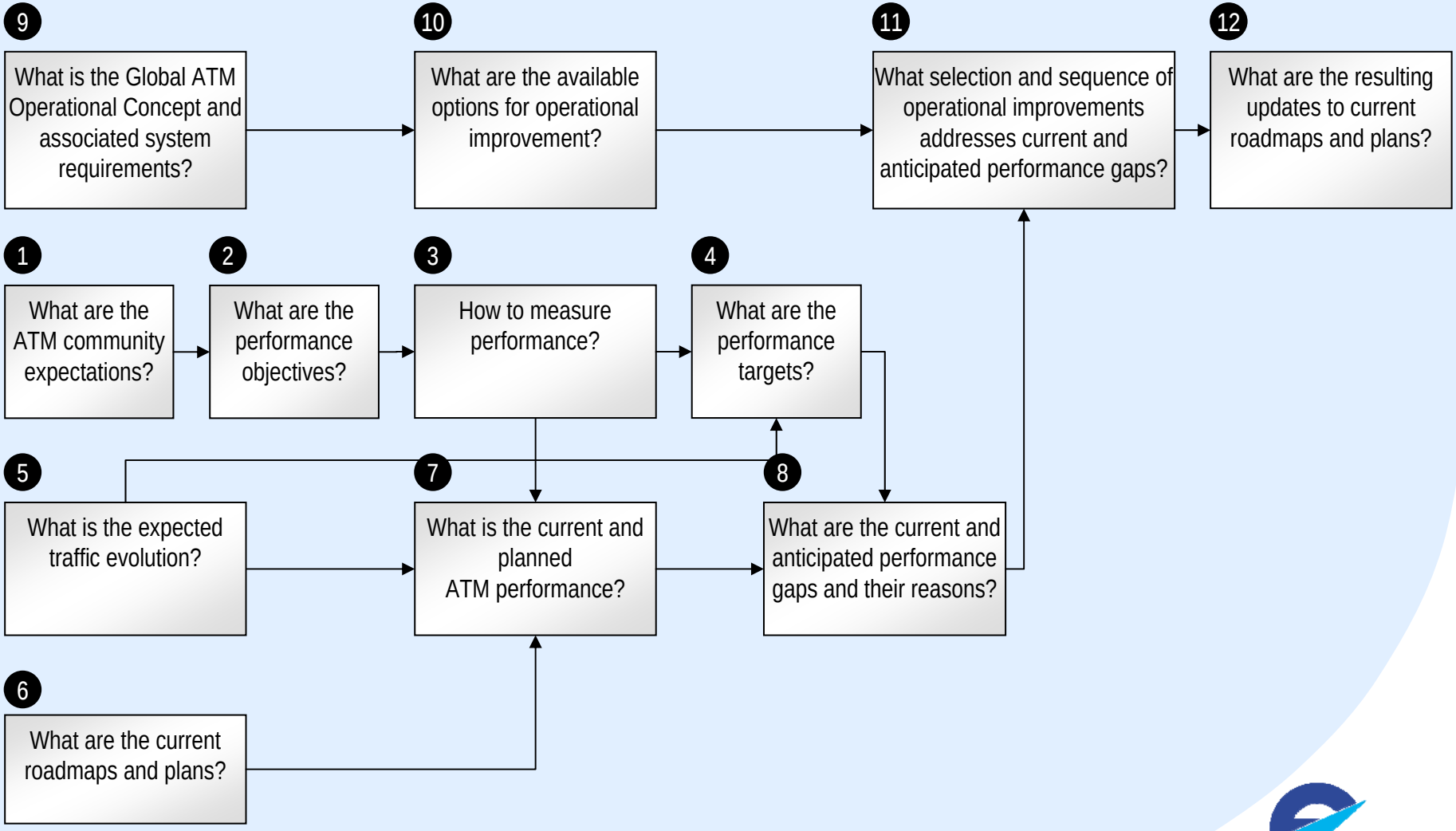
- Expectation
  - 11 high level expectations of society are defined in the OCD (safety, capacity, cost effectiveness etc.).
- Key Performance Area (KPA)
  - 11 KPAs, one per expectation as defined in the OCD. KPAs named after their corresponding expectation.
  - Used as categories throughout the performance framework, to group related *performance objectives.*
- Performance Objective
  - Each *expectation* should be reached through meeting a set of specific, measurable, achievable, relevant and timely (SMART) *objectives.*
  - *Objectives* define – in a qualitative way - a desired trend from today's performance (eg improvement), within a well specified ATM planning environment (eg each objective is applicable within the scope of a given geographical area, time period and other scope-limiting criteria).
- Performance Indicator
  - *Indicators* are defined when there is a need to numerically document current performance levels and progress in achieving an *objective.*
- Performance Target
  - A set of agreed numerical values of related *performance indicators*, representing the minimum performance levels at which an *objective* is considered to be 'achieved'.
- Performance Metric
  - A generic definition of what can be measured, how it can be measured and in which context and scope this should be done. Defines also the units in which the measurement is to be expressed.

Key Performance Areas (KPA)

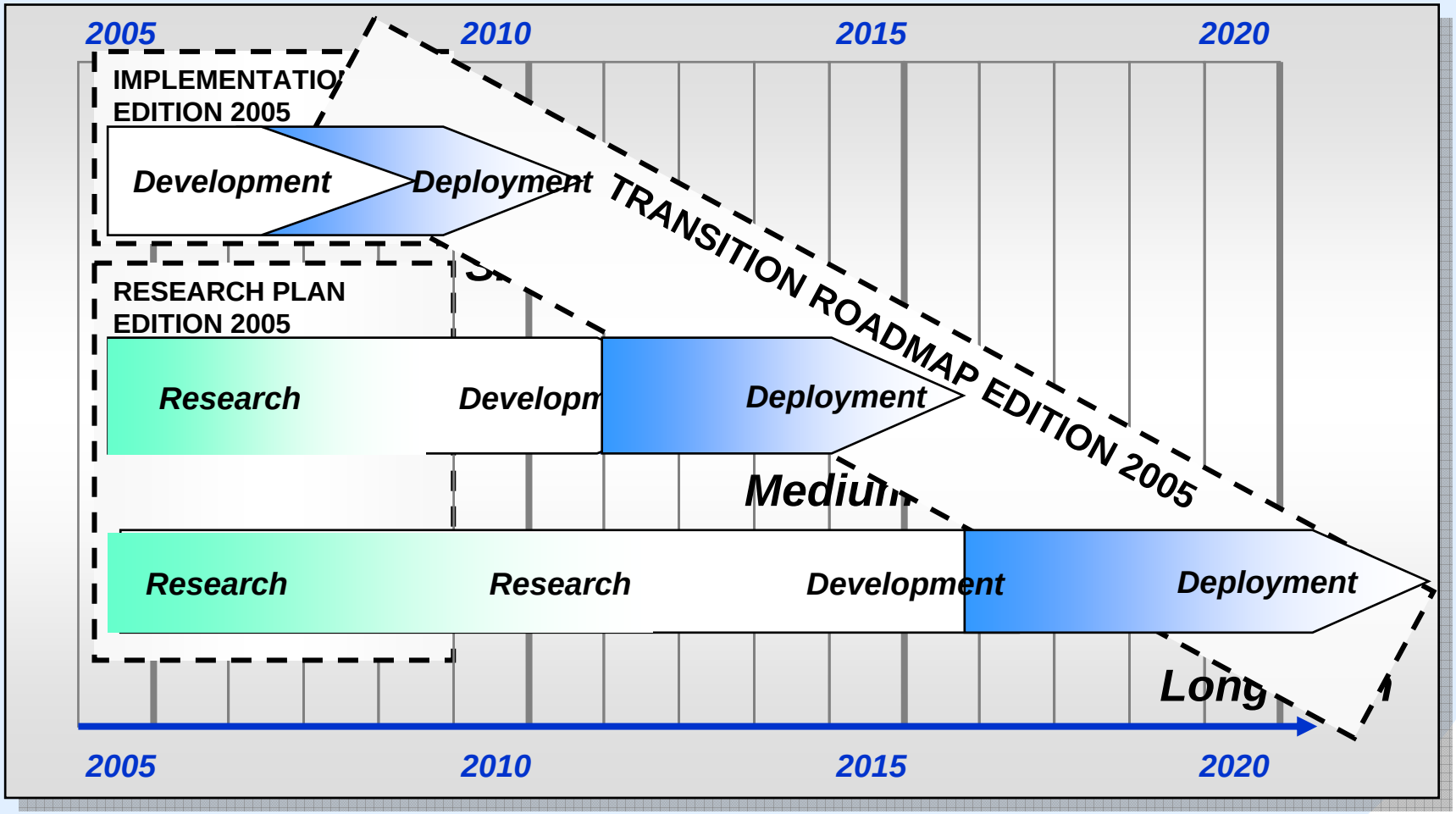
- KPA 01 **Access and Equity**
- KPA 02 **Capacity**
- KPA 03 **Cost Effectiveness**
- KPA 04 **Efficiency**
- KPA 05 **Environment**
- KPA 06 **Flexibility**
- KPA 07 **Global Interoperability**
- KPA 08 **Participation by the ATM community**
- KPA 09 **Predictability**
- KPA 10 **Safety**
- KPA 11 **Security**

Trade-off issues

Performance Based Transition Process



Transition Roadmap



Key Performance Areas

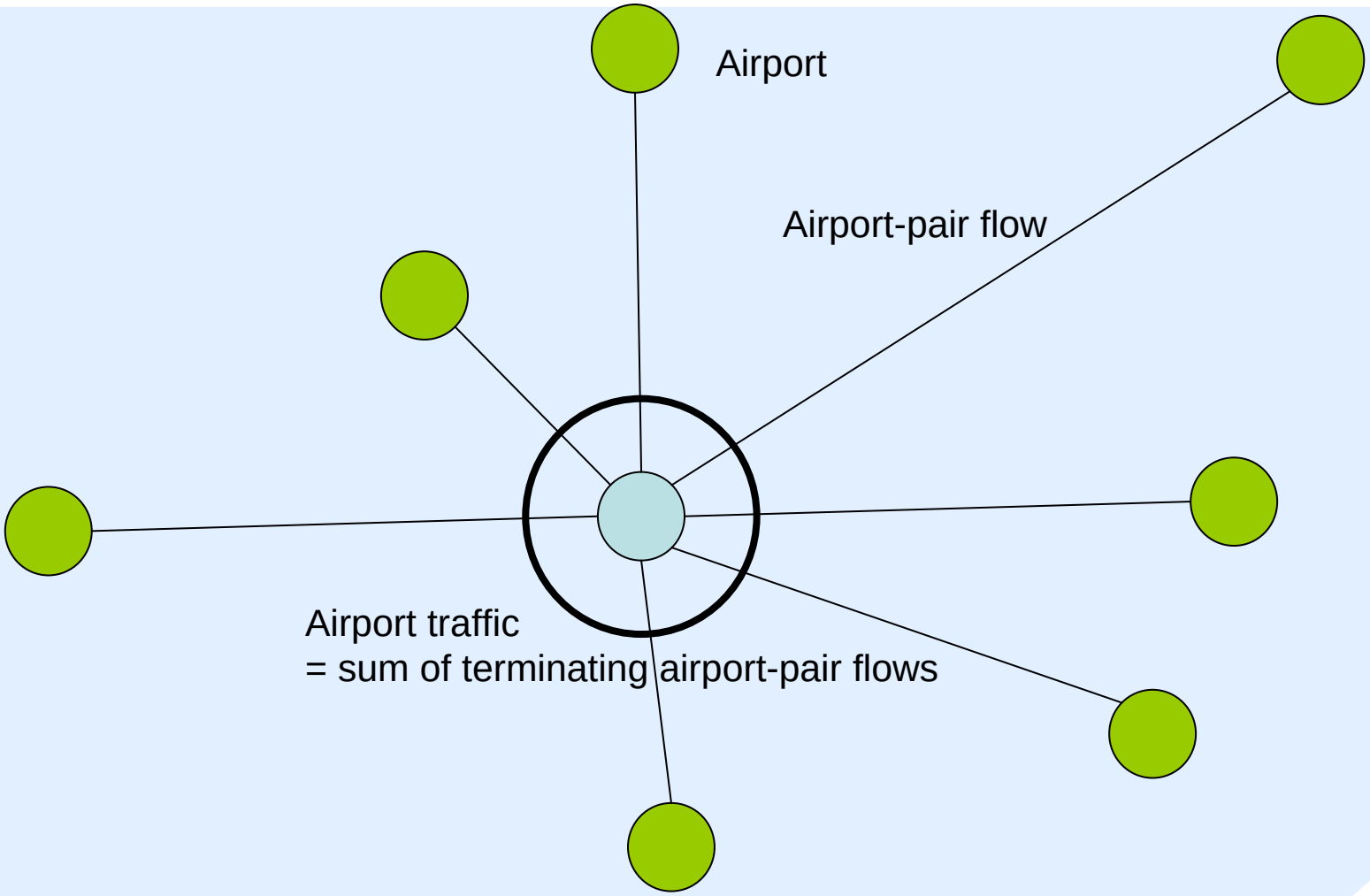
KPA 01 **Access and Equity**

- "…ensure that all users have the right of access to ATM resources…"
- "…that shared use of the airspace for different airspace users can be achieved *safely*…"
- Possible objectives:
  - Reduce the of locations and instances where segregation is applied
  - Agree and enforce rules on prioritisation

