AIR TRANSPORT DEPARTMENT

FACULTY OF OPERATION AND ECONOMICS OF TRANSPORT AND COMMUNICATIONS
UNIVERSITY OF ŽILINA

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7 – 8 November 2013

Bratislava, Slovakia

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Organization Board

Juliana Blašková

Martin Hromádka

E-mail

inair@fpedas.uniza.sk

kld@fpedas.uniza.sk

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PERFORMANCE BASED AIR NAVIGATION SERVICES

Key Area Safety

prof. Sanja Steiner, PhD

Air Transport Department, Faculty of Transport and Traffic Sciences, University of Zagreb, Croatia

ssteiner@fpz.hr

assist. prof. Tomislav Mihetec, PhD

Croatian Civil Aviation Agency, Croatia

tomislav.mihetec@ccaa.hr

Arijana Modić, mag. traff. eng.

arijana.modic@gmail.com

Abstract – *Performance scheme is the basis of Single European Sky for achieving the main efficiency related objectives. It also contributes to the sustainable development of air transport by improving the overall efficiency of air navigation services within four key performance areas: safety, environment, capacity and cost-efficiency.*

The Performance scheme should provide indicators and binding targets of key areas with condition of achievement and keeping the necessary safety level, allowing thereby setting targets in other key areas. Implementation of the performance plan itself is carried out during the reference period in which the objectives are set at EU level, as well at national and functional airspace block level. The first reference period includes the time between 2012 and 2014, while the second period will include time between 2015 and 2019.

Purpose of this paper is to investigate the level of efficiency of providing air navigation services in key area Safety, in terms of the European transport development during the reference period between 2012 and 2014, through the analysis of key performance indicators.

Key words – *air transport, air navigation services, performance scheme, key performance areas, key performance indicators, safety.*

INTRODUCTION

The service offer level of air navigation service providers doesn't accompany the increase of traffic demand in European airspace. Air navigation services can be observed from several points of view. Primary objective of air navigation service providers is to serve as many aircraft in their own airspace, meeting the required level of safety, while aircraft operators look at the provision of services through the financial aspect (reduced costs) and the quality aspect which is reflected in the delay of the carrier itself. Due to requirement equalization of all stakeholders in air transport, the Performance scheme of air navigation service providers has been implemented.

European air traffic growth has a variable nature. According to statistics, during the 2011, IFR traffic grew by an average of 3.1 percent (which is below the traffic increase numbers before economic crisis during the 2007 and 2008). One of the main reasons for the slow traffic growth is adverse events in 2010 - strikes, the impact of volcanic ashes and weather, which led to stagnation.

Decrease in air traffic by -1.3 percent with an average annual increase of +1.0 percent based on medium term forecasts of traffic during the 2012 has been anticipated for period between 2011 and 2014. Descending path of air traffic caused by the continuity of economic crisis in Europe can be seen comparing forecast from 2012 with the previous one. It should be noted that development of air transport is uneven that depends on the size of the air transport market, demand, the economic development of a States, etc...

European air traffic management system serves more than 26.000 flights on a daily basis and despite the crisis it is predicted that air traffic will increase twofold by 2020. Costs of European air traffic management services annually amount between 2 and 3 billion €. [1]

The above mentioned facts have led to need for harmonization of air traffic growth with the possibility of reducing costs and increasing the overall performance.

In order to make the harmonization of air traffic possible, the idea of functional airspace blocks establishment has been developed. Functional airspace blocks are based on operational requirements and regardless the State boundaries, to improve cooperation between different air navigation service providers. There are currently nine FAB's established.

Formulation of rules and procedures at European level was needed for their organization, leading to development of initiative Single European Sky (SES). The main objective of initiative is to meet future capacity and the necessary level of safety through legislation or regulatory packages.

Regulatory package related to improving the efficiency of air navigation services is second regulatory package – SES II. The ultimate objective of SES II is to increase the economic, financial and environmental efficiency of services provided in Europe. It represents the amendment of the first regulatory package, which set the foundations for the following areas: Performance scheme, Functional airspace blocks, Network management and Common charging scheme.

PERFORMANCE SCHEME

Performance scheme is the basis of Single European Sky for achieving the main objectives related to efficiency and also contributes to the sustainable development of air transport by improving the overall efficiency of air navigation services within four key performance areas:

- safety,
- environment,
- capacity, and
- cost efficiency.

