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IMPLEMENTATION ASSESSMENT OF AIRPORT COLLABORATIVE DECISION MAKING AT SPLIT AIRPORT

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ABSTRACT

The problem of aircraft delay within airport system has been present for the last few decades and represents a major generator of delay in the whole system of air traffic. Due to the complexity of operations at the airport as well as the number of participants involved in the process, there is a need for a unique collaborative system. The Airport Collaborative Decision Making (ACDM) system is based on two key elements: the predictability of events and on-time performance. Improving the two key elements in all phases of flight planning would allow participants in the air traffic system significant improvements in operation performing. The ACDM system is one of the five priority measures in the Flight Efficiency Plan, which was developed by the International Air Transport Association (IATA), Civil Air Navigation Services Organization (CANSO) and the European Organization for the Safety of Air Navigation (EUROCONTROL).

The paper will analyze the issue of traffic at the Split Airport in terms of delay and on-time performance. Also the paper will analyze the main causes of aircraft delay by IATA codes and according to participants in air transport. The results of the analysis will indicate the need for implementation of the ACDM system.

KEY WORDS

Airport Collaborative Decision Making, Split Airport, aircraft delay, aircraft on-time performance
1. INTRODUCTION

For departure aircraft operations, there are three types of delay indicators: total delay, five minutes or more, and more than 15 minutes delay. Analyses indicate that the average delay time by the delayed flight (all causes) for departure aircraft operations in April 2012 amounts to 29 minutes, which represents an increase of 15% compared to April 2011 [1]. The percentage of delayed flights (delay five minutes or more) in 2012 grew by 2% compared to 2011, and reached 31%. Flights that are delayed more than 15 minutes for departure aircraft operations in 2012 increased to 17% compared to the previous year [1].

For the arrival aircraft operations the average delay time by the delayed flight (all causes) in 2012 were 31 minutes, which represents increase of 18% compared to the previous year [1].

The largest share of aircraft delays per single flight for 2012 represents a reactionary delay with 4.56 minutes, followed by the delay caused by the airline 2.56 minutes, airspace capacity with 0.81 minutes, the capacity of the airport’s airspace with 0.73 minutes, etc.

Figure 1. The relationship of various factors affecting air traffic delays, expressed in minutes per flight in April 2011 and April 2012 [1]

Figure 1 shows the relationship between different factors affecting air traffic delays in April 2012 and the trend compared to April 2011.

Generally speaking, total delay in air traffic can be observed with regard to four main factors that generate delay, such as: airline, ATM, airports and weather conditions. Figure 2 shows the relationship between four main factors that affect air traffic delays in April 2012 and the trend in relation to the April 2011.

Figure 2. Relationship of four major factors affecting air traffic delays, expressed in minutes for April 2011 and April 2012 [1]

The analysis in Figure 2 indicates that the greatest proportion of total delay per individual flight in April 2012 was generated by airline with 2.56 minutes, followed by ATM with 1.65 minutes, airports with one minute and weather conditions with 0.32 minutes. Comparing trends in Figure 2 a slight increase in air traffic delays in all aspects can be observed.

Within Europe there are over 450 [2] international airports generating traffic of over 1.6 billion passengers [3]. The analysis of top 10 congested airports in terms of departure operations indicates lower total delay in 2012 compared to the previous year. The most common delays at all airports are delays due to late arrival of aircraft and crew from a previous flight and they account for an average of 30% of all delays (reactionary delay).

Figure 3 shows the main causes of delay in top 10 European congested airports from the perspective of departure aircraft operations for 2012, respectively for the following airports: Istanbul Atatürk (LTBA), Lisboa (LPAR), Porto (LPPR), Madrid Barajas (LEMD), Malaga (LEMG), London
Heathrow (EGLL), Toulouse Blagnac (LFBO), Paris Orly (LFBO), Nice (LFMN), London Luton (EGGW).

Figure 3. Overview of the main causes of delay in the top 10 congested European airports in 2012 [1]

2. CURRENT STATE OF AIR TRAFFIC IN THE REPUBLIC OF CROATIA

According to the number of aircraft operations air traffic in the Republic of Croatia in the last few years has seen a slight increase.

Air traffic in 2012, according to the number of passengers achieved a growth of 7.2% compared to 2011 [4].

In terms of ATFM delay within the Croatian airspace trends show a decline in the recent years. In 2010 the average delay was 1.1 minutes, while in 2012 the average delay was 0.3 minutes [5].

The statistics show that at the Croatian airports in 2012 there were 95,876 aircraft operations recorded [4], out of which the Zagreb, Split and Dubrovnik airports generated approximately 75% of aircraft operations.