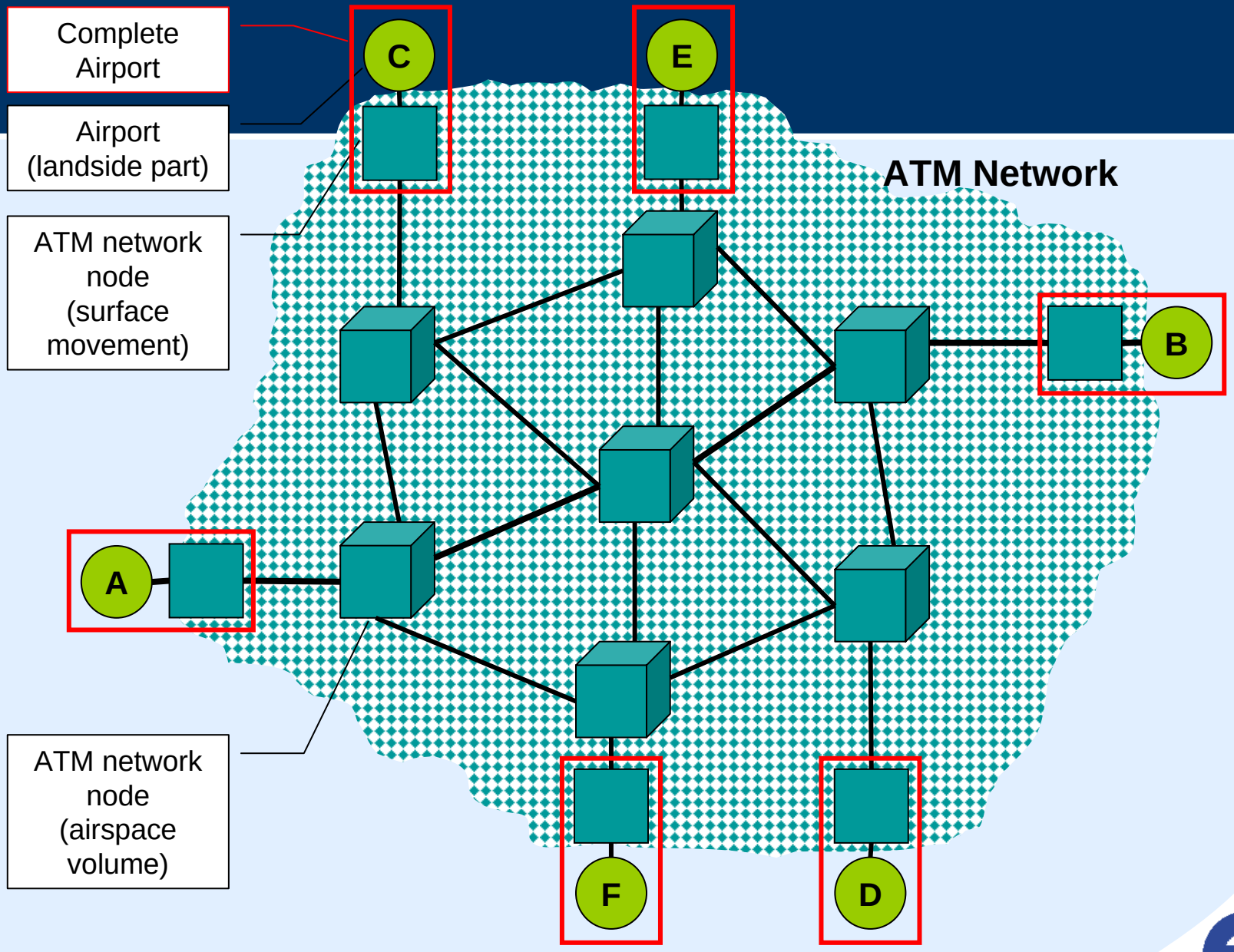
KPA 02 **Capacity**

- Network approach
- Different kinds of capacity
  - Airspace
  - ATC sector
  - Airport
  - Network capacity

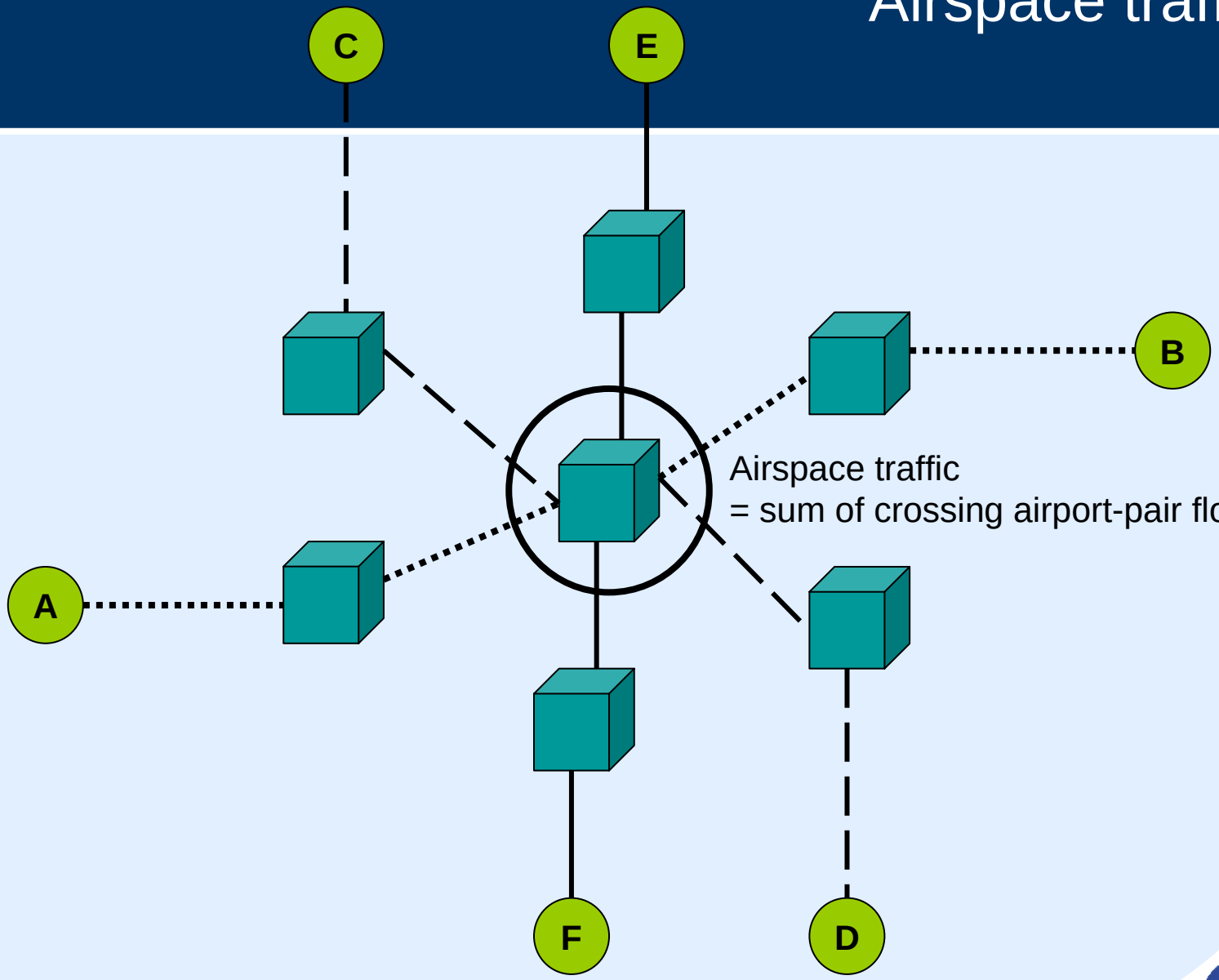
Nodes of Airports



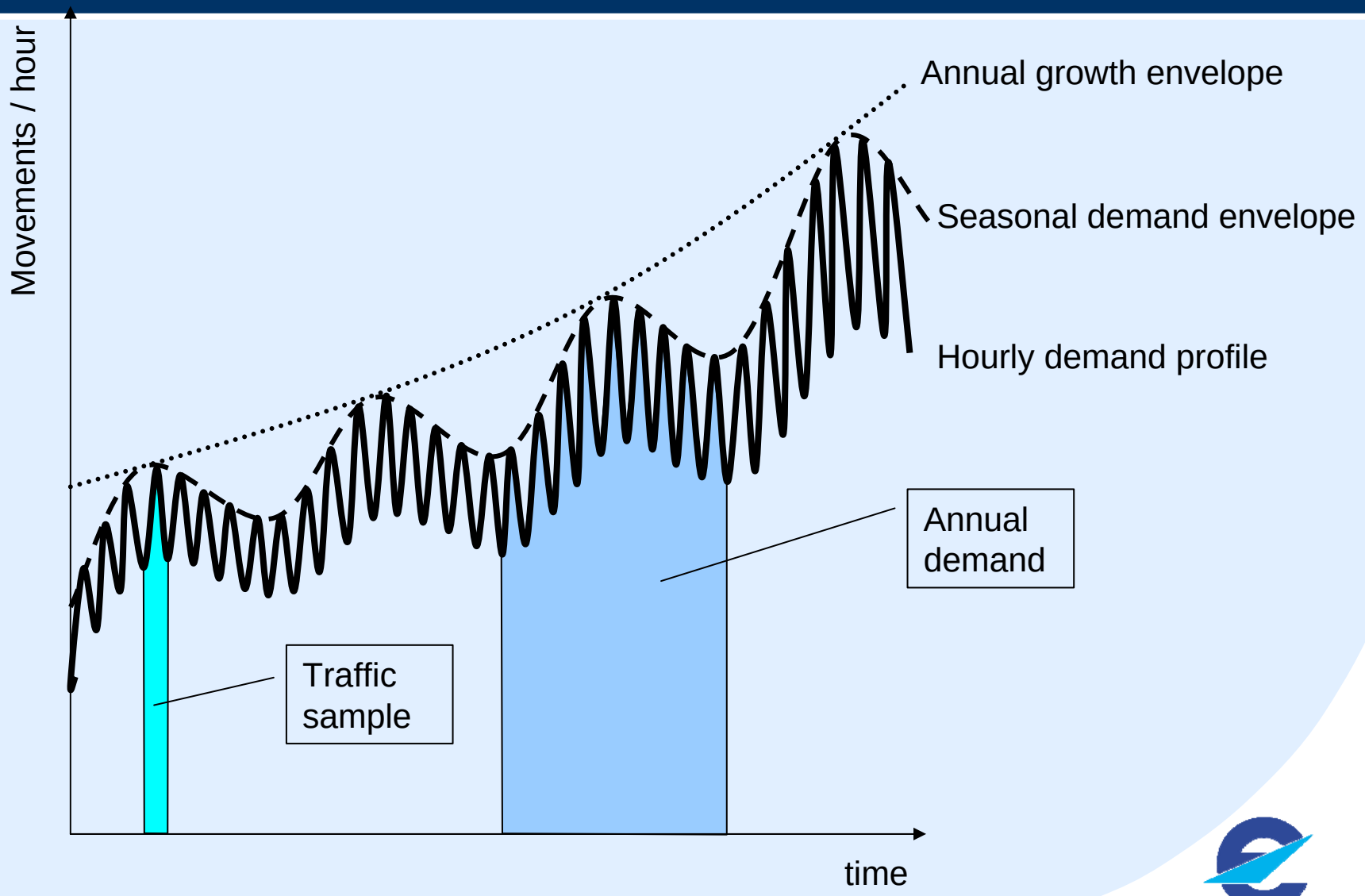
Flows through airspace nodes



Airspace traffic



Modelling of Hourly Demand



Capacity

- Capacity to be considered at network level
- Airport capacity
  - Hourly
  - Annual
- ATC sector capacity
- Target based on “Typical busy hour”
  - Not the busiest hour of the year.
  - Reason: cost-effectiveness