The Plan should provide indicators and binding targets of key areas with condition of achievement and keeping the necessary safety level, allowing thereby setting targets in other key areas. Implementation of the Plan itself is carried out during the reference period in which the objectives are set at EU level, as well at national and functional airspace block level. The first reference period includes the time between 2012 and 2014, while the second period will include time between 2015 and 2019. [2]

The first reference period is considered to be a transitional period.

Key environment-related objective is to maintain a constant amount of emissions caused by service providing in the period from 2009 to 2014.

Cost efficiency-related objectives, along with the charging regime of service provision, will seek to ensure a constant unit rates, in spite of predicted traffic increase of 16,7% by the end of 2014.

Finally, regarding capacity, aircraft delays will be reduced to the lowest level so as to ensure flexibility of airspace capacity to unexpected large increase in air traffic.

Contribution of individual air traffic management indicators until the 2014 as the end of the first reference period is shown on the Figure 1.
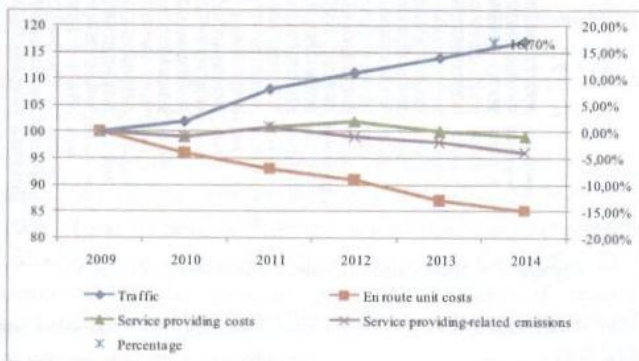

Figure 1 - *Objectives for achieving efficiency at EU level*

Source: Performance Review Commission: Performance Review Report 2011, EUROCONTROL, Brussels, 2012.

Example of specific targets is shown in Table 1.

Table 1 - *Targets for the first reference period*

SAFETY	States must monitor and notify a series of key safety indicators
ENVIRONMENT	Reduce extension of en-route flights by 0.75% compared to 2009
CAPACITY	Determine the unit rate at 53.92 € till 2014
COST EFFICIENCY	Reduce annual average en-route delays to 0.5 min per flight till 2014

National supervisory authorities have an important role in the Performance scheme implementation as well as in efficiency and certain objectives monitoring.

KEY PERFORMANCE AREA SAFETY AND INDICATORS ANALYSIS

Performance indicators are used for setting targets in particular key performance areas.

In key area safety the following key performance indicators are identified:

- safety management effectiveness,
- application of RAT method,
- the level of voluntary reporting – Just culture.

Although the targets for increasing safety aren't set up during the first reference period, three afore-mentioned key safety indicators will be considered. Same will be used for identification and analysis of main safety violation causes, as well as finding solutions for risk reduction.

SAFETY MANAGEMENT EFFECTIVENESS

Efficiency in this area can be measured in two ways:

- through the number and severity of accidents and incidents (passive indicators),
- through the efficiency of all barriers set to prevent occurrences of accidents and incidents (active indicators).

Therefore, detailed reviews and analysis of previous incidents as well as the total performance of air navigation service provision are needed for accident and incident prevention in future.

Safety management represents an essential efficiency element in this key area. Each State, as a part of its State safety programme must implement a safety management system. Safety management system is a systematic approach to managing safety, including the necessary organizational structure, responsibilities, policies and procedures. It will:

- identify potential hazards,
- ensure the implementation of corrective measures, necessary to maintain satisfactory level of safety,
- ensure continuous monitoring and regular safety performance assessment,
- aim at continuous improving of safety management systems' feasibility. [3]

Safety management effectiveness measures through the SMS implementation level and the main enabler of this

system – safety culture. Air navigation service provider's safety management system, expect the foregoing, includes posterior:

- responsibilities,
- SMS organizational structure,
- safety planning (in the context of establishing targets to increase efficiency),
- measuring and monitoring safety performance,
- questionnaires on the safety level,
- reporting and investigation of incidents,
- documentation,
- continuous safety improvement. [4]

Questionnaires at State and ANSP level are being used for the purpose of measuring the total safety management effectiveness. Answer to each question should indicate a certain implementation degree of safety management system, describing the efficiency of every individual provider. Degrees are specified by the letters A to E, whereat:

- A refers to „start" – processes are usually „ad hoc" and chaotic,
- B refers to „planning/appliance start" – where activities, processes and services are defined,
- C refers to the „implementation" – where standard management processes are defined,
- D refers to „management and measuring" – targets are used as a means of process control and overall efficiency is measured,
- E refers to „continuous improvement" – continuous process and efficiency improvement.