3. TRAFFIC ANALYSIS AT THE SPLIT AIRPORT

Delays analysis at the Split Airport indicates that the average delay time per delay flight for arrival and departure operations (for all causes) in 2011 was 23.5 minutes [6]. The average delay time per delay flight for the arrival and departure operations (for all causes) in 2012 was 22.8 minutes, which represents a decrease of 10% compared to the previous year.

Figure 4. Delay (in minutes) of air carrier Croatia Airlines at Split Airport in 2012, according to IATA codes

SOURCE: authors’ research [6]

The largest delay at the Split Airport is generated by Croatia Airlines with 1,330 delays (2012) making a total of 32,290 minutes of delay. The delay proportion by IATA codes for air carrier Croatia Airlines in 2012 is shown in Figure 4. For other air carriers at the Split Airport in 2012 (Figure 5) there were 2,397 delays with a total of 52,715 minutes of delay recorded [6].

IATA delay code analysis indicates that a large number of delays at the Split Airport represents reactive delay (IATA code 93) which in the total delay accounts for 68% for the national air carrier (Croatia Airlines) delay and 73% (other air carriers).

Figure 5. Delay (in minutes) of other air carrier at the Split Airport in 2012, according to IATA codes

SOURCE: authors’ research [6]
4. AIRPORT COLLABORATIVE DECISION MAKING SYSTEM BASIC CONCEPT

Airport Collaborative Decision Making (ACDM) is an innovative system of collaborative decision-making based on the exchange of information between the various partners involved in air traffic. ACDM system was developed by the European Organisation for the Safety of Air Navigation (Eurocontrol) with aims to reduce delays, improve the predictability of future events and optimize existing resources [7].

![Diagram of ACDM system]

**Figure 6.** The interrelation of partners within ACDM system [7]

The ACDM system requires no additional investment in infrastructure or supporting technical means, but is based on better use of the existing resources. The partners involved in ACDM implementing process are: airport operators, air carriers, ground handling operators, operator providing air navigation services and the European Air Traffic Flow Management. The interrelation of the partners within the ACDM system is shown in Figure 6.

4.1 Factors required for realization of ACDM system

ACDM system base consists of six fundamental elements:

- Information sharing
- Milestone approach
- Variable Taxi Time
- Pre departure sequence
- CDM in adverse conditions
- Collaborative Management of Flight Updates

The information sharing system together with the Milestone approach makes the base of the ACDM system and allows upgrading of ACDM system with other elements. The aim of information sharing system is to provide various partners involved in air traffic with correct information at the right time. The second element of ACDM system, Milestone approach, links a segment of the aircraft in the air along with a segment when the aircraft is on the ground, improving information flows and anticipated upcoming events. The objective of this element is to monitor the status of the aircraft from initial planning through to takeoff with a particular airport. The Milestone approach is divided into 16 points in which the most important times in aircraft operational process are recorded (Figure 7).

![Diagram of aircraft status]

**Figure 7.** Preview of the status of aircraft in all phases through 16 points [7]
Variable taxi time represents the estimated aircraft taxi time between aircraft parking position and appropriate runway.

After introduction of the Information sharing system, Milestone approach and Variable taxi time the next element which upgrades ACM system is the pre-departure sequence. In order to realize the pre-departure sequence it is necessary to fully implement the previously mentioned element of the ACM system. The pre-departure sequence of departing aircraft is created based on the time received from the aircraft ground handling operator or aerodrome operator and by the type of aircraft.

CDM in adverse conditions is aimed at information sharing about adverse conditions between partners during periods of reduced capacity (airport maintaining, weather conditions ...).

The sixth and the final element of the ACM system is the Collaborative management of flight updates, which has the task of quality improvement in information exchange between CMFU and CDM airport.

### 4.2 Benefits of ACM system

The system of collaborative decision-making between partners within the air transport system is based on timely and accurate information as well as updated information. When information is transparently shared among all participants in the system the result is increased predictability of certain aircraft operations. In this manner, all participants of air transport: operators at the airport (ground handling companies, de-icing company), air carriers and ATM providers can operate at a higher operational level.

Results of the U.S. Federal Aviation Administration (FAA) study have shown that after implementation of the ACM system, accuracy of aircraft operation performance grew by 15% as shown in Figure 8 [8].

**Figure 8.** Relationship of aircraft operations before and after the introduction of the ACM system [8]

In Europe, there are thirty-nine airports that have begun the implementation process of the ACM system [9]. The ACM system is currently fully implemented at eight airports. Ten airports are in the initial stages while at twenty-one airports the implementation process has started [9]. The aim of the ACM system is to integrate forty airports within the dynamic management of the European airspace network. Eurocontrol conducted analytical studies to determine the impact of the ACM system on the European airspace network in case those forty-two airports implement the ACM system.