Typical Busy Hour Demand

Busiest hour of year demand

Typical busy hour demand

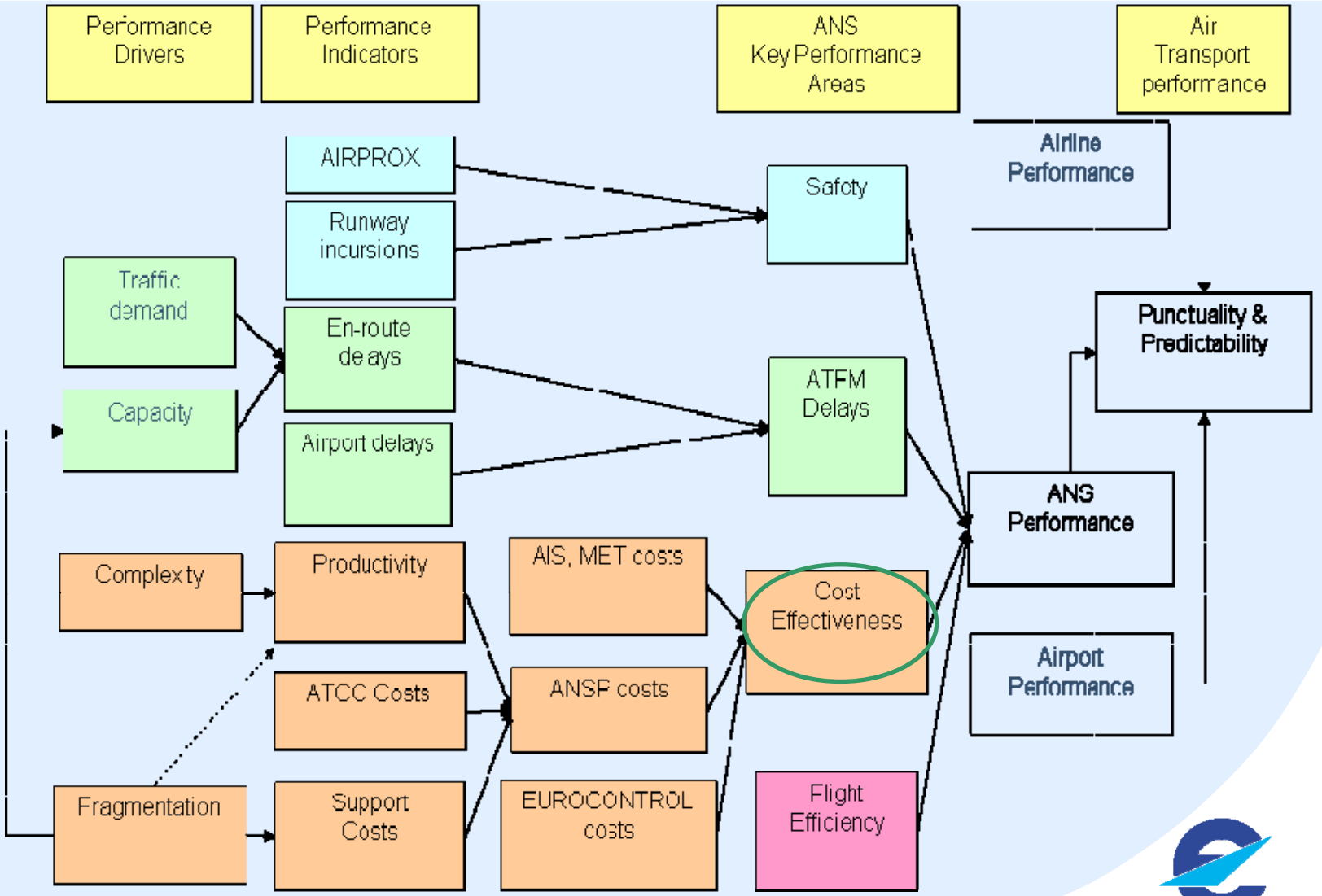
2 % **175th busiest hour of year**

100 % of year

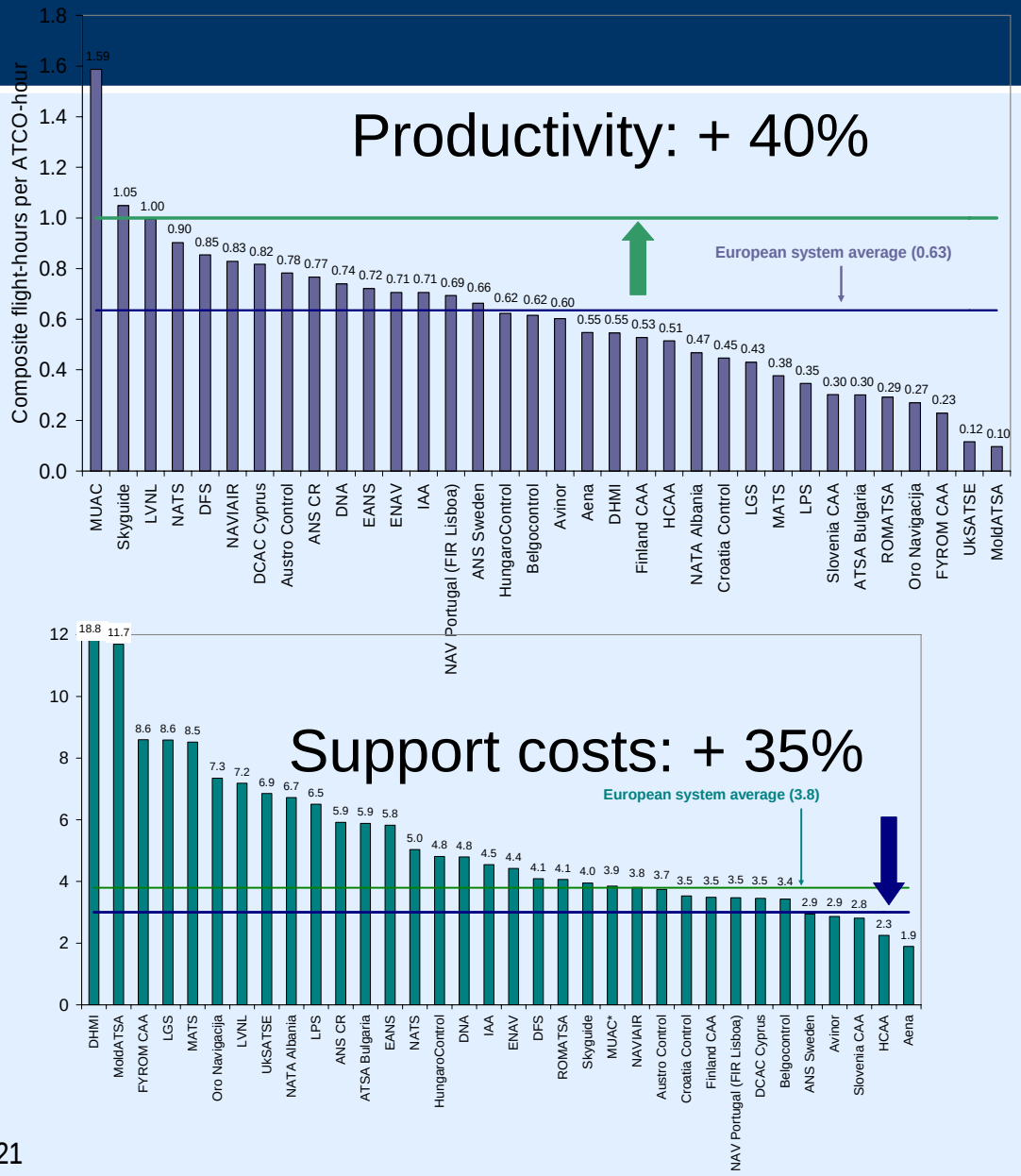
KPA 03 **Cost Effectiveness**

- Cost-effective ATM services while balancing the interest of the ATM community and trade-offs between performance areas.
- Cost-effective improvements of ATM services. (also balancing between interests and trade-offs).

Cost-effectiveness



Improving cost-effectiveness



6b. Raising average performance to 4rd best levels: Significant improvements
+ 40% in productivity

+ 35% in reduced support costs

(10%= €700 M p.a.)

6c. Fragmentation of the European ATM system: significant influence on cost-effectiveness?

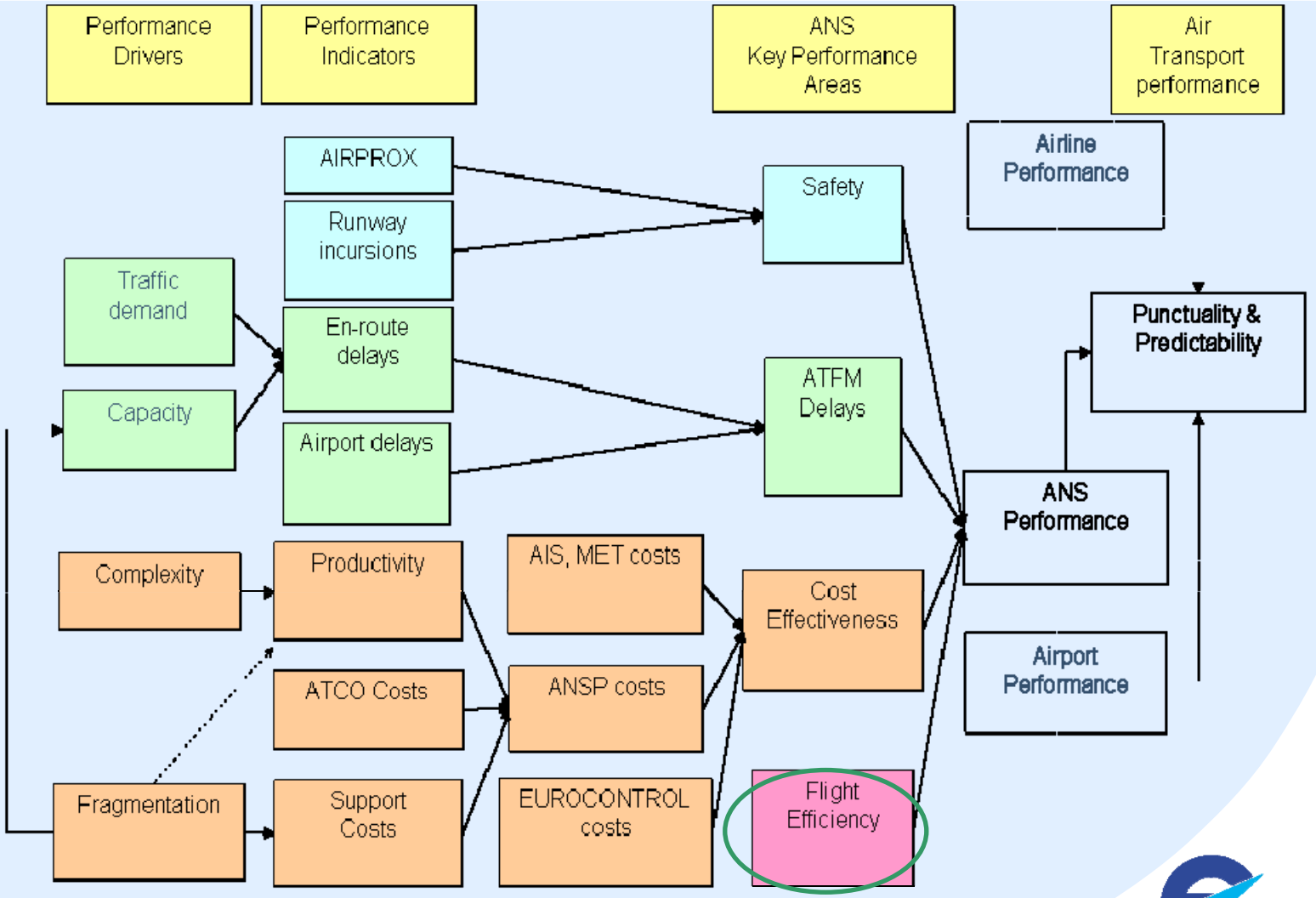
Cost-effective improvements of ATM services

- Through Cost Benefit Analyses
- Address community member perspectives
  - Airports
  - Airspace users
  - Air Navigation Service Providers
- Address their “value”
  - Benefits
  - Costs
  - Risk
- Main input to:
  - Trade-off analysis
  - Collaborative Decision Making