Another method to determine the efficiency in this area is based on the following equation:

$$S_j = \frac{100 \sum_{k=1}^{n_j} r_{k_j} \cdot w_{k_j}}{4 \sum_{k=1}^{n_j} w_{k_j}} \qquad (1),$$

wherein:

- S_j is the final result of safety management effectiveness of a State,
- r_{k_j} is numerical value of the State's response to question k within the analysed area j (value from 0 to 4),
- w_{k_j} is the weight of an answer k within the analysed area j,
- n_j refers to number of questions within the analysed area j for which there is no answer with value 0. [5]

Final questionnaire result (final estimate) can be expressed in two forms:

- with numbers 0 – 4 as a result of pre-defined equation,
- with percentage that indicates the position of a subject in the interval from 0 (0%) to 4 (100%). [5]

Safety management effectiveness by particular States (for 2012) is shown in Figure 2. It is evident that some certain extent in the same field has been made in Ireland with 84.7 percent, the UK with 83.7 percent, Italy with 79.8 percent, Malta with 74.2 percent and France with 71.5 percent efficiency achieved.

On the other hand Luxembourg with 28.7 percent, Czech Republic with 38.3 percent, Greece with 40.2 percent, the

Netherlands with 4.8 percent and Austria with the actual 41.9 percent efficiency achieved should work on improvement of the overall safety management effectiveness (Figure 2).
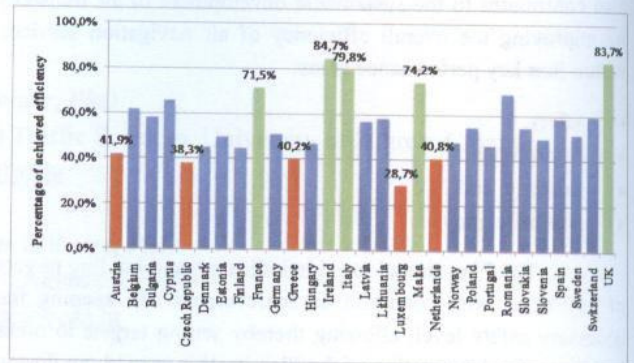

Figure 2. *Safety management effectiveness by States*

Source:http://prudata.webfactional.com/Dashboard/eur_view_2 012.html

Safety management effectiveness by individual air navigation service providers (for 2012) is shown in Figure 3. Apparently, NAVIAIR (Denmark) with 89.0 percent, DFS (Germany) with 85.5 percent, NATS NERLS (UK) with 84.1 percent, HungaroControl (Hungary) with 83.6 percent and ORONAVIGACIA (Lithuania) with 82.9 percent have achieved the best efficiency.

Air navigation service providers, which need to enhance and improve their safety management system, are HANSP (Greece) with 42.1 percent, ANA (Luxembourg) with 43.1 percent, LGS (Latvia) with 57.3 percent, NAV (Portugal) with 60.0 percent and CYATS (Cyprus) with 60.1 percent efficiency achieved.
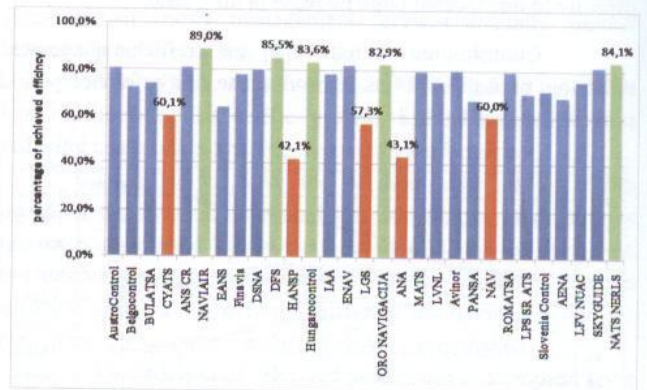
Figure 3 – *Safety management effectiveness by ANSP*

Source:http://prudata.webfactional.com/Dashboard/eur_view_2 012.html

EUROCONTROL and EASA conduct initiatives to assist providers in managing safety risks. During the first reference period until the end of 2014, EUROCONTROL has set objective for itself to help and support 22 service providers in order to improve and enhance safety management system within the organization.

