

## Reorganizing the Passenger Flows in Terminal 2 with support of *Arena*<sup>®</sup>

In the year 2004 Munich Airport was the second largest Hub-Airport in Germany and already No. 8 in Europe. In summer 2005 not less than 227 destinations in 66 countries were served from Munich. Forecasts say that passenger volume will grow from 26.8 million today to 48.1 million in the year 2015.

Lufthansa as a strong partner of Munich Airport owns 40% of Terminal 2, which opened in June 2003. One of the most important design criteria of Terminal 2 was to guarantee maximum passenger convenience and a minimum connecting time of 30 minutes. The architects and operational planners proofed to be successful, because in the annual SKYTRAX - survey among 500.000 international passengers Munich Airport achieved the reward 'Best Airport in Europe 2005'.



But now new regulations of the European Union (EU) forces the airport to re-organize passenger flows in both terminals, especially for transferring passengers. In the past a transfer-passenger arriving e.g. from San Francisco and departing to e.g. Madrid was allowed to proceed from his arrival gate in Munich to his departure gate on a direct way without passing any additional security checkpoints, because he was controlled prior boarding the plane at his departure airport. But the EU does not longer approve the security standards of so-called third countries, which are all countries outside the EU.

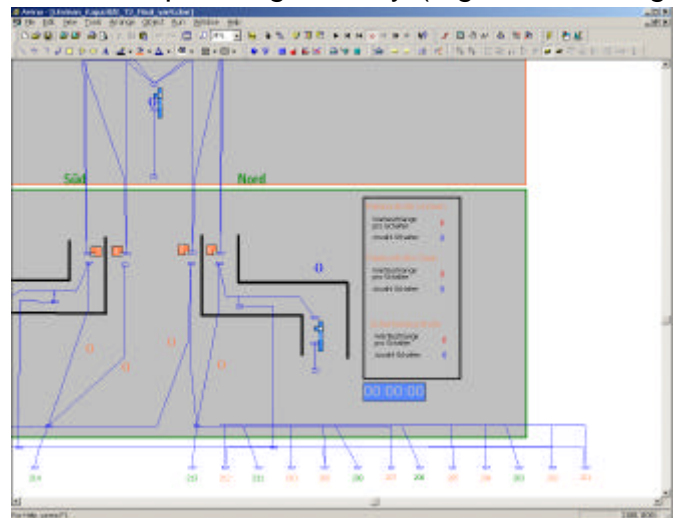
The task for the airport planners was then to implement new security controls within an existing terminal infrastructure. Doing this, many contradictory objectives had to be considered. First, reduction of passenger convenience had to be as little as possible, while the minimum connecting time of 30 minutes had to be maintained. Second, the security controls and associated waiting areas had to fit into the available terminal areas. Third, the costs for reconstruction, equipment and personnel had to be minimized.

Munich Airport, therefore, used Rockwell Software's *Arena*<sup>®</sup>, provided and supported by *SAT Simulations- und Automations-Technologie AG* (Freiburg, Germany) to simulate the arrival passenger flows and their way through the terminal. Because of the small amount of time, which was available to analyze different solutions, we decided to build only a schematic model of the arrival process.



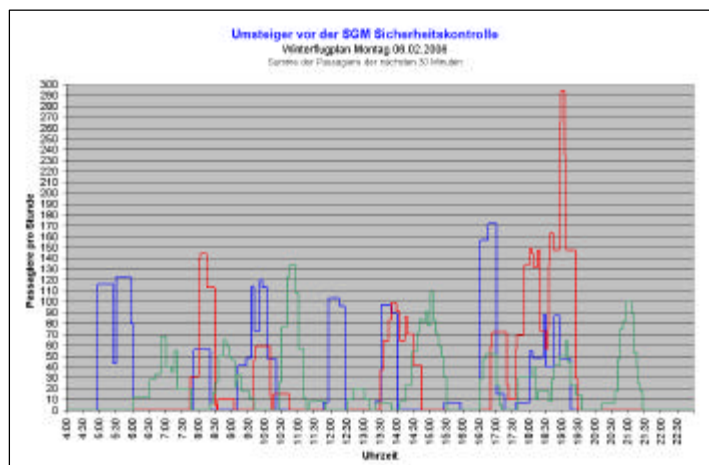
Because of the need to link different data, e.g. the scenario flight schedules and an airport database with information about the EU-status of the airports, we used MS-Access and VBA to pre-process the input-data for ARENA. A user interface allowed easily to set the required parameters for the simulation. The transfer passenger flows between arrival and departure flights were calculated using a 3-step VBA algorithm.

This flight related data were written to the entity attributes at the beginning of each *Arena*<sup>®</sup> simulation run. Different processes on the passenger's way (e.g. de-boarding, passport-control, security-control) were built using the process-module with a triangle distribution. The ways between the checkpoints had a walking distance and the passengers had randomly assigned walking speeds.



The results of the simulation runs, most important the queue-length and the waiting-times before the control stations, were written in the Access-Database and after some post-processing transferred to Excel-sheets. By running the *Arena*<sup>®</sup> simulation several times with different operational layouts we were able to identify the optimum number of control counters with a reasonable balance between costs, performance and passenger convenience.

By running the *Arena*<sup>®</sup> simulation several times with different operational layouts we were able to identify the optimum number of control counters with a reasonable balance between costs, performance and passenger convenience.



If you will have a transfer-flight via Munich please enjoy our new security controls and remember, that the queue you might be waiting in was predicted with *Arena*<sup>®</sup> and only reluctantly accepted by the airport in order to fulfill the new EU security requirements.

Stefan Fornasier  
 Munich Airport International