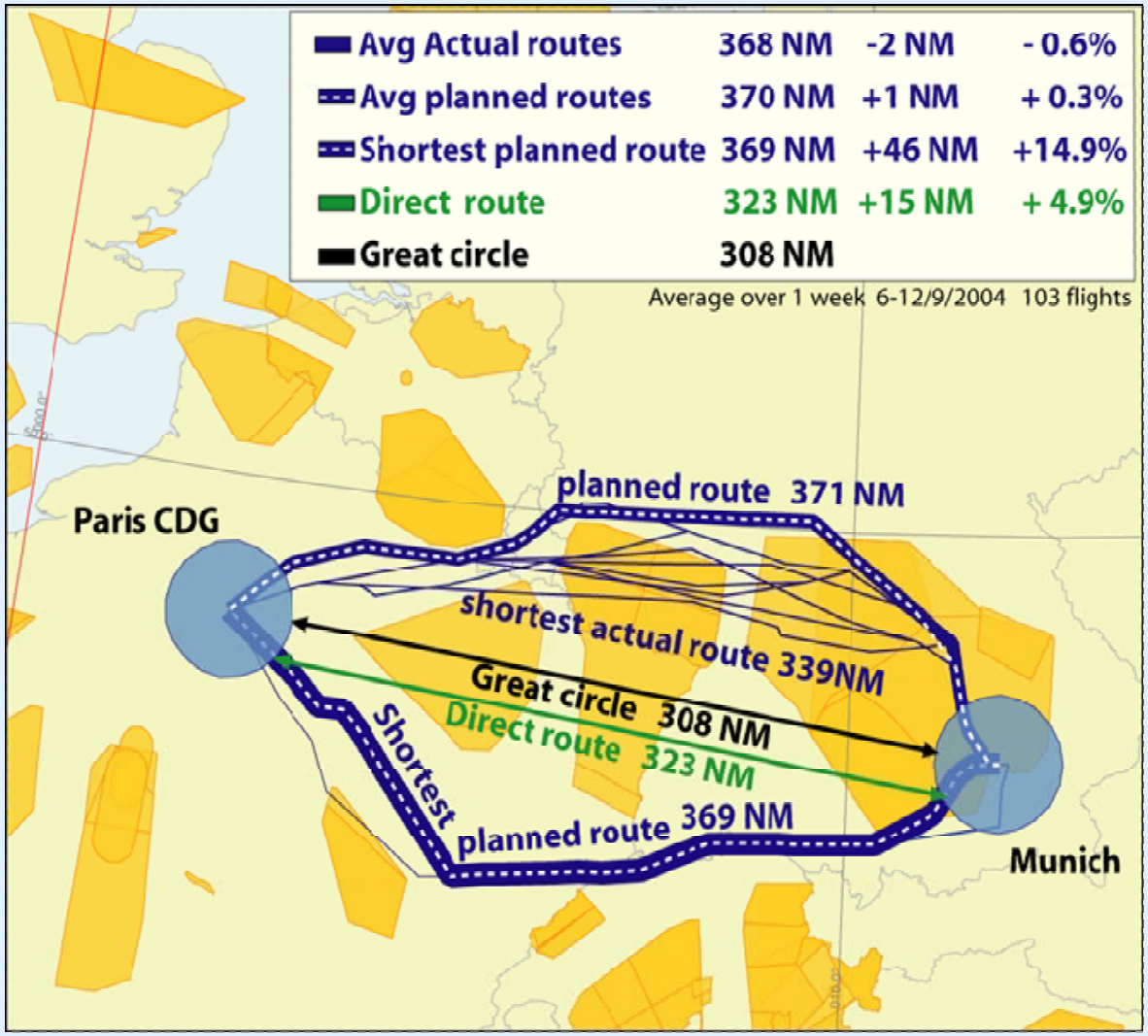
KPA 04 **Efficiency**

- Operational and economic cost-effectiveness of gate-to-gate flight operations from a single flight perspective.
- Direct operating costs
  - Flight time
    - Aircraft/crew costs
    - Schedule adherence
  - Route distance
  - Fuel usage
    - Non-optimum speeds
    - Non-optimum levels

Efficiency


Performance Drivers
Performance Indicators
ANS Key Performance Areas
Air Transport performance
AIRPROX
Runway incursions
Safety
Airline Performance
Traffic demand
Capacity
En-route delays
Airport delays
ATFM Delays
Punctuality & Predictability
ANS Performance
Complexity
Productivity
AIS, MET costs
Cost Effectiveness
ATCO Costs
ANSP costs
Airport Performance
Fragmentation
Support Costs
EUROCONTROL costs
Flight Efficiency

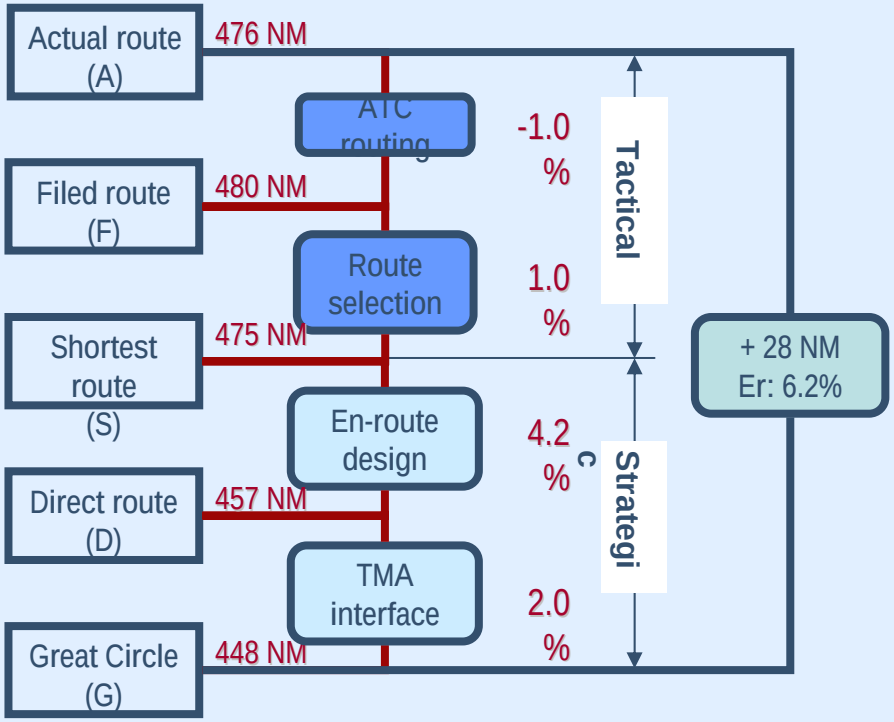
Flight efficiency-example



- Focus on
  En-route
  Horizontal
  Flight efficiency

  En-route excludes a circle of 30NM around airports

Flight efficiency- example



Flight-efficiency, a major contributor to ATM performance

€1,000M - €1,500M p.a.

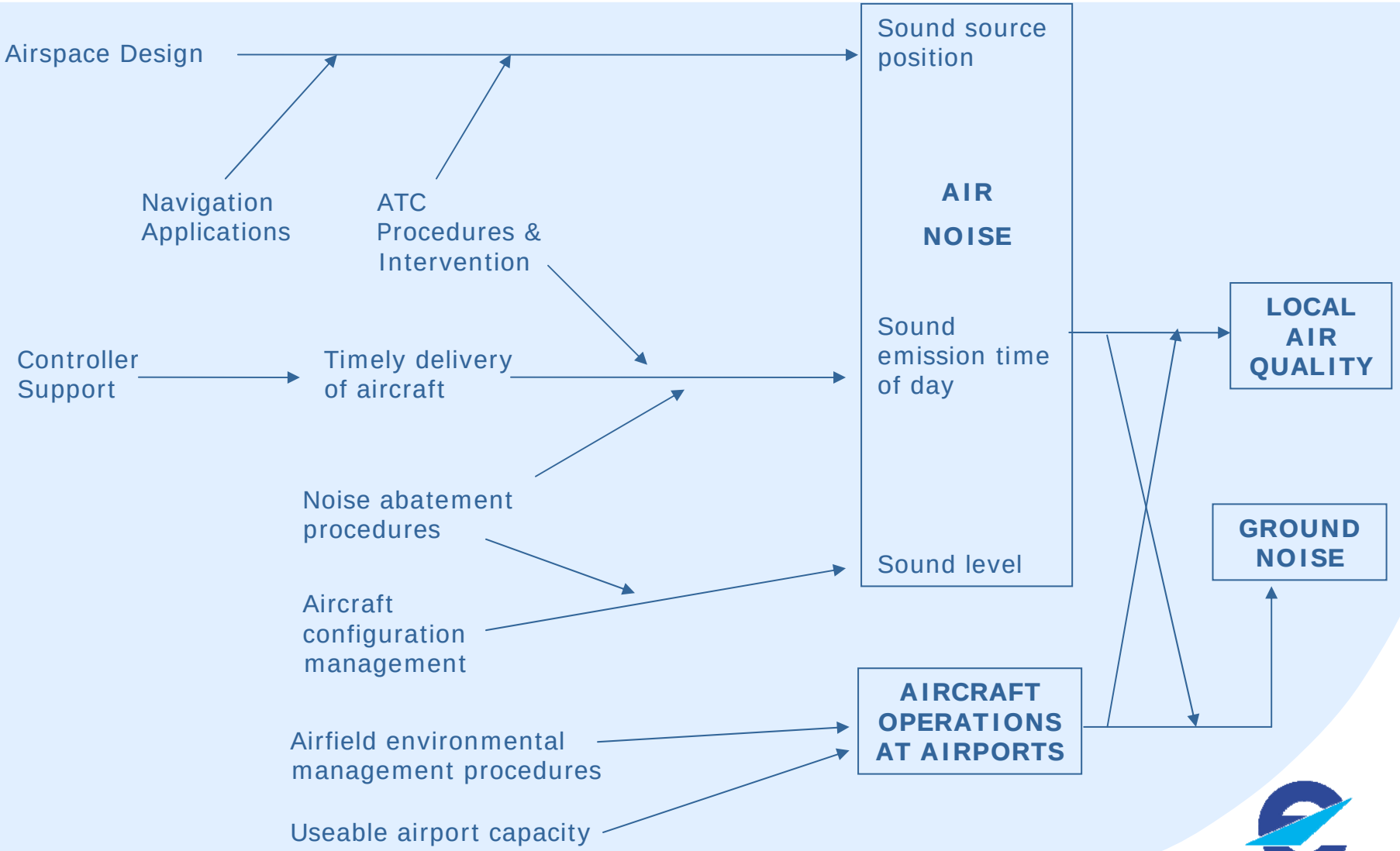
Airspace design and strategic use is the most critical element

Further work is needed, involving civil and military concerned parties

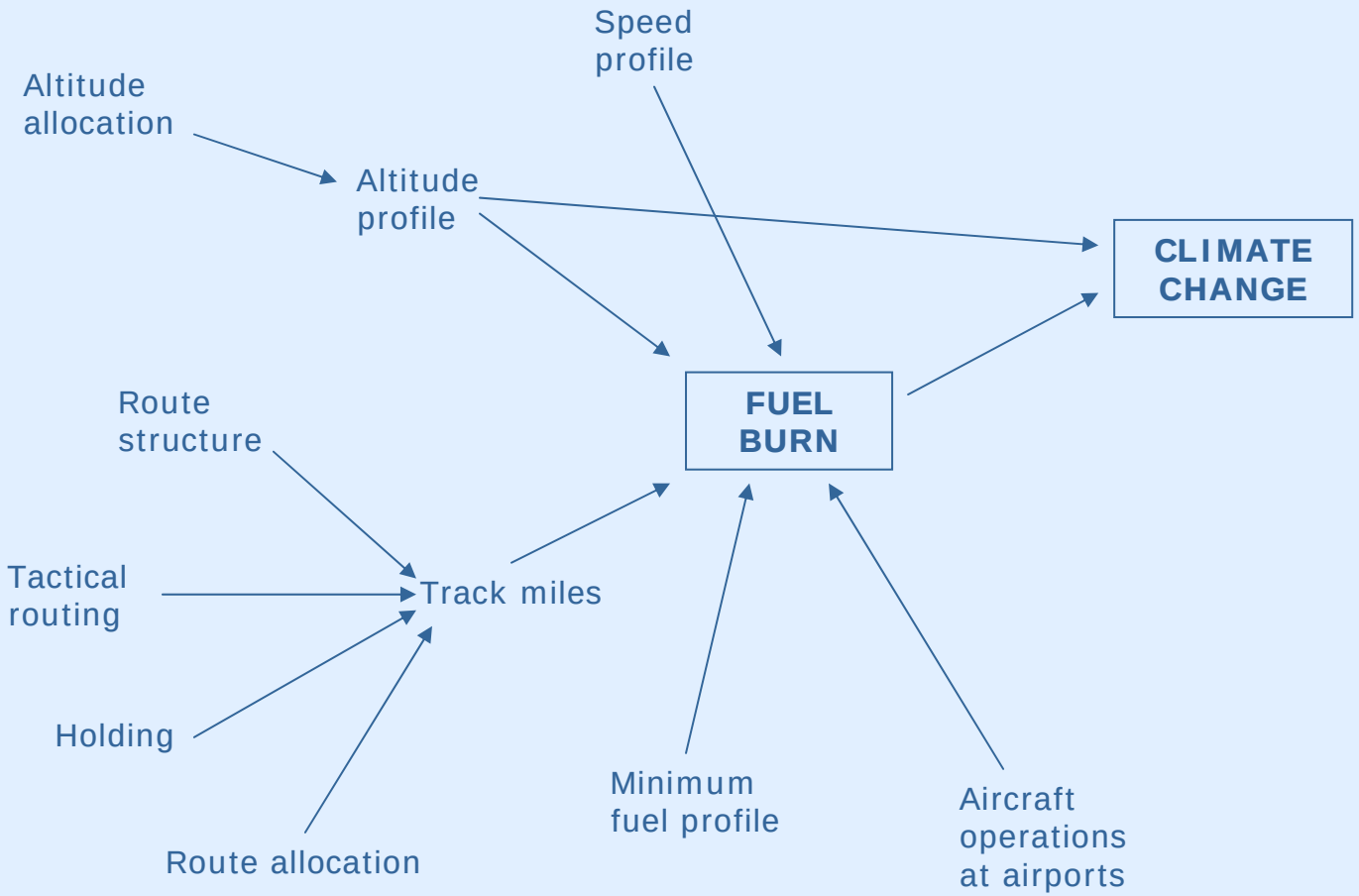
KPA 05 **Environment**

- 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.
- Many perspectives:
  - Air quality
  - Noise
  - Climate change
- Many influences
  - Many options for solutions