This objective will be accomplished through:

- development of guidelines for the best air traffic management practice,
- structured approach to identification of key safety risk areas,
- gathering information on operational safety,
- coherent approach to safety management within the functional airspace blocks. [6]

RISK ANALYSIS TOOL

Risk is a factor that exists in every human activity, including operations related to aircraft (no matter if operations are carried out in the air or on the ground). Large numbers of ANSP's and national supervisory authorities have begun with the RAT method application. It allows coordinated reporting about severity assessments of events that lead to violation of safety:

- separation minima infringements,
- runway incursions,
- ATM specific technical events. [7]

Risk analysis method enables further development of these indicators during the second reference period up to 2019.

Air navigation service providers use the following categories of severity when registering and reporting of risk occurrences:

- serious incidents,
- major incidents,
- significant incidents,
- no impact on safety,
- has not been defined due to insufficient available information or dubious evidences.

Risk analysis tool method is applicable to each given event.

Level of reported high-risk separation minima infringements in Europe (severity A and B) is shown in Figure 4. In comparison to previous year, in 2009 a significant decline of SMI occurred of even 42 percent, while in 2010 the same has increased by 26 percent.

Despite the mentioned increase, level of reported separation minima infringements was still below the level from 2008. Total number of reported occurrences has increased by only 3 percent - from 1.418 to 1.458. As far as the 2011, compared to the previous year, the number of reported occurrences has increased by 12 percent as well as the number of serious and major incidents.
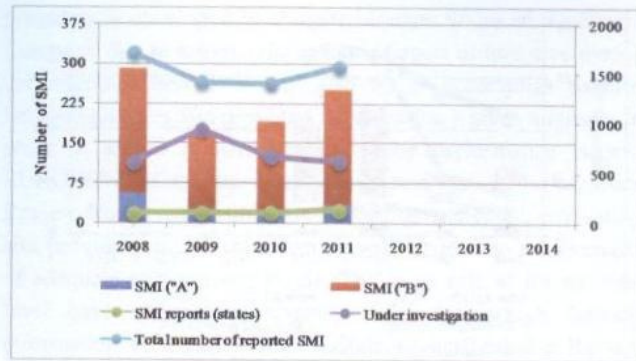

Figure 4 - *Separation minima infringements*

Source:http://prudata.webfactional.com/Dashboard/eur_view_2 012.html

Serious incidents (severity level A) increased in the total number from 16 to 35. Major incidents (severity level B) increased in the total number from 178 to 217 (Figure 5). [8]
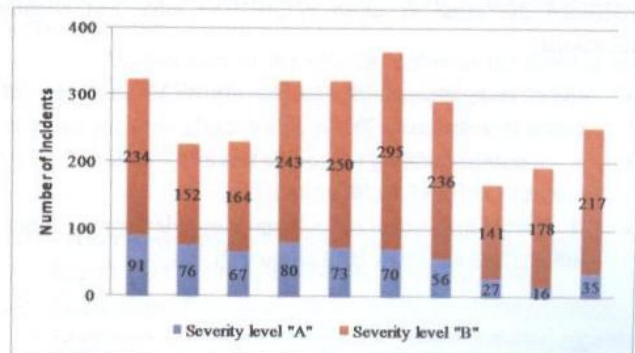

Figure 5 – *Number of reported high-risk RI*

Source: Performance Review Commission: Performance Review Report 2012, EUROCONTROL, Brussels, 2013.

Runway incursion refers to unauthorized entry and movement of aircraft, vehicles or people on the runway. Values for RI are described in the text below and in Figure 6.

Significant growth in total number of reported runway incursions from 1.093 to 1.377 (+12 percent) has been occurred in 2010. Such increase corresponds with reporting system improving, particularly in the Member States. It may also indicate on the existence of a real RI increase, but also at some unapproved entrances onto the runway, severity level A or B.