Results of the study show benefits that can be achieved: increasing the sector capacity within the "core area" up to 4 percent (approximately 1-2 aircraft per sector), reducing en route delays from 33% to 50%, and reduction of ATFM delays by 18 to 23% [10].

The Munich Airport is the first airport in Europe that fully implemented the ACM system and represents reference for the result analysis that could be achieved by implementing the ACM system at certain airports.

Some of the key performance indicators at which the evaluation can be performed: waiting time at the runway, impact of arrival delays on departure delays, airport slot adherence, accuracy in defining the required duration of ramp handling process. Waiting time at the runway represents the time
that an aircraft spends at position until it receives
takeoff clearance from air traffic control.
The statistics indicates that the waiting time at the
runway is significantly reduced by implementing
the ACDM system in 2007. The average waiting
time at the runway was reduced from 4.39 minutes
(in 2005) to 3.41 minutes (in 2007) when the
ACDM system was implemented [11]. The airport
slot adherence is slot compliance indicator. The
analyses from the Munich airport indicated that
adherence to the slots time increased from 78.9%
before the ACDM system was implemented (in
2005) to 85.3% after the ACDM system has been
The impact of the arrival delay on the departure
delay is an indicator first introduced in the ACDM
system. Thus, there are no adequate data from the
period before the implementation of the ACDM
system and it is not possible to make a comparison
of indicators. However, it was noted that after the
introduction of this indicator about 50% of flights
that were delayed in arrival are compensated
through the ground aircraft operation and the
aircraft arrived according to scheduled time
Accuracy in defining the required duration of ramp
handling process represents an important segment
of the ACDM system and has a significant impact
on other ground aircraft operations. The Munich
airport analysis indicates that the deviation
between the planned and actual ramp handling
time in most cases is between 1 and 5 minutes,
which from an operational point of view is the

5. THE POSSIBILITY OF IMPLEMENTING
ACDM SYSTEM AT Split AIRPORT

The Split Airport has been developing since 1996
its own modular application solution that fully
covers all activities on the airport airsides. The
software solution encompasses all phases of the
aircraft ramp handling process, from initial
planning to management and control. Software
also has the ability for multi-purpose use of a
central database and connection (interface) with
other systems.

In 2013 the Split Airport developed and established
regular updates of their own information on the
planned traffic using EUACA (European Airport
Coordinators Association) database. This database
is the basis for the data exchange between the
Split Airport and Eurocontrol, and is the basis for
future strategic and tactical planning and better
management of the European airspace network.
Taking into account further requirements for
dynamic data exchange and ACDM system
requirements, at this point it is necessary to
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requirements, at this point it is necessary to
consider the software solution in which the above
requirements are to be implemented.

6. CONCLUSIONS

The current problem of the European air traffic
network is the congestion of air routes considering
the capacity of conventional air traffic control
system as well as a lack of capacities of hub
airports. Operational implications are reflected in
the flight delays, with negative consequences for
both airline operators and the airport.
The continued growth of air traffic and at the
current level of delays, the capacity of air traffic
control as well as airports will not be able to follow
further growth trends, particularly in the safety and
environmental aspects.
The analysis of the current European air traffic
status indicates that the largest generator of delays
in air traffic system is the delay of an aircraft due
to the late arrival of the aircraft (and crew) from a
previous flight.
The status of Croatian air traffic in terms of delays
recorded similar trends as the European air traffic.
The statistics from the Split Airport indicates that
the greatest observed delay is the reactive delay.
The greatest share of delays belongs to the national
air carrier Croatia Airlines.
In order to reduce the delay, EUROCONTROL, the
European organization for air safety, embarked on
the development of collaborative decision-making
(CDM), which would be performed through
cooperation of various holders of air traffic services
to reduce the overall delay. Since the system is not
currently implemented at an optimal number of
airports it is not possible to analyze the full
implementation of the system.
The results obtained from the Munich airport
indicate that the implementation of the ACDM
system has led to a reduction in: taxi time, the
waiting time at the runway and ramp handling
time. At the same time the Munich airport recorded a growth in: on-time operations performance, compliance with time slots, better communication among partners (airport operators, air traffic control, the company specialized in handling, de-icing ...) This created significant savings to the airport, the national airline (Lufthansa) as well as other airlines and air traffic control. The implementation of the ACDM system at Split Airport is a time-consuming and complex process. However, in case it achieved the same or similar results to the Munich Airport, the implementation of the system has to be justified from the operational and economic point of view.

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