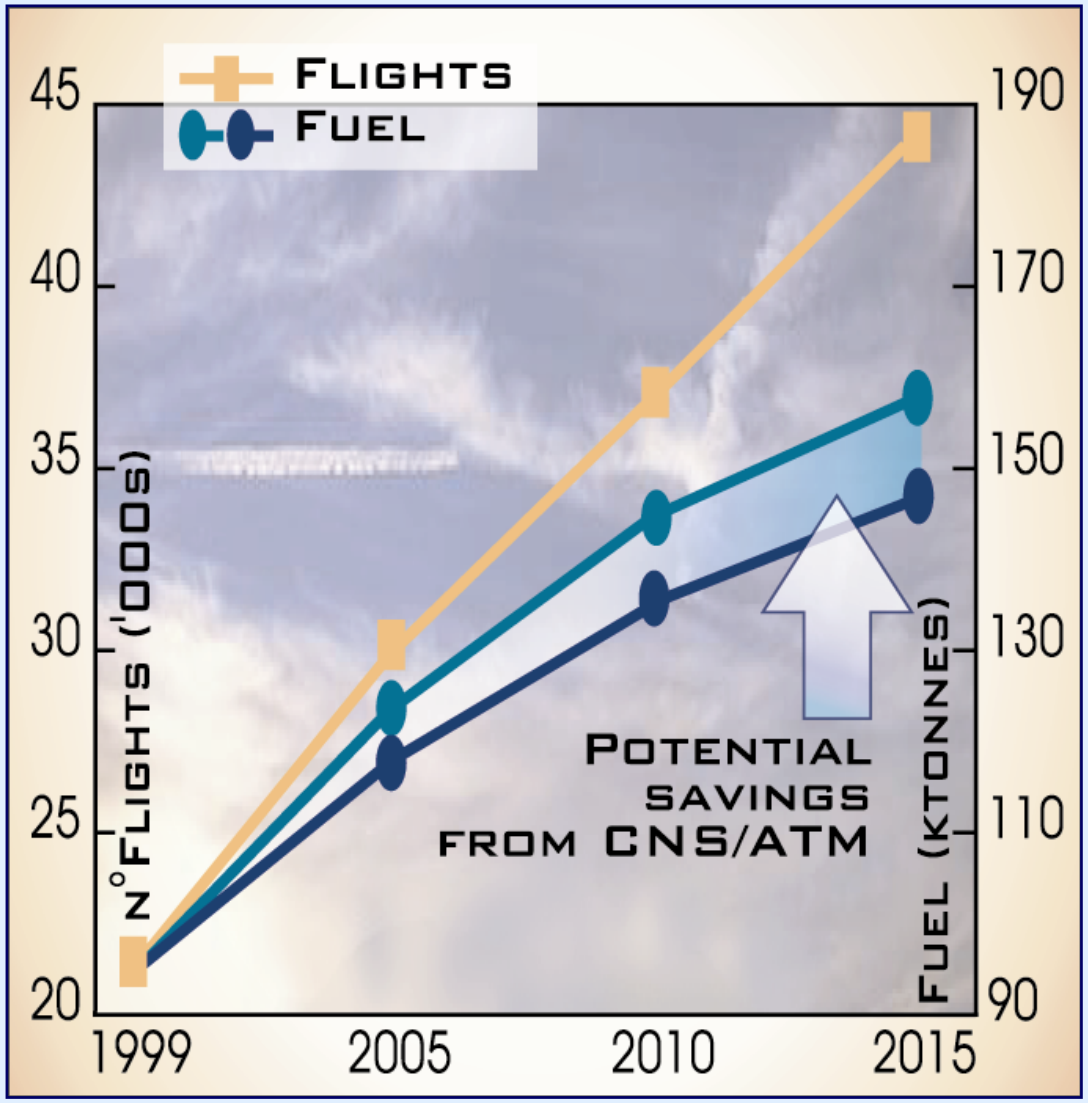
ATM-related Influencing Factors
Noise & Local Air Quality



ATM-related Influencing Factors
Fuel Burn & Climate Change



An Environmental Challenge
Decoupling fuel burn from traffic growth



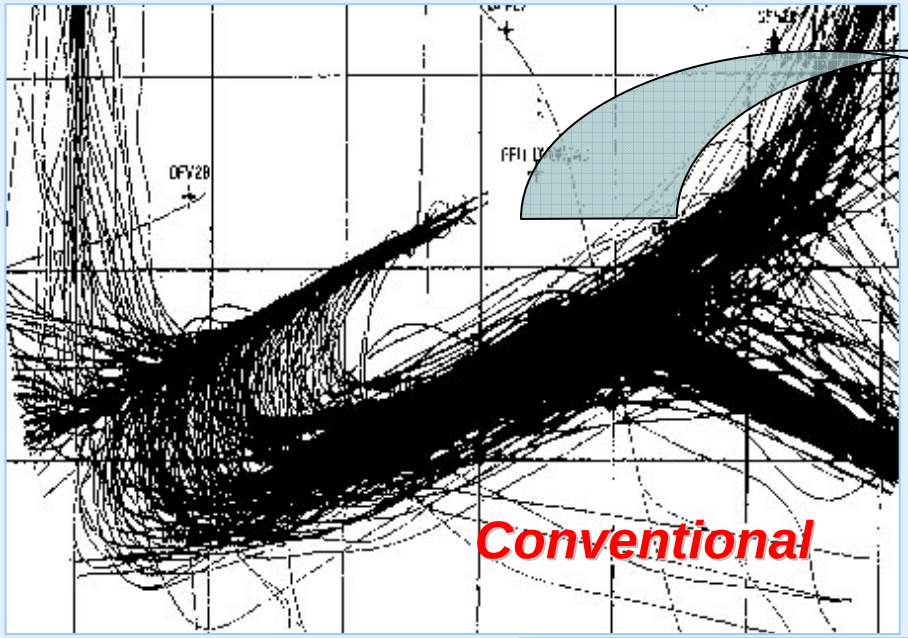
Daily flights

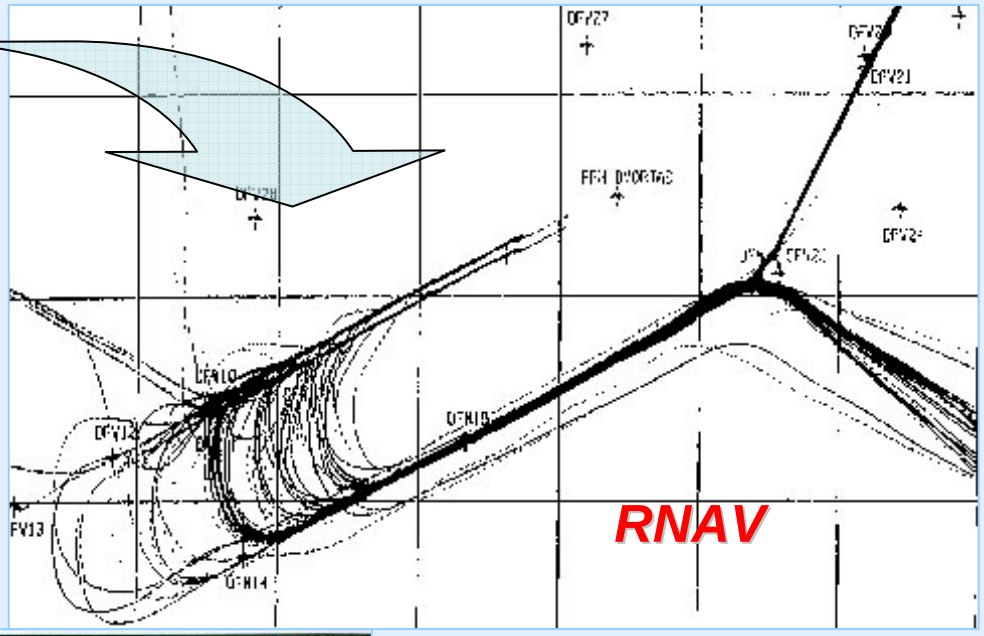
Airframe/engine technology

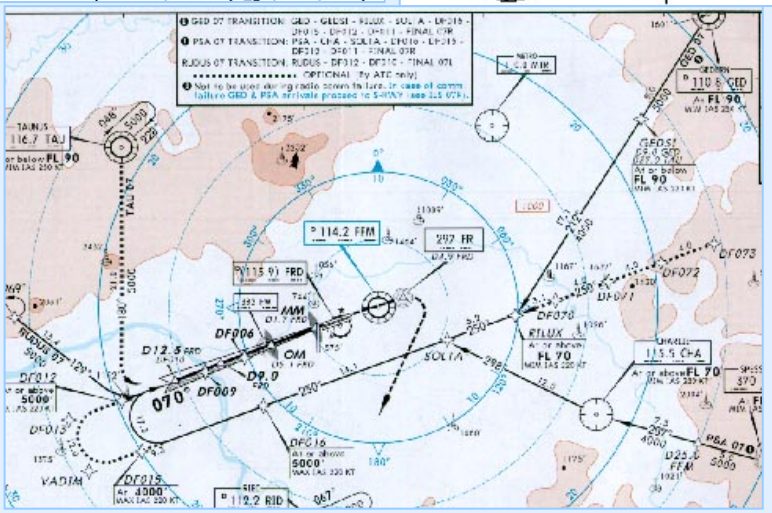
+ CNS/ATM

CNS/ATM could bring an additional 5-12% fuel burn reduction

From Conventional to RNAV Arrivals
Harmonising aircraft performance

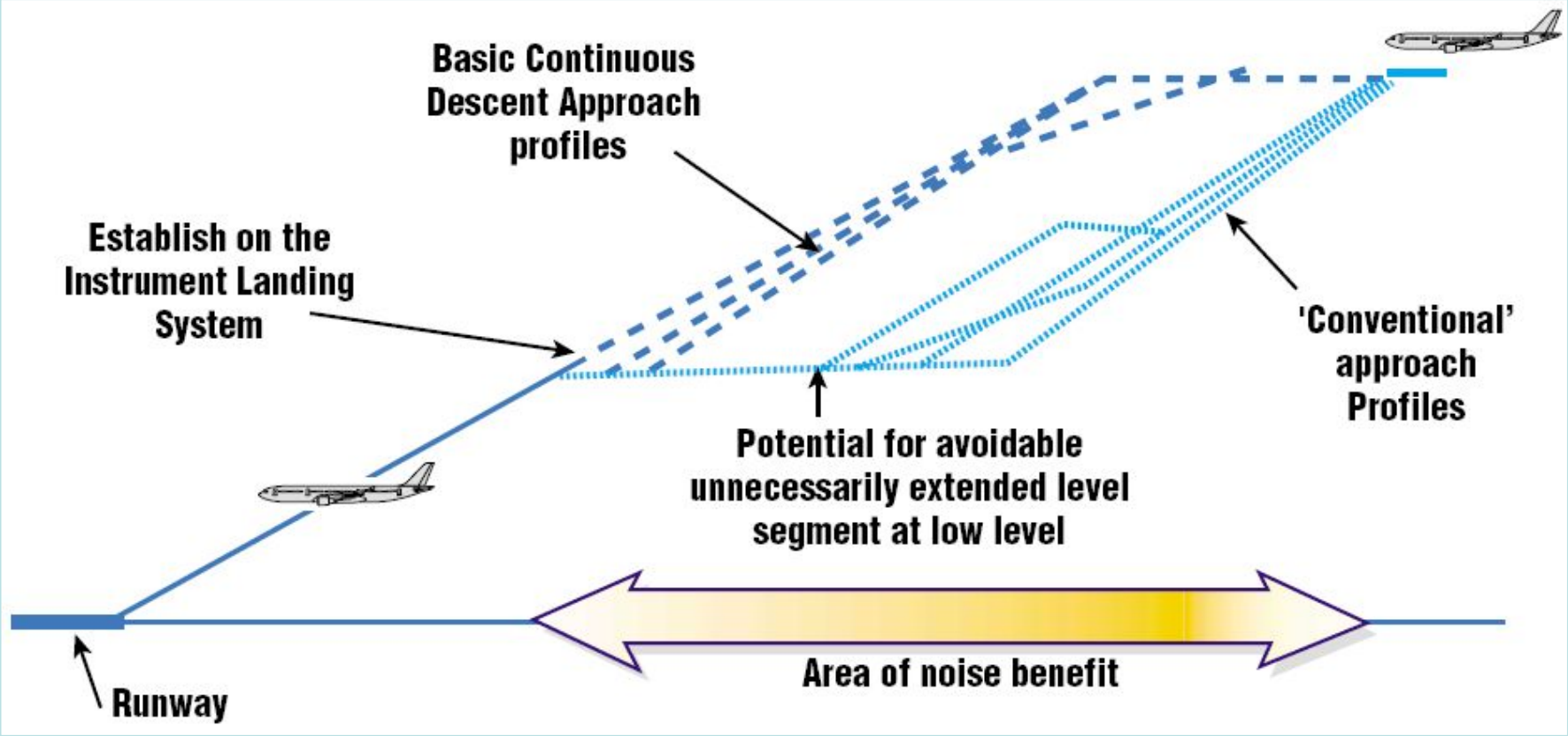






Courtesy DFS

Continuous Descent Approach Concept and Methods



- 'Radar-based' Vectored Approach
- (P-RNAV based) i.e. RNAV route (STAR – open or closed)
- Combination RNAV/vectors

KPA 06 **Flexibility**

- Ability of all airspace users to modify flight trajectories dynamically and adjust departure and arrival times.
- Indicator of flexibility:
  - Notification time for changes
  - Ability to accommodate changes
- Trade-off example:
  - Flexibility – capacity