Number of reported events in 2011 grew by 1 percent, from 1.377 to 1.384 (Figure 6). Unauthorized entry on the runway severity level A has risen from 22 to 26, while severity level B decreased from 77 to 61. For 2012, more than 10 percent of unauthorized movements are still under investigation. [8]
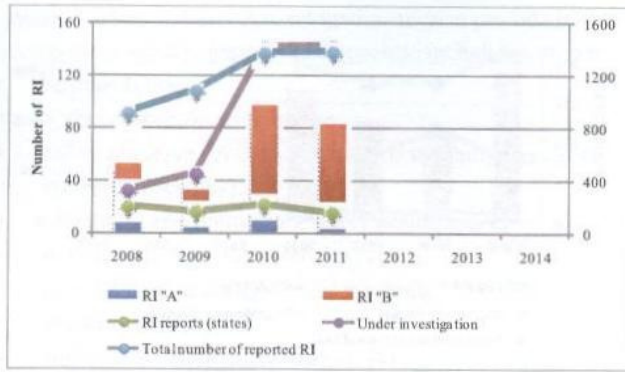
Figure 6 – *Runway incursion*

Source:http://prudata.webfactional.com/Dashboard/eur_view_2012.html

In 2009, 2010 and 2011 there were altogether 12.200, 15.668 and 14.576 specific technical events reported, respective. During the 2012 figures of the highest risk categories have remained the same as those in 2010 or have had slightly decreased:

- AA – complete inability to provide ATM services – 18 events reported as in 2010,
- A – a serious inability to provide services – recorded 50 events in 2010, 49 in 2011,
- B – partial inability to provide services – decreased from 809 in 2010 to 799 in 2011 (Figure 7). [8]
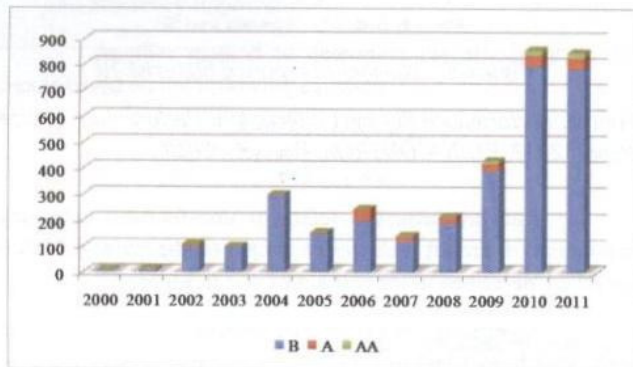

Figure 7. *Number of reported ATM specific technical events*

Source: Performance Review Commission: Performance Review Report 2012, EUROCONTROL, Brussels, 2013.

JUST CULTURE

The last key performance indicator in safety area is just culture. Just culture applies to voluntary reporting of events (mistakes) that led to risk, but without punishing the responsible person.

Work environment where every mistake is punished leads to distrust and reluctance for reporting errors or other flaws and risks. This kind of environment disables proper decision making and informing about the real risks. For this reason, just culture has been developed as an atmosphere of trust in which people are encouraged and even rewarded for providing needful information, with a clear line of acceptable and unacceptable behaviour. Hence, this way, the level of safety

awareness and safety risks enhances and information exchange about the same is induced. [9]

The third key safety indicator concerns to reporting of incidents by Member States and their providers through questionnaires determined in accordance with the EUROCONTROL regulations, which measure the level of existence or lack of just culture. Just culture concept has originally been intended for development of organizational safety culture based on trust and information exchange. Over the past decade, just culture has been developed with purpose of overcoming relation investigation – legal consequences. Actualization of this concept still remains a problem for most States. Attitude alteration to implement just culture is a slow process, especially if this change involves the expansion of safety culture stands. States with difficulties can slow down the implementation process for a while, distinctively if the organizational culture considerably differs from national norms.

Just culture is only being observed during the first reference period. EUROCONTROL in cooperation with European Commission and EASA works on defining indicators and alert mechanisms to be considered for evaluation of just culture implementation level. In defining these indicators, questionnaires that examine following specific areas are being used:

- policy and its implementation,
- jurisdiction and incident reporting,
- investigation.

