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RAISING THE DYNAMICS: SIMULATION-BASED PERFORMANCE ANALYSIS FOR LELYSTAD AIRPORT

Miguel Mujica Mota, Paolo Scala, Nico DeBock

Aviation Academy, Amsterdam University of Applied Sciences
Weesperzijde 190
Amsterdam, 1097DZ, THE NETHERLANDS

ABSTRACT

Amsterdam's Schiphol capacity is limited to 500,000 air traffic movements per year and currently is reaching the limit. For that reason, Schiphol Group decided to divert the non-hub related traffic to the regional airport in Lelystad. This airport will be upgraded to handle commercial traffic, mainly low cost carriers. We used a divide and conquer approach in SIMIO modules in which we included the main elements in the system namely airspace, runway, taxiways and airport stands for analyzing the future performance and potential operative problems of the airport. An analysis of the different operative areas of the system was performed and we could identify problems due to the emergent dynamics once the different subsystems interacted between them.

1 INTRODUCTION

Amsterdam Schiphol (AMS) is the main airport in the Netherlands and it was the fifth busiest airport in Europe in 2014 in terms of passenger traffic (ACI, 2014). AMS is also the main hub for KLM, which provided 54% of the seats available at the airport in 2013, and a major airport for the sky team alliance, whose members are responsible for 66.3% of the airport traffic in terms of ATM (Schiphol Mag,2014). Due to environmental reasons, the capacity is limited to 500,000 air traffic movements per year (landings and departures). In 2015 there were 450,679 movements at the airport, 90% of the imposed cap (Schiphol Group, 2016). Since the operation is approaching to its limits, Schiphol Group would like to support the airport strategy by redistributing non hub-related traffic to other airports in the Netherlands in order to relieve capacity at Schiphol and at the same time continuing providing support for the development of the region. The alternative is to upgrade Lelystad airport (LEY) to attract commercial flights of European cities and regions, putting focus on tourist destinations. In that way LEY will take an important role in the multi airport system of the Netherlands composed currently by Amsterdam, Rotterdam and Eindhoven. Since the airlines are the ones that take the decision of whether flying to LEY or not it is important to investigate the performance indicators of the future airport in order to have a better insight and management of the capacity of the multi airport system (De Neufville 1995) that will serve the demand of the region.
The authors developed a simulation model (Banks et al. 2010) of the airport in order to identify the best configurations for the objectives pursued by the operator (Mujica et al. 2015). The current case study presents one of the analysis of the different resources of the system that will affect the capacity and PIs of the facility under study.

2 METHODOLOGICAL APPROACH

In order to perform a deep analysis of the future airport and make an efficient use of the resources, a methodological approach was followed. It is a divide-and-conquer approach of a model-based analysis for identifying the factors that affect the performance of the sub systems and then the independent models were overlaid for developing an integral one. We used stochastic models based on discrete event systems approach (DES) of SIMIO which is a tool that has the object-oriented characteristics that allowed a smooth implementation of the methodology. The developed model has is dynamic, stochastic, and asynchronous. It is composed by different sub models that represent the identified subsystems of the airport environment. This approach allows to assess the independent performance of the subsystems and after the

coupling, new restrictions are imposed in the final model. The next figure illustrates the architecture of the different developed models.

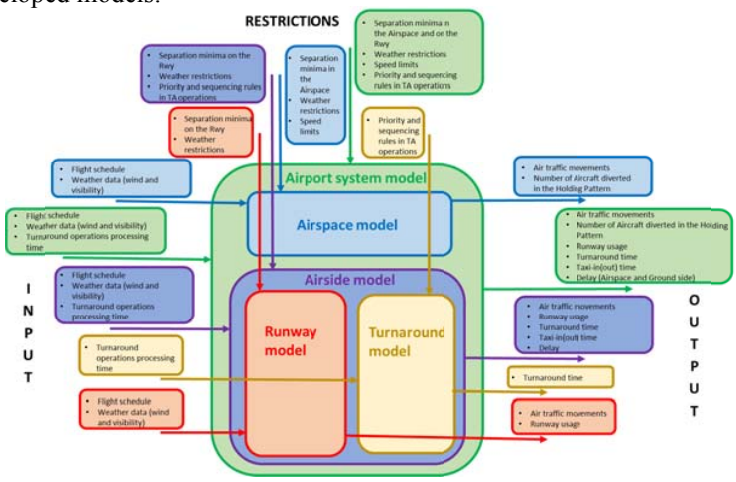

Figure 1: modular coupling of the model of Lelystad

We performed an experimental design to understand the performance of the system and it allowed us to raise the performance dependencies for the following resources:

- Impact of Stairs vehicles in the delay at the airspace
- Impact of Bulk and Loader trucks in the delay of TMA
- Effect of Stairs in Delay on Off Block Time
- Impact of Turnaround time with Fuel, Water and stairs vehicles.

3 CONCLUSIONS AND FUTURE WORK

We presented the results for the analysis of the complex model of an airport which is under development in the Netherlands. It was developed by coupling different models of the subsystems developed in SIMIO together. The final one allowed to identify the dependencies and variability impact of the airspace and airside performances. We identified the main drivers for the improvement of the system and the situations in which the system is highly dependent on the number and types of vehicles used. Schiphol group could assess the expected turnaround time and configuration that perform best varying the amount of vehicles.

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