KPA 07 **Global Interoperability**

- The ATM system should be based on global standards and uniform principles.
- Indicator of global interoperability
  - Adherence/implementation to global standards and procedures

KPA 08 **Participation by the ATM community**

- Continuous involvement in planning, implementation and operation of the ATM system
- Different per lifecycle phase:
  - Planning
  - Implementation
  - Operation
- Challenge: meeting (sometimes conflicting) expectations on
  - Access/equity
  - Capacity
  - Cost/effectiveness etc
- Monitored and managed per ATM community segment
- Collaborative Decision Making

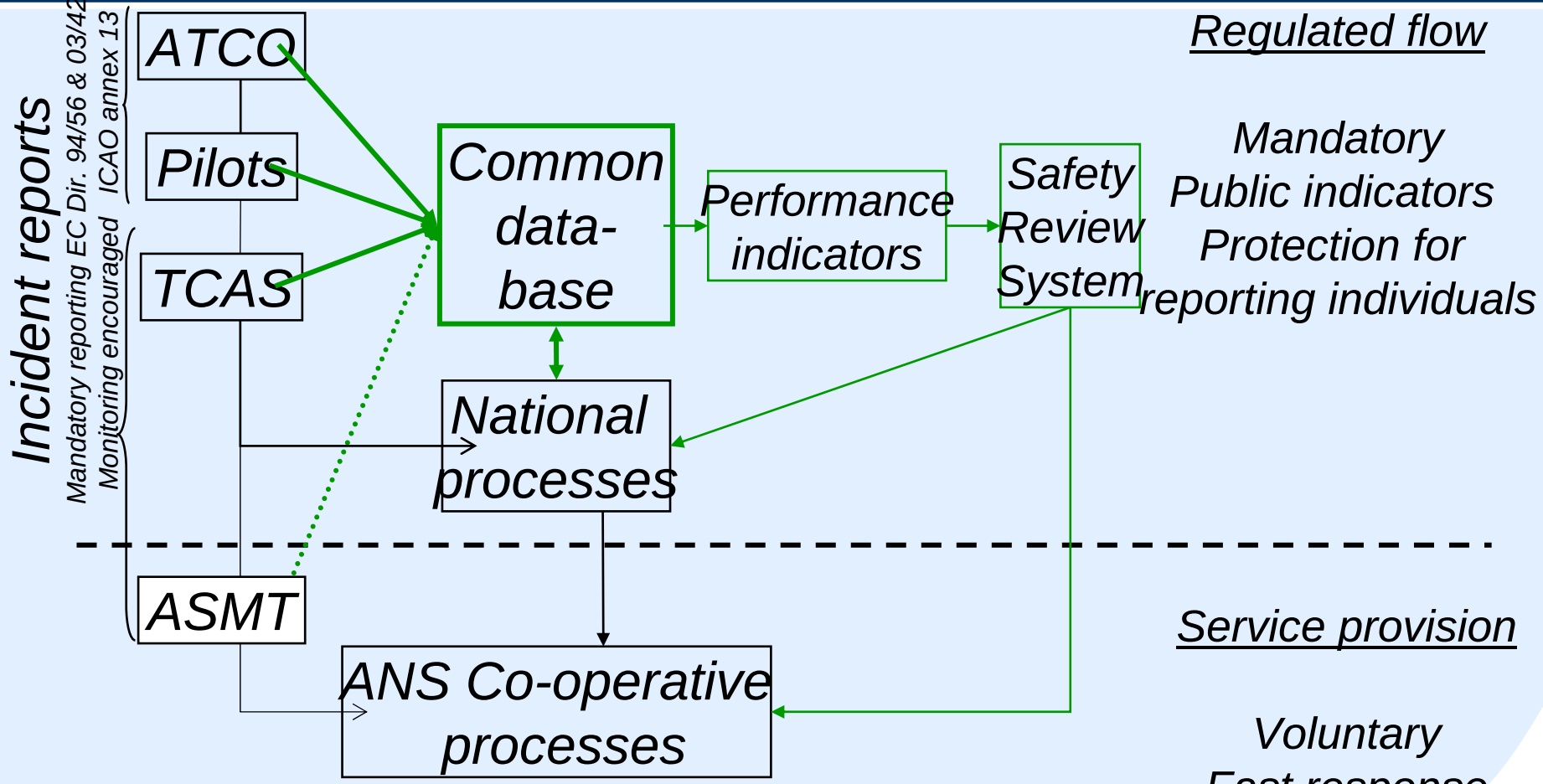
KPA 09 **Predictability**

- The ability of the airspace users and ATM service providers to provide consistent and dependable levels of performance.
- Important for punctuality
  - Not equally important for all airspace users
- Strong interdependency between service providers and airspace users.

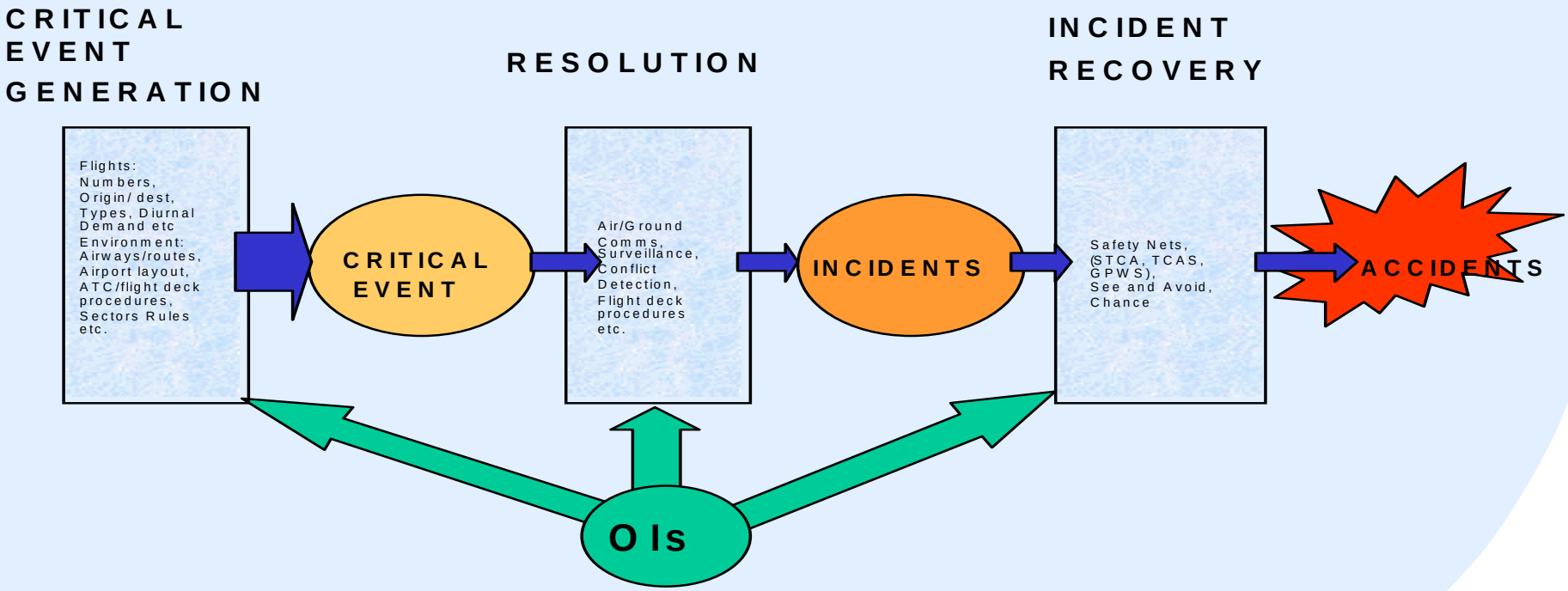
KPA 10 **Safety**

- The highest priority….uniform safety standards and risk and safety management practices should be applied systematically. Safety needs to be assessed against appropriate criteria.
- Accident/incident recording and analysis
  - Foundation for pro-active safety management
- Many influences and options for improvements

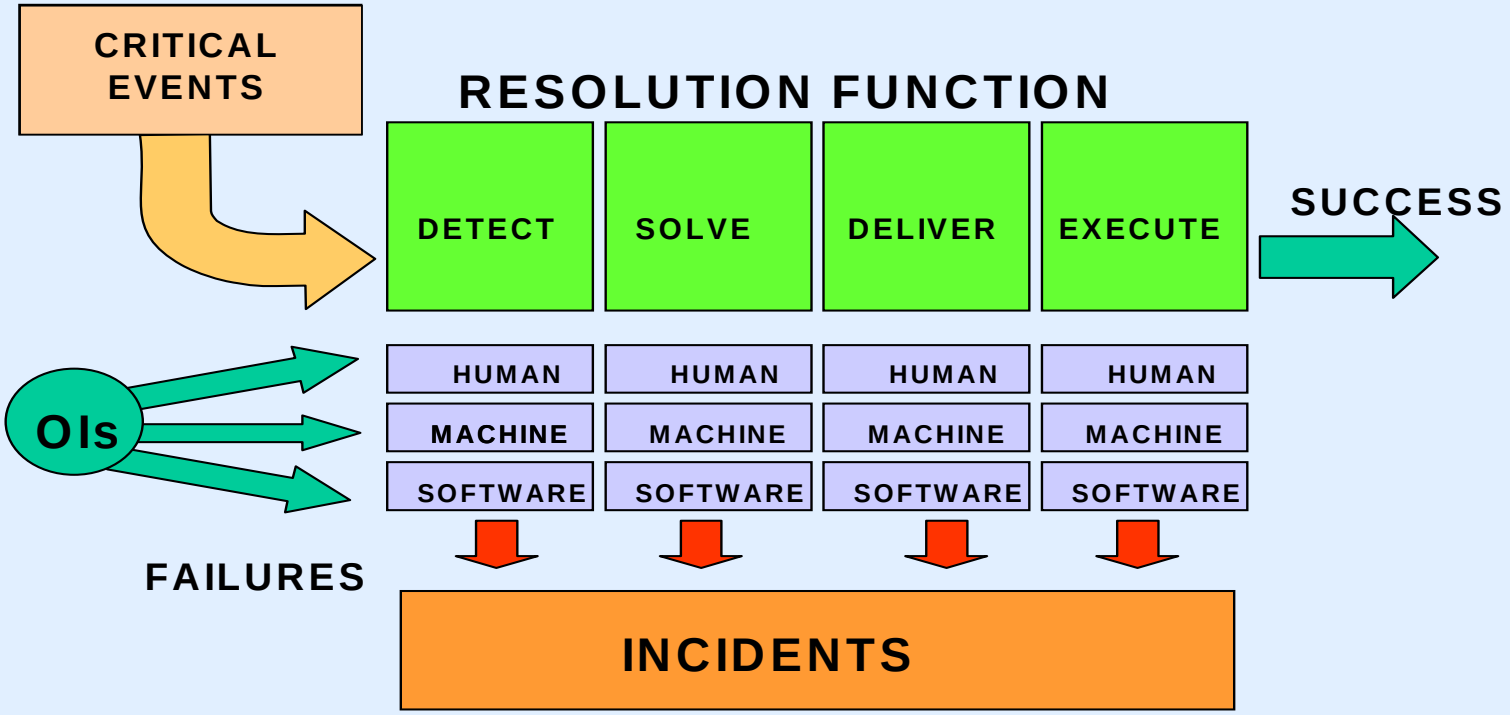
Proposed safety performance monitoring framework (source PRC)



Analysis example



Analysis example



A failure in any of these stages is assumed to lead to an incident

KPA 11 **Security**

- Protection against threats which stem from intentional and unintentional acts affecting aircraft, people and installations on the ground.
- Possible objectives:
  - Reduce number of avoidable security incidents
  - Introduce security management system(s)
- Security Accident/incident recording and analysis
  - Foundation for pro-active security management