Questions are answered positive or negative to detect obstacles in each of these three areas. Measurements are carried out based on questionnaires at national and ANSP level. Distributed over three examination areas, 21 questions are composed for States and 24 questions are composed for air navigation service providers (Table 2). [10]

Table 2 – *Questions segmentation for just culture measuring*

	Policy/its implementation	Jurisdiction/reporting	Investigation
National level	10	8	3
ANSP level	13	3	8

Based on questionnaire results, following figures show just culture implementation at State and ANSP level. On the best way of full implementation of this concept are Cyprus, Ireland and UK, while Luxembourg is far away and needs more hard work to catch up with other European countries.
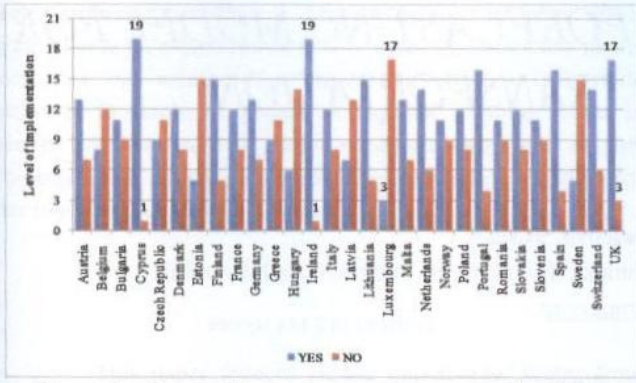
Figure 8 – Level of just culture implementation by States

Source:http://prudata.webfactional.com/Dashboard/eur_view_2012.html

For a more detailed analysis, precisely at ANSP level, AustroControl (Austria), ORONAVIGACIA (Lithuania) and SKYGUIDE (Switzerland) have achieved the best implementation of just culture. HungaroControl (Hungary) and AENA (Spain) are at a crossroads, which indicates the need for restructuring in some fields in order to accomplish the appropriate application of just culture concept (Figure 9).
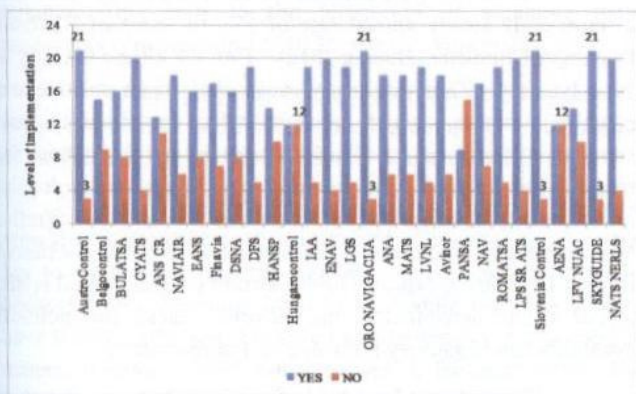

Figure 9 – Level of just culture implementation by ANSP

Source:http://prudata.webfactional.com/Dashboard/eur_view_2012.html

CONCLUSION

European airspace is one of the most congested airspaces in the world with over 26.000 flights in the peak day. For this reason and for the purpose of European network coherence, as well as air traffic and network management based on safety and efficiency, concept of the Single European Sky has been developed. Main objectives of the SES initiative are restructuring of European airspace, creating additional capacity and increasing the overall efficiency.

Air traffic is increasing every day and with ascending traffic unavoidable costs, severe delays and environmental pollution appear. Performance scheme of air navigation service providers is developed to obligate Member States of the Single European Sky to achieve the ultimate targets of initiative during the reference period. It will also try to accomplish balance between all users and providers needs within a given airspace. In order to assure implementation of the performance targets, EUROCONTROL has been designated as a Performance Review Body, responsible for collecting, analyzing, evaluating and providing information, which will enable the achievement of adequate performance levels. The same role at the national level have national supervisory authorities, which forward information collected within a State to Performance Review Body in order to increasing the efficiency of a whole network.

Binding targets are set by the end of the reference period to maximize efficiency within European airspace, but in order to achieve those targets certain measures must be taken.

One part of the solution lies in the full establishment of functional airspace blocks that will lead to capacity enlargement and bettering of air traffic flows, safety, cost reduction and increasing the overall efficiency through enhanced organization of airspace and cooperation between different service providers.

Another part of the solution refers to the flexible use of airspace requiring civil-military coordination within the airspace and through air traffic management.

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