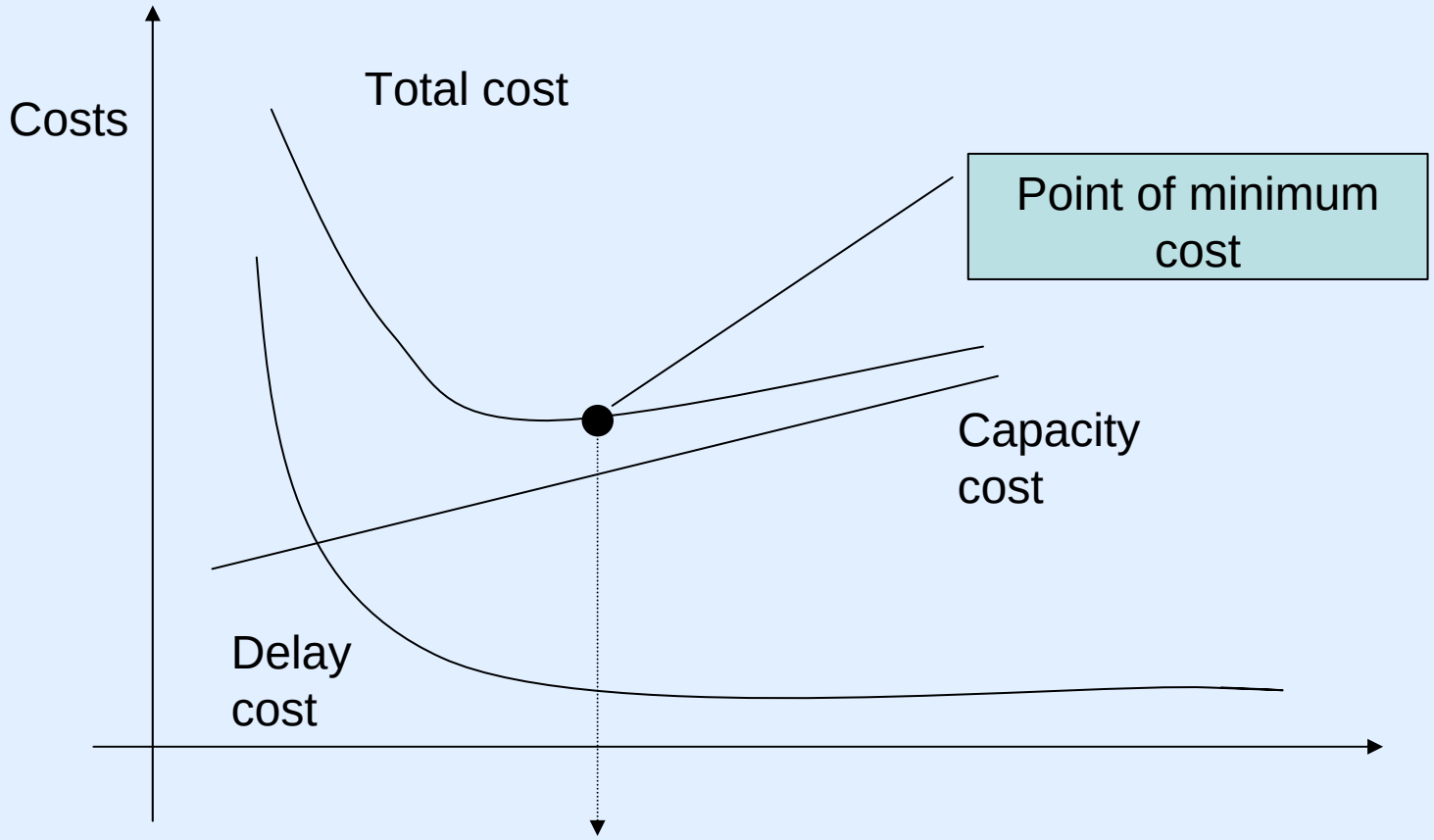
Trade-offs between Performance Objectives -Examples

- Capacity versus flight efficiency
- Short-term cost-effectiveness versus investment
- Access versus capacity
- Flexibility versus capacity

How to deal with trade-offs?

- Use common performance metric
  - Cost: cost of improving performance vs. cost of lack of performance
- Multi-criteria decision making
  - Combine monetary and qualitative indicators to propose performance targets that satisfy constraints and improve overall performance taking account of different performance objectives and ATM community viewpoints
- Co-operative agreements and communication between members of ATM community

Cost as Common Performance Metric
- Example -

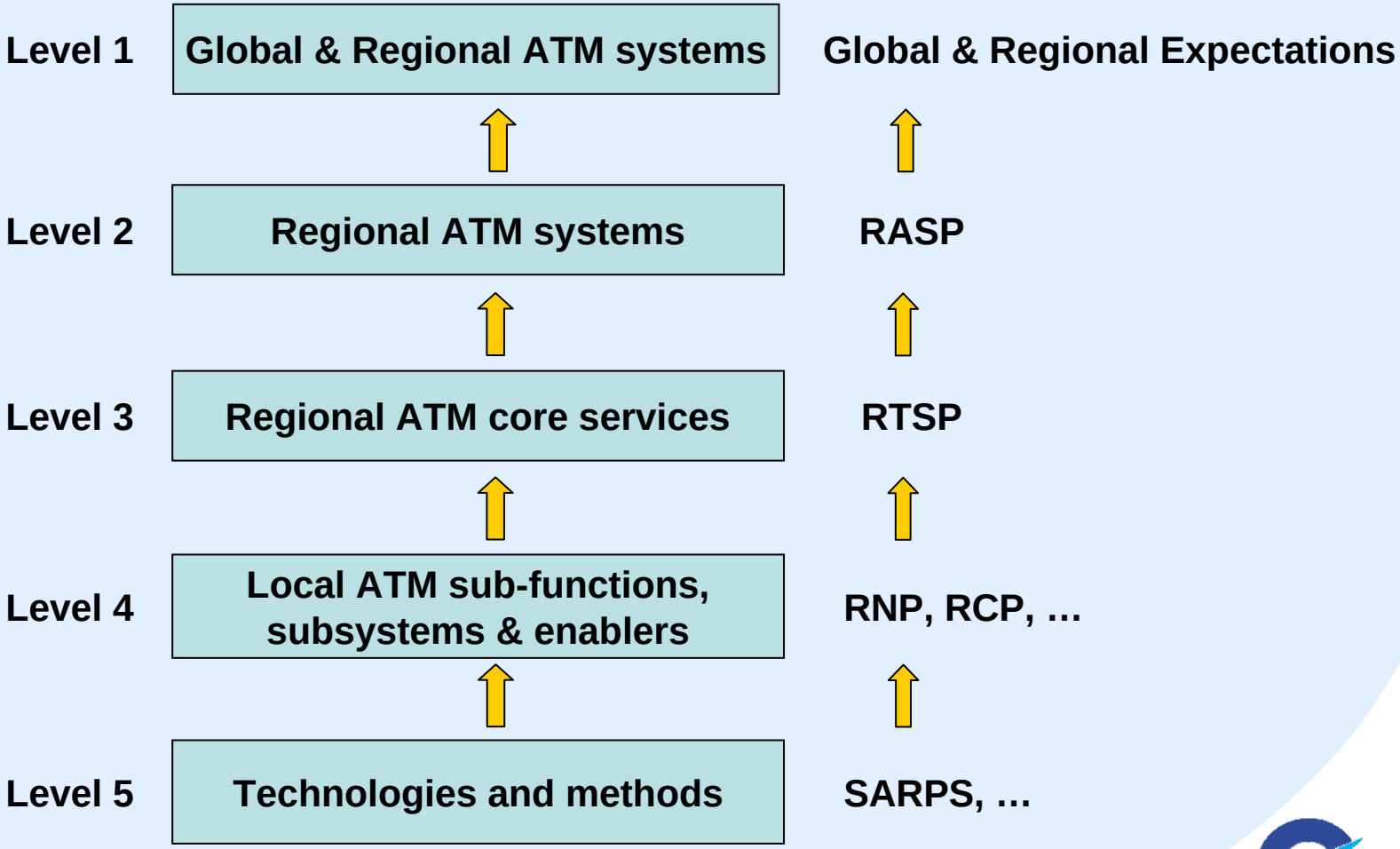


Performance Framework
Levels and influence models

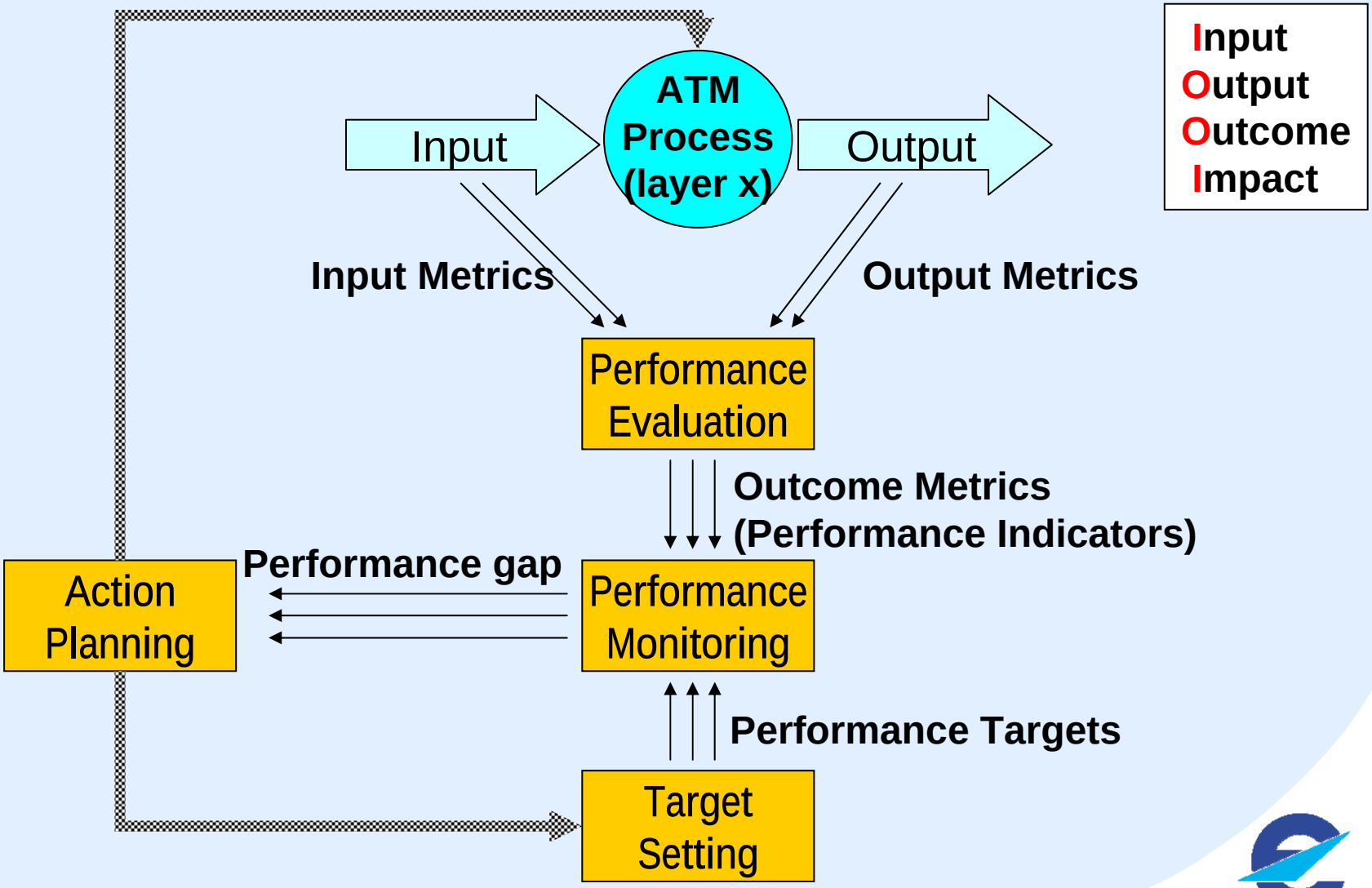
- How to translate an overall ATM system performance target to
  - ATM concept components?
  - ATM system sub functions and enablers?
  - Specific technologies and methods?
- Requires an understanding how and to which extent performance is *influenced* by *changes* in the ATM system.
- Approaches:
  - Empirical evidence
  - Expert judgments
  - Influence modeling
  - Combination of the above

Layered (Hierarchical) Performance Planning

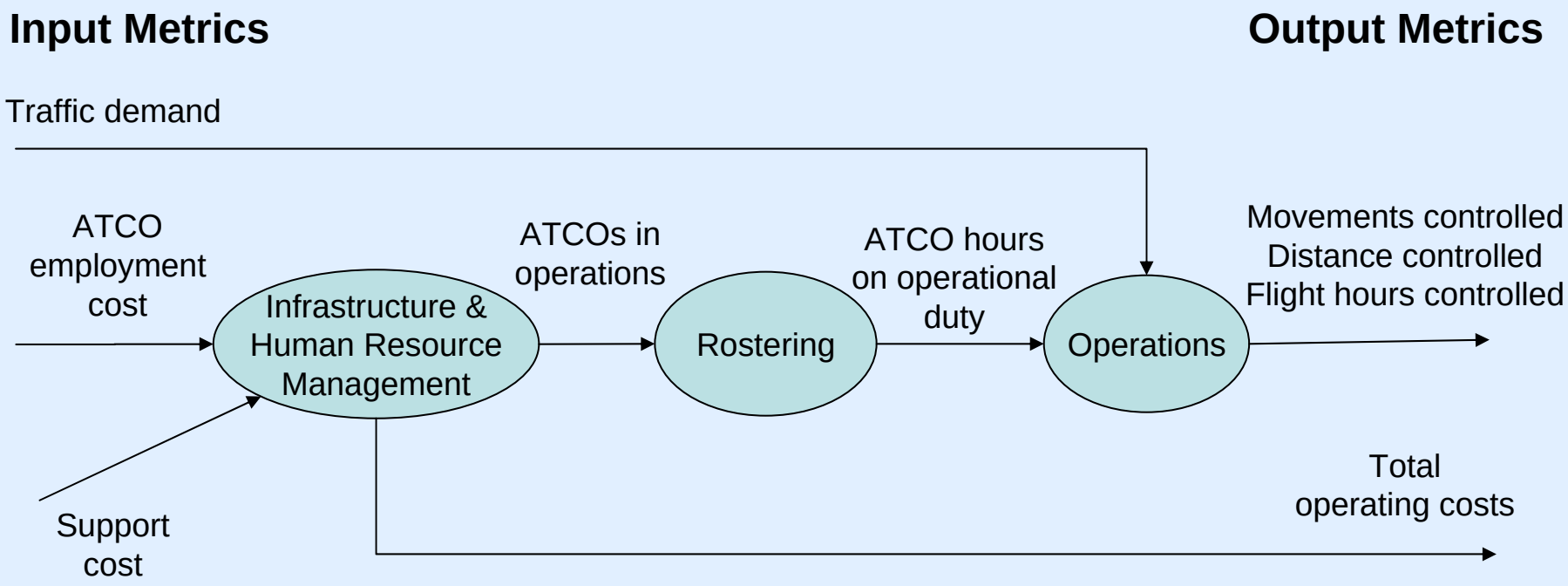
⇧ = Impact relationship



Role of Performance Metrics explained via the IOOI Framework



Role of Models
Influence Analysis (Example)

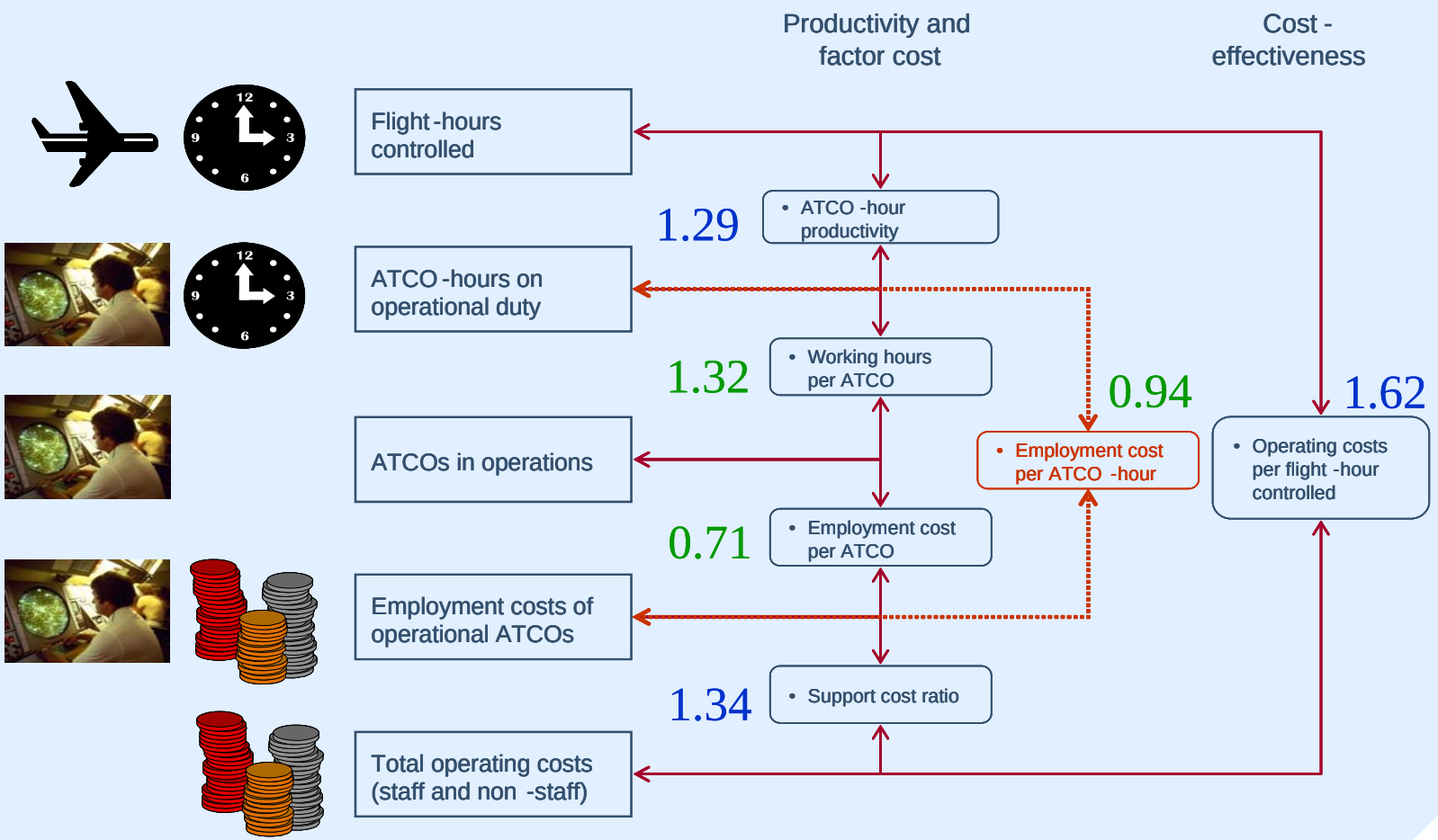


Performance Indicators (Outcome Metrics)

Total operating costs per flight hour controlled (external)
ATCO-hour productivity (internal)
Working hours per ATCO (internal)
Employment cost per ATCO-hour (internal)
Employment cost per ATCO (internal)
Support cost ratio (internal)

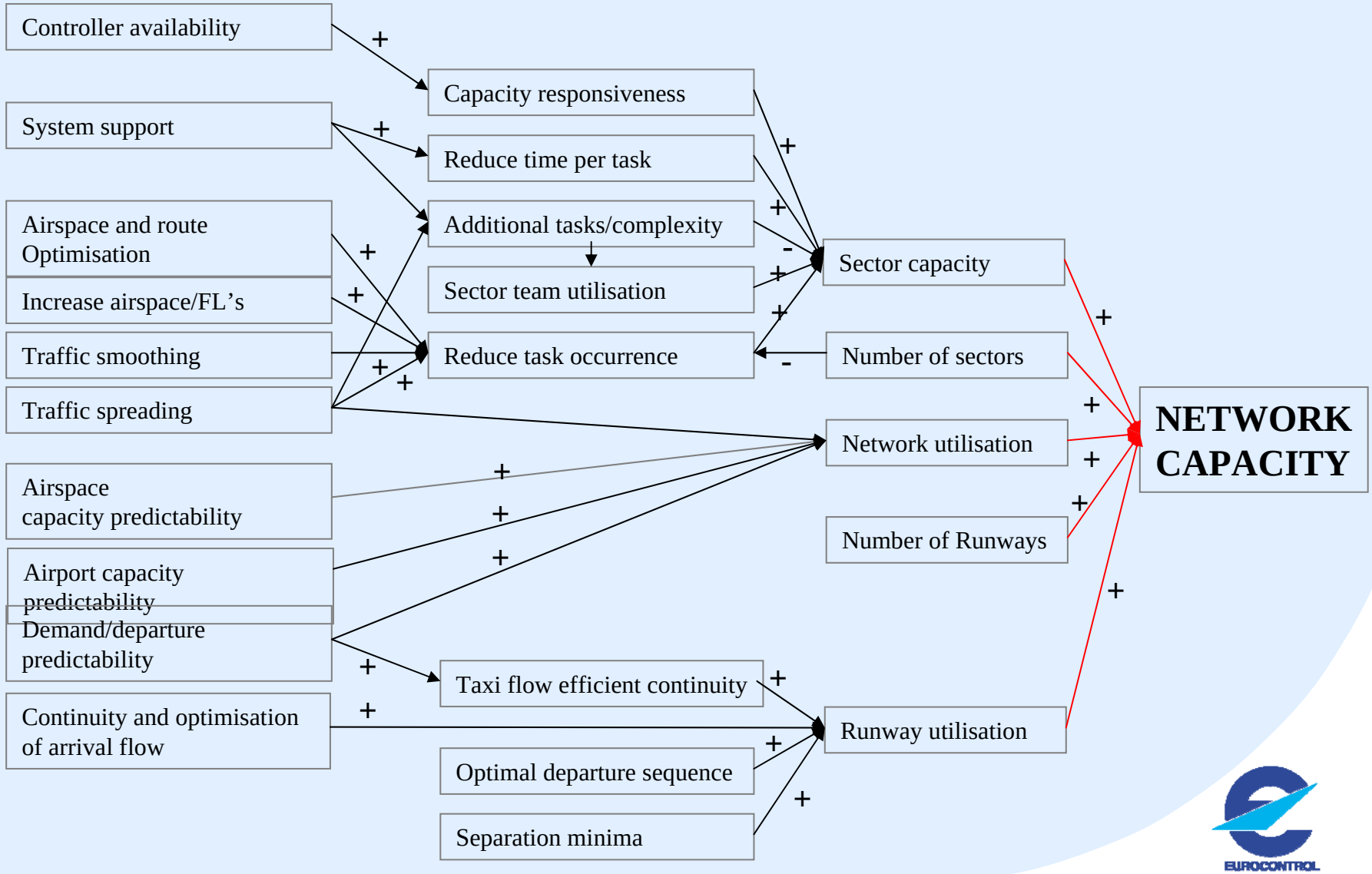
See next slide

Models Define Performance Indicator Relationships (Example)



Ratios are multiplicative: 1.62 = 1.29 x 0.94 x 1.34

Capacity influence model example



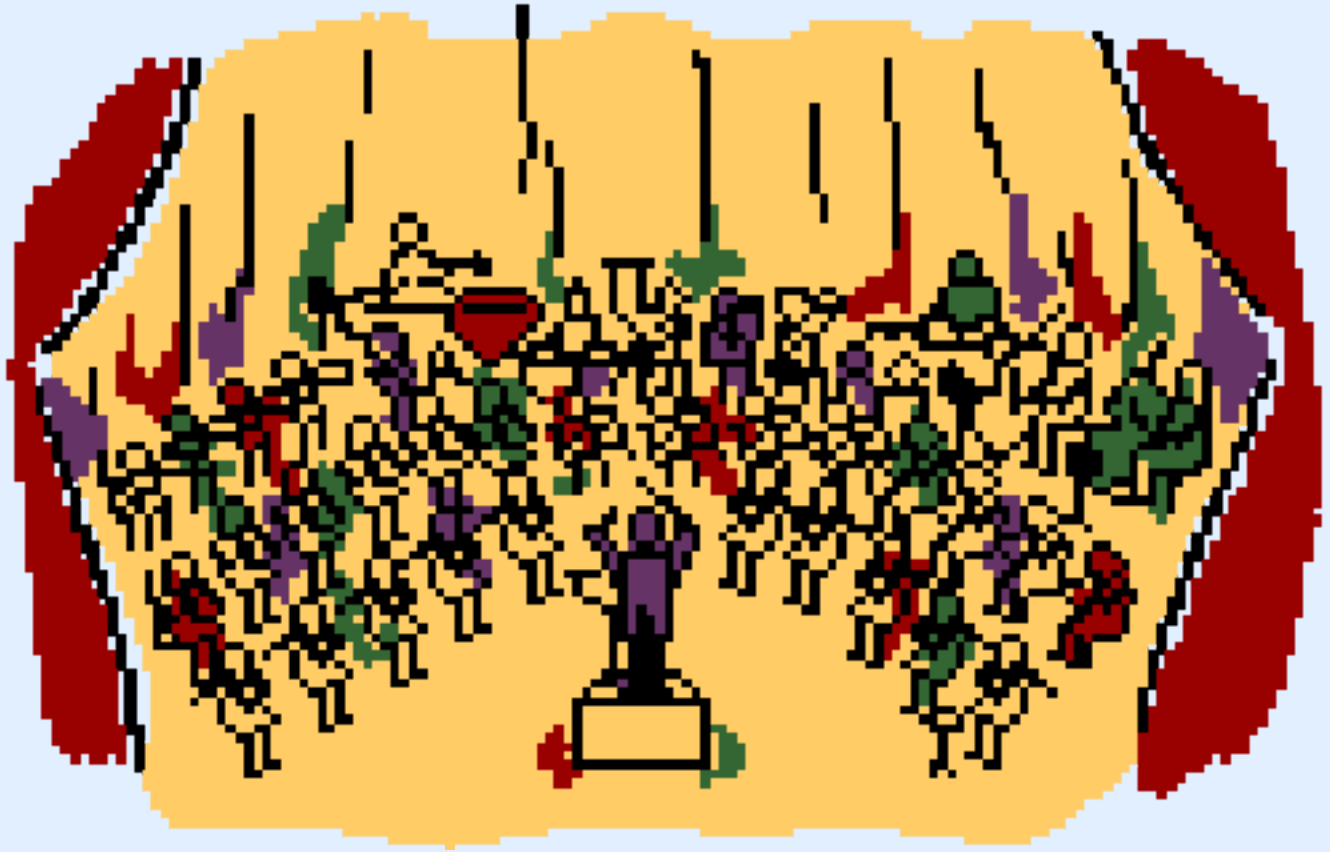
Conclusion/overview

- Performance is the driver for ATM system evolution
- Performance management should be an integral part of the operations of each community member
- Performance management can and should start/improve today:
  - Use of best practices
  - Pragmatic and practical
- Performance management requires:
  - Knowledge>>performance data recording and analysis
  - Investment>> time and effort
  - Good contacts with community members (CDM!)

For more information

http://www.eurocontrol.int

Performance is



Playing together an always improving concert

Thank you

